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52 Tottenham Street

Energy Statement

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Quality Assurance Approval Status

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Sustainability Energy Climate Change Socio-Economic



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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 to provide space heating for the commercial space;
 - Air Source Heat Pumps to provide space and hot water to the upper most flat.
- 1.4 The opportunity for the incorporation of renewables has been maximised and further use of ASHPs or other renewable technologies is not considered feasible mainly due to the physical constraints of the site. Conventional gas-fired boilers will provide space and hot water heating in the units where ASHPs are not applied.
- 1.5 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.
- 1.6 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.



2. Introduction

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

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

Proposed Development

2.3 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

2.4 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

- 3.1 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

- 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 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.



4. Planning Context

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

National Context

National Planning Policy Framework (2019)

- 4.2 The National Planning Policy Framework (NPPF) was updated in February 2019. Paragraph 7 of the revised NPPF states that:
 - "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 148 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 2018)

- 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 The guidance is intended to assist local councils in developing policies for renewable energy in local plans, and identifies the planning considerations for a range of renewable sources.

London Context

The London Plan Consolidated with Alterations Since 2011 (2016)

- 4.4 The London Plan was further updated in March 2016. The Plan is the overall strategic plan for London. Chapter five of the Plan details London's Response to Climate Change. The following policies are considered pertinent to this Statement:
 - Policy 5.2 (Minimising Carbon Dioxide Emissions) includes:

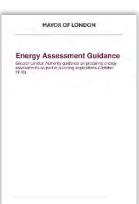




- An Energy Hierarchy: Be Lean; Be Clean; Be Green;
- Carbon reduction targets for major developments; including a "zero carbon" target for 2019:
- Sets out the information requirements for energy assessments.
- Policy 5.3 (Sustainable Design & Construction) encourages consideration of sustainability as part of the design and construction;
- Policy 5.5 (Decentralised Energy Networks) requires planning authorities to require developers prioritise connection to existing or planned decentralised energy networks where feasible;
- Policy 5.6 (Decentralised Energy in Development Proposals) encourages development to establish or connect to energy networks;
- Policy 5.7 (Renewable Energy) within the framework of the Energy Hierarchy, major development proposals should provide a reduction in expected carbon dioxide through the use of on-site renewable energy generation, where feasible;
- Policy 5.9 (Overheating and Cooling) major development proposals should reduce potential overheating and reliance on air conditioning systems in accordance with a Cooling Hierarchy;

Energy Assessment Guidance (2018)

- 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 5.2. 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.





Emerging London Plan (2019)

- 4.7 The draft New London Plan is a broad plan to shape the way London develops over the next 20-25 years. Energy issues are discussed in Chapter 3 (Design), Chapter 8 (Green Infrastructure and Natural Environment) and Chapter 9 (Sustainable Infrastructure). The following draft policies are considered important to this report:
 - Draft Policy D1 (London's Form and Characteristics) Development should aim for high sustainability standards (with reference to the policies within London Plan Chapter's 8 and 9);
- MAYOR OF LORDON

 The London Plan
 Intend to Publish (clean version)

 Spatias Development Strategy
 for Greater Lordon
- Draft Policy SI1 (Improving Air Quality) Development should not lead to further deterioration of existing poor air quality;
- Draft Policy SI2 (Minimising GHG Emissions) Encourages major development to be zerocarbon and minimise annual and peak energy demand in accordance to 'Be Lean, Be Clean, Be Green, Be Seen' energy hierarchy.
- Draft Policy SI3 (Energy Infrastructure) Major development proposals in Heat Network
 Priority Areas should have a communal low-temperatures heating system and the heating
 source should be selected in accordance to the Heating Hierarchy;
- Draft Policy SI4 (Managing Heat Risk) Encourages development to minimise adverse impacts on the urban heat island and to assess the risk of internal overheating and reduce reliance on air conditioning.

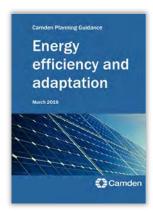
Local Context

Camden Local Plan (June 2017)

- 4.8 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.
- 4.9 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;
- Camden Local Plan
 2017
 Camden
- Policy CC2 (Adapting to Climate Change) requires 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;



- Camden Planning Guidance Energy Efficiency & Adaptation (March 2019)
- 4.10 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.
- 4.11 Includes requirements concerning credits under certain BREEAM categories (60% energy, 60% water and 40% materials); and reference the 20% renewables target.





5. Baseline Emissions

- 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 (irrespective of the design proposals) and that any active cooling system would be provided by electrically powered equipment. This is to ensure consistency with the requirements of the GLA guidance.
- 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).

Table 5.1 Carbon Dioxide Emissions (SAP10) – Baseline (Residential)

Step	Carbon Dioxide Emissions (Tonnes CO₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013	4.0	3.2

Table 5.2 Carbon Dioxide Emissions (SAP10) – Baseline (Non-Domestic)

Step	Carbon Dioxide Emissions (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013	2.2	1.5



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

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



Table 6.1 Proposed Building Fabric U-Values

Fabric Element	Part L1A (W/m ² K)	Proposed (W/m ² 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)

Air Tightness

6.10 A high level of air tightness is proposed and a level below 4m³/h/m² 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 Accredited Construction Details (ACDs) will be applied.

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_x 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 The absence of nearby waterbody and relatively small footprint of the site rule out the options of Water Source and Ground Source Heat Pumps.
- 8.10 There is potential to include Air Source Heat Pumps (ASHPs); however, this potential is also limited by site constraints and there is only adequate plant space at roof level to serve the upper most flat.
- 8.11 At ground floor and within the commercial unit, it is proposed to incorporate a relatively compact ASHP system to provide space heating with the "outdoor" part hidden internally and behind a louvre. The lack of suitable space has prohibited the application of ASHPs throughout the other residential units.

Micro Hydro Power

8.12 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

8.13 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

8.14 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

- 8.15 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;
- 8.16 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

8.17 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

8.18 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 Low carbon and renewable technologies have been assessed and it is proposed to incorporate:
 - ASHP for space and hot water heating in the top floor flat;
 - ASHPs for space heating in the commercial unit.
- 9.5 The opportunity for the incorporation of renewables has been maximised and further use of ASHPs or other renewable technologies is not considered feasible mainly due to the physical constraints of the site. Conventional gas-fired boilers will provide space and hot water heating in the units where ASHPs are not applied.

Carbon Savings – Residential

9.6 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 9.1 CO₂ Emissions after Each Stage of the Energy Hierarchy (SAP10) (Residential)

Step	Carbon Dioxide Emissions (Tonnes CO₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013	4	1
After energy demand reduction	4	1
After CHP	4	1
After renewable energy	3	1



Table 9.2 Regulated CO₂ Savings from Each Stage of the Energy Hierarchy (Residential)

	Regulated Carbon Dioxide Savings	
	(Tonnes CO ₂ per annum)	%
Savings from energy demand reduction	0	-6%
Savings from CHP	0	
Savings from renewable energy	1	27%
Total Cumulative Savings	1	20%

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	2	3
After energy demand reduction	2	3
After CHP	2	3
After renewable energy	1	3

Table 9.4 Regulated CO₂ Savings from Each Stage of the Energy Hierarchy (Non-Domestic)

	Regulated Carbon Dioxide Savings	
	(Tonnes CO ₂ per annum)	%
Savings from energy demand reduction	0	-1%
Savings from CHP	0	0%
Savings from renewable energy	1	35%
Total Cumulative Savings	0	34%



- 9.7 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.
- 9.8 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.

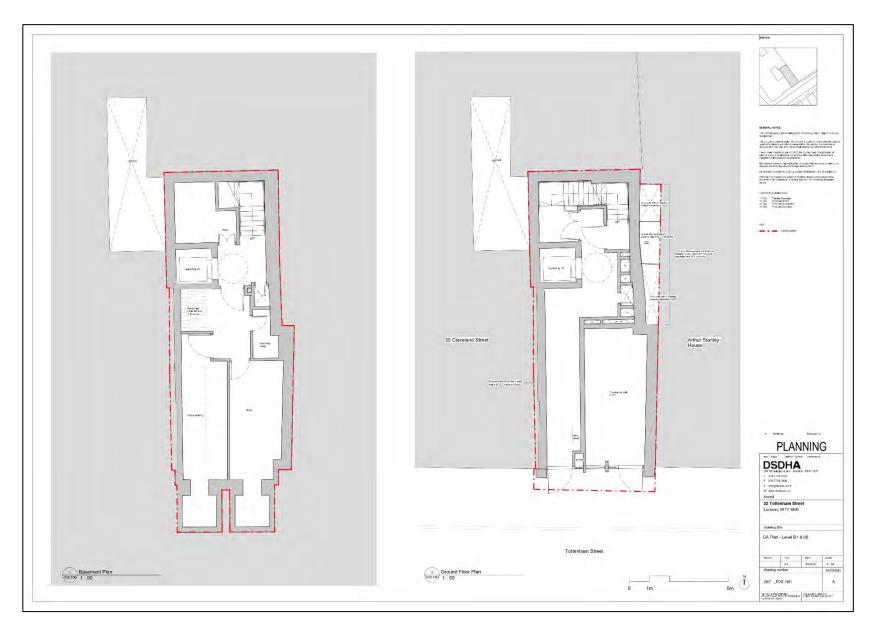


Appendices



A. Site Plans

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B. Key Local Planning Policy Requirements



London Planning Policy Framework

Key London Plan planning policy is detailed below:

The London Plan as Altered (2016)

The London Plan is the overall strategic plan for London. Chapter five details London's Response to Climate Change and includes a number of policies that set the overarching principles for reducing carbon emissions in the built environment:

Policy 5.2 - Minimising Carbon Dioxide Emissions

Planning Decisions

- A) Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:
 - 1) Be lean: use less energy;
 - 2) Be clean: supply energy efficiently;
 - 3) Be green: use renewable energy.
- B) The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Residential Buildings:

Year	Improvement in 2010 Building Regs
2010-2013	25% (Code Level 4)
2013-2016	40%
2016-2031	Zero Carbon

Non-Residential Buildings:

Year	Improvement in 2010 Building Regs
2010-2013	25%
2013-2016	40%
2016-2019	As per building regulations requirements
2019-2031	Zero Carbon

- C) Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emission reduction outlined above are to be met within the framework of the energy hierarchy.
- D) As a minimum, energy assessments should include the following details:
 - a) Calculations of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including



plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the hierarchy;

- b) Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services;
- c) Proposals to reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP);
- d) Proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

Policy 5.3 – Sustainable Design & Construction [extract]

Planning Decisions

- B) Development proposals should demonstrate that sustainable design standards are integral to the proposals, including its construction and operation, and ensure that they are considered at the beginning of the design process.
- C) Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles apply:
 - Minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems);
 - b) Avoiding internal overheating and contributing to the urban heat island effect;
 - Efficient use of natural resources (including water), including making the most of natural systems both within and around buildings;
 - d) Minimising pollution (including noise, air and urban run-off);

Policy 5.5 - Decentralised Energy Networks

Strategic

A) The Mayor expects 25 per cent of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target the Mayor prioritises the development of decentralised heating and cooling networks at the development and area wide levels, including larger scale heat transmission networks.

LDF Preparation

- B) Within LDFs boroughs should developer policies and proposals to identify and establish decentralised energy network opportunities. Boroughs may choose to develop this as a supplementary planning document and work jointly with neighbouring boroughs to realise wider decentralised energy network opportunities. As a minimum, boroughs should:
 - a) Identify and safeguard existing heating and cooling networks;



- ldentify opportunities for expanding existing networks and establishing new networks. Boroughs should use the London Heat Map tool and consider any new developments, planned major infrastructure works and energy supply opportunities which may arise;
- c) Developer energy master plans for specific decentralised energy opportunities which identify;
 - Major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing);
 - Major heat supply plant;
 - Possible opportunities to utilise energy from waste;
 - Possible heating and cooling network routes;
 - Implementation options for delivering feasible projects, considering issues of procurement, finding and risk in the role of the public sector.

Require developers to prioritise connection to existing or planned decentralised energy networks where feasible.

Policy 5.6 - Decentralised Energy in Development Proposals

Planning Decisions

- A) Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.
- B) Major development proposals should select energy systems in accordance with the following hierarchy:
 - 1) Connection to existing heating or cooling networks;
 - 2) Site wide CHP network;
 - 3) Communal heating and cooling.

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

Policy 5.7 - Renewable Energy

Strategic

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

Planning Decisions

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

LDF Preparation

C) Within LDFs boroughs should, and other agencies may wish to development more detailed policies and proposals to support the development of renewable energy in London – in particular, to identify broad areas where specific renewable



energy technologies, including large scale systems and the large scale deployment of small scale systems, are appropriate. The identification of areas should be consistent with any guidelines and criteria outlined by the Mayor.

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

Policy 5.9 - Overheating and Cooling

Strategic

A) The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

Planning Decisions

- B) Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this is in accordance with the following cooling hierarchy:
 - 1) Minimise internal heat generation through energy efficient design;
 - 2) Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls;
 - 3) Manage the heat within the building through exposed internal thermal mass and high ceilings;
 - 4) Passive ventilation;
 - 5) Mechanical ventilation;
 - 6) Active cooling.
- C) Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

LDF Preparations

Within LDFs boroughs should develop more detailed policies and proposals to support the avoidance of overheating and to support the cooling hierarchy.

Local Planning Policy Framework

Camden Local Plan (June 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 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:

- 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 [extract]

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

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

[...]

a) Measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

[...]



C. GLA Carbon Emissions Reporting Spreadsheet



SAP 2012 PERFORMANCE SAP10 PERFORMANCE

DOMESTIC

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	5	3
After energy demand reduction	5	3
After heat network / CHP	s	3
After renewable energy	4	3

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

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	0	-5%
Savings from heat network / CHP	0	0%
Savings from renewable energy	1	20%
Cumulative on site savings	1	15%
Annual savings from off-set payment	4	-
	(Tonne	s CO2)
Cumulative savings for off-set payment	118	-
Cash in-lieu contribution (£)	7,087	

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	4	1
After energy demand reduction	4	1
After heat network / CHP	4	1
After renewable energy	3	1

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

	Regulated domestic carbon dioxide savings		
	(Tonnes CO ₂ per annum)	(%)	
Savings from energy demand reduction	0	-6%	
Savings from heat network / CHP	0	0%	
Savings from renewable energy	1	27%	
Cumulative on site savings	1	20%	
Annual savings from off-set payment	3	-	
	(Tonnes CO2)		
Cumulative savings for off-set payment	96	-	
Cash in-lieu contribution (£)	5,731		



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 (Tomes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	4	6
After energy demand reduction	4	6
After heat network / CHP	4	6
After renewable energy	3	6

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 ₂ per annum)	(%)	
Savings from energy demand reduction	0	0%	
Savings from heat network / CHP	0	0%	
Savings from renewable energy	0	10%	
Total Cumulative Savings	0	9%	

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO ₂)	Cumulative Shortfall (Tonnes CO ₂)
Total Target Savings	1	-
Shortfall	1	28
Cash in-lieu contribution (£)	1,661	-

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

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO2 per amum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	2	3
After energy demand reduction	2	3
After heat network / CHP	2	3
After renewable energy	1	3

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 ₂ per annum)	(%)	
Savings from energy demand reduction	0	-1%	
Savings from heat network / CHP	0	0%	
Savings from renewable energy	1	35%	
Total Cumulative Savings	1	34%	

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO ₂)	Cumulative Short fall (Tonnes CO ₂)
Total Target Savings	1	-
Shortfall	0	1
Cash in-lieu contribution (£)	55	-



SITE-WIDE

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2013 baseline	8		
Belean	8	0	-3%
Be clean	8	0	0%
Be green	7	1	16%
	-	CO2 savings off-set (Tonnes CO2)	
Off-set	-	146	-

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L2013 baseline	6		
Be lean	6	0	-4%
Be clean	6	0	0%
Be green	5	2	30%
	-	CO2 savings off-set (Tonnes CO2)	-
Off-set	-	96	-



D. Indicative Energy Model Outputs (Be Lean)



		User Details:			
Assessor Name:		Stroma N	umber:		
Software Name:	Stroma FSAP 2012	Software	75.0075	ersion: 1.0.4.17	
		Property Address. Un	if 4		
Address :	Tottenham Street, Lon-	don			
Overall dwelling nim	iensions:		A THE LUCK		
Ground floor		Area(m²) 36.71 (1a)	Av. Height(m) x 2.58 (28	Volume(m ³)](3a
					=
First floor		26 (1b)	x 3.3 (2b	95.8	(3b
Second floor		18.23 (1c)	x 3,3 (2c	60.16	(3c
Third floor		23.08 (1d)	x 2.24 (2d	1) = 51.7	(3d
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.	(1n) 104.02 (4)		-	
Dwelling volume		(3a))+(3b)+(3c)+(3d)+(3e)+(3n) = 292.37	(5)
2. Ventilation rate				20207	
2. Ventuation rate	main seco	ndary other	total	m³ per hou	r
Number of chimneys	heating hea		= 0 x 40 =	0	(6a
Number of open flues	0		= 0 K20 =		(6p
Number of intermittent f			x 10 =		=
					(7a
Number of passive vent			0 *10	10	(7b
Number of flueless gas	fires		n x 40 =	0	(7c
1				Air changes per ho	our
Infiltration due to chimp	eys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 1 *(5)		(8)
	been carried out or is intended, p			- 0	1(0)
Number of storeys in				0	(9)
Additional infiltration			[(9)-1]x(0.1 = 0	(10
	0.25 for steel or timber fram			0	(11
if both types of wall are p deducting areas of open	present, use the value correspon	ding to the greater wall area (aft	fer		
	floor, enter 0.2 (unsealed)	or 0.1 (sealed), else ente	er O	0	(12
	nter 0.05, else enter 0			0	(13
	vs and doors draught strip	ped		0	(14
Window infiltration		0.25 - [0.2 x (14	4) + 100] =	0	(15
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16
Air permeability value	, q50, expressed in cubic	metres per hour per squar	re metre of envelope are	ea 4	(17
If based on air permeab	ility value, then (18) = [(17) +	20]+(8), otherwise (18) = (16)		0.2	(18
Air permeability value appli	ies if a pressurisation test has be	en done or a degree air permea	bility is being used		
Number of sides shelter	red	1001 4 70 07	F (40)	2	(19
Shelter factor	Service Control	(20) = 1 - [0.07		0.85	(20
Infiltration rate incorpora	ating shelter factor	$(21) = (18) \times (2$	(U) =	0.17	(21
- FIL - 12	for monthly wind speed				

	y avera	ge wind	speed	from Tab	le 7									
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind F	actor (22alm =	(22)m -	-4										
(22a)m=		1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
			00.10			Acres 1			500.00			_		
Adjust	0.22	0.21	te (allow	ing for s	helter ar	0.16	0.16	0.16	(22a)m	0.18	0.19	0.2		
Calcula	0.00				the appli			0.16	0.17	0.16	0.19	0.2		
If me	chanic	al ventil	ation:										0.5	(23a
					23b) = (23a) = (23a)			0.5	(23)
If bala	anced wit	h heat red	covery: effi	ciency in 9	6 allowing	for in-use	factor (from	n Table 4h) =				77.35	(230
	_		1	_	-	_	1	1	1		_	1 - (23c) ÷	100]	
(24a)m=	0.33	0.33	0.32	0.3	0.3	0,27	0.27	0.27	0.28	0.3	0.3	0.31		(24
		ed mech	_		n without	_	_	_	o)m = (2	2b)m + (_	1 . 1		(24)
(24b)m=	0	- 4	0	0	0	0	0	0		0	0	0		(24)
					or positiv					5 × (23h	a)			
(24c)m=	_	0.0	0	0	0	0	0	G	0	0	0	101		124
(24d)m=	f (22b)	0	0	0	0	0	. 0	0.5 + [(2 0.5 + [(2	0	0.5]	0	0		(24
(24d)m= Effe	f (22b)	0	0	0	1	0	. 0	0	0	0.5]	0.3	0.31		
(24d)m= Effec (25)m	f (22b)r 0 ctive air	change 0.33	0 rate - e	0 nter (24	a) or (24 0.3	0 b) or (24	0 lc) or (24	o ld) in bo	0 x (25)	0				
(24d)m= Effer (25)m 3 He	0 otive air	0 change 0.33 s and l	0 rate - e 0.32	nter (24 0.3 parame	0 a) or (24 0.3	0 b) or (24	0 c) or (24 9.27	o ld) in bo	0 c (25) n.26	0	0.3			
(24d)m= Effect (25)m 3 He ELEN	0 otive air	0 change 0.33 es and l Gro	0 0 e rate - e 0.32 e al loss	nter (24 0.3 parame	0 a) or (24 0.3 ter	0 b) or (24 0.27	0 (c) or (24 (9.2) rea m²	0 in box 0.27	0 x (25) 0.26 ue ex	0.3 0.3 A X U	0.3	0.31		(25) X k J/K
(24d)m= Effec (25)m 3 He ELEM Window	f (22b)r 0 ctive air 0.33	o change 0.33 es and la Groate 1	0 0 e rate - e 0.32 e al loss	nter (24 0.3 parame	0 a) or (24 0.3 ter	0 b) or (24 0.27 Net A A,	0 c) or (24 c) o	0 4d) in boo 0.27 U-val W/m2	0 (25) (1.26) (1.26)	0 0.3 A X U (W/)	0.3	0.31		(25) X k J/K
(24d)m= Effect (25)ml 3 He ELEN Window	f (22b)r 0 ctive air 0.33 IENT ws Type	0 change 0.33 of Groates 1 e 2	0 0 e rate - e 0.32 e al loss	nter (24 0.3 parame	0 a) or (24 0.3 ter	0 b) or (24 0.27 Net A A,	oc) or (24 0,27 rea m ² 7 x x	0 dd) in box 0.27 U-val W/m2	0 (25) (0.26) (0.26) (0.26) (0.04) = 0.04) =	0 0.3 A X U (W/I	0.3	0.31		(25) X k J/K (27)
(24d)m= Effect (25)m 3 He ELEM Window Window	f (22b)r 0 ctive air 0.33 IENT ws Typows Typows	o change of a chan	0 0 e rate - e 0.32 e al loss	nter (24 0.3 parame	0 a) or (24 0.3 ter	0 0 or (24 0.27 Net A A,	0 0 c) or (24 0.27 crea m² 7 x 4 x 4 x 4 x 4 x 4 x 4 x 4 x 4 x 4 x	0 1d) in box 0.27 U-val W/m2 W/m2 1/[1/(1.4)*	0 (25) (0.28) (0.28) (0.28) (0.04) = 0.04] =	0 0.3 A X U (W// 18.12 14.29	0.3	0.31		(25) X k J/K (27) (27)
(24d)m= Effect (25)mi 3 He ELEN Window Window Window	ottive air 0.33 ar losss IENT ws Typows Typows Typows	o change of a chan	0 0.32 0.32 eat loss os s	nter (24 0.3 parame	0 a) or (24) 0.3 ternogs	0 0,27 Net A A, 13,6	rea m² x x x x x x x x x x x x x x x x x x	0 in box 0.27 U-val W/m2 W/m2 1/[1/(1.4.)+1/[1/(1.4.)	0 (25) (0.28) (0.28) (0.28) (0.04) = 0.04] =	0 0.3 A X U (W/I 18.12 14.29 12.78	0.3	0.31		(25) X k J/K (27) (27) (27)
(24d)m= Effect (25)m 3 He ELEN Window Window	ottive air 0.33 ar losss IENT ws Typows Typows Typows	0 change 0.33 es and h Groares e 1 e 2 e 3 e 4	0 0.32 0.32 eat loss os s	onter (24 0.3 parame	0 0.3 0.3 ternogs	0 or (24 0.27 Net A A , 13.6 10.7 9.64 15.8	rea m² 7 x' 8 x' 9 x'	0 3d) in box 0.27 U-val W/m2 1/[1/(1.4.)*	0 (25) (0.28) (0.28) (0.28) (0.04) = 0.04] =	0 0.3 A X U (W// 18.12 14.29 12.78 21.07	0.3	0.31		(25) X k J/K (27) (27) (27) (27)
(24d)m= Effec (25)m 3 Ha ELEN Window Window Window Window Window Window Window Window Window Window Window Window	(22b)i 0 ctive air 0.33 IENT ws Type ws Type ws Type ws Type ws Type ws Type	0 change 0.33 es and h Groares e 1 e 2 e 3 e 4	0 0 2 rate - e 0.32 eat loss os a (m²)	onter (24 0.3 parame Openi	0 0.3 0.3 ternogs	0 or (24 0.27 Net A A 13.6 10.7 9.64 7.64	rea m² 7 x' 8 x' 9 x' 9 x	0 dd) in box 0.27 U-val W/m2 W/m2 1/[1/(1.4.)+1/[1/(1.	0 (25) (0.28) (0.28) (0.28) (0.04) = 0.04] =	0 0.3 A X U (W/I 18.12 14.29 12.78 21.07 1.38	0.3	0.31		(25) X k J/K (27) (27) (27) (27) (29)
(24d)m= Effect (25)m 3 He ELEN Window	(22b) 0 ctive air 0.33 I 10888 IENT ws Typo ws Typo ws Typo ws Typo ws Typo ws Typo dows and	0 change 0.33 ss and 1 Greate 1 ee 2 ee 3 ee 4 5.57 48 selement 1 roof wine	0 0.32 rate - e 0.32 real loss os s a (m²)	Openia 49.	0 a) or (24) 0.3 ter ngs m²	0 or (24	rea m² x x x x x x x x x x x x x x x x x x	U-val W/m2 1/(1/(1.4)* 1/(1/(1.4)* 1/(1/(1.4)* 0.18	0 × (25) 0.28 0.04] = 0.04] = 0.04] = 0.04] =	0 0.3 A X U (W/I 18.12 14.29 12.78 21.07 1.38 6.34	0.3	0.31	k.	(25) X k J/K (27) (27) (27) (27) (29)
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(24d)m= Effect (25)m 3 Hc ELEN Window Window Window Walls Roof Total a * for win * include Fabric	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	or change of the	0 0 2 rate - e 70.32 eat loss ss. ss. a (m²) 62 79 ss. m² dows, use h sides of h	0 onter (24 onte	0 a) or (24) 0.3 ter. ngs m²	0 or (24	rea m² x x x x x x x x x x x x x x x x x x	0 dd) in box 0.27 U-val W/m2 W/m2 1/[1/(1.4.)+1/[1/(1.	0 × (25) 0.28 ue 2K 0.04] =	0 0.3 A X U (W/I 18.12 14.29 12.78 21.07 1.38 6.34	0.3	k-value kJ/m²-K	k.	(25) X k J/K (27) (27) (27) (29) (30) (31)
(24d)m= Effect (25)m 3 He ELEN Window Window Window Walls Roof Total a * for window Fabric Heat c	o thive air to the control of the co	change ch	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Opening (24) Opening (49) Opening (49) Opening (49) Opening (49)	0 a) or (24) 0.3 ter. ngs m²	0 b) or (24 l) 0.27 Net A A	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 dd) in box 0.27 U-val W/m2 W/m2 1/[1/(1.4.)+1/[1/(1.	0 x (25) 0.28 ue 2K 0.04] =	A X U (W// 18.12 14.29 12.78 21.07 1.38 6.34	0.3 K) Significant in the second in the se	k-value kJ/m²-K	73.98	(25) X k (27) (27) (27) (29) (30) (31)
(24d)m= Effect(25)m 3 Hc ELENWindow Window Window Window Walls Roof Total a *for win **includ Fabric Heat c Therm For desi	0 33 It losses IENT Was Typi was Typi was Typi was Typi are a of e dows ane heat lo apacity al mass gn asses gn asses	0 change	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Openi 49. 0 of effective winternal was a U) P = Cmetails of the	a) or (24) 0.3 ter ngs m²	0 b) or (24 b) 27 Net A A A A A A A A A A A A A A A A A A A	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 Hd) in box 0.27 U-val W/m2 W/m2 V/m2 V/m2 V/m2 V/m2 V/m2 V/m2 V/m2 V	0 x (25) 0.28 use 2K 0.04] = 0	0.3 A X U (W// 18.12 14.29 12.78 21.07 1.38 6.34 (a) +0.04j s	0.3 K) as given in (32a) Medium	k-value kJ/m²-K	73.98 973.91	



	of therma		are not kn	own (36)	= 0.05 x (3	(1)			(33)+	(36) =		Г	78.93	(37
		at loss ca	lculated	month	v					= 0.33 × (25)m v /5)	- 1	76.93	(31)
, , , , , , ,	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	31.84	31.43	31.02	28.97	28.56	26.51	26.51	26.1	27.33	28.56	29.38	30.2		(38)
Heat tr	ansfer o	coefficier	nt. W/K						(39)m	= (37) + (38)m			
(39)m=	110,77	110,36	109,95	107.9	107.49	105 44	105.44	105.03	106.26	107 49	108.31	109.13		
										Average =		17/12=	107.8	(39)
	-	meter (F	41			1	-			= (39)m =	47.7			
(40)m=	1.06	1.06	1.06	1.04	1.03	1.01	1.01	1.01	1.02	1.03 Average =	1.04	1.05	1.04	(40)
Numbe	er of day	s in mo	nth (Tab	le 1a)						Avelage =	oun(40)	12/12=	1.04	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
		ing ene												
		pancy, I 9, N = 1		[1 - exp	o(-0.0003	349 x (TI	FA -13.9)2)] + 0.0	0013 x (TFA -13	9)	77		(42
if TF		9, N = 1		[1 - exp	o(-0.0003	349 x (TI	FA -13.9)2)] + 0.1	0013 x (TFA -13	9)	77		(42)
if TF if TF Annua	A > 13.1 A £ 13.1 averag	9, N = 1 9, N = 1 e hot wa	+ 1,76 x	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		9)	77	-7.7	(42)
if TF if TF Annua Reduce	A > 13. A £ 13 (averag	9, N = 1 9, N = 1 le hot wa al average	+ 1,76 x ter usag	ge in litre usage by	es per da	ay Vd,av	erage =	(25 x N)	+ 36		9)		1	
if TF if TF Annua Reduce	A > 13.1 A £ 13.6 I averag the annual that 125	9, N = 1 9, N = 1 le hot wa al average litres per i	+ 1,76 x ter usag not water resson per	ge in litre usage by day (all v	es per da 5% if the c	ay Vd,av	rerage = designed ((25 x N) to achieve	+ 36 a water u	se target o	9)	0.08	1	
if TF if TF Annua Reduce not more	A > 13.1 A £ 13.1 I averag the annue that 125 Jan	9, N = 1 9, N = 1 le hot wa al average litres per l	+ 1,76 x ter usag not water nerson per Mar	ge in litre usage by day (all v	es per da 5% if the o vater use,	ay Vd, av Welling is hot and co	erage =	(25 x N) to achieve	+ 36		9)			
if TF if TF Annua Reduce not more	A > 13.1 A £ 13.1 I averag the annue that 125 Jan or tisage ii	9, N = 1 9, N = 1 le hot wa al average litres per l	+ 1,76 x ter usag not water nerson per Mar	ge in litre usage by day (all v	es per da 5% if the o vater use,	ay Vd, av Welling is hot and co	rerage = designed ((25 x N) to achieve	+ 36 a water u	se target o	9)	0.08		
if TF if TF Annua Reduce not mon Hot walk (44)m=	A > 13.1 A £ 13.4 I average the annual inat 125 Jan r usage ii	9, N = 1 9, N = 1 le hot wa al average litres per l Feb 106 08	+ 1,76 x eter usag not water person per Mar day for ex	ge in litre usage by day (all v Apr ach month	es per da 5% if the covater use, May vd,m = fa	ay Vd, av Welling is hot and co Jun ictor from	designed (designed) Jul Table 1c x	(25 x N) to achieve Aug (43)	+ 36 a water us Sep	Oct 102.08 Total = Su	Nov 106.08	Dec 110.08	1200.92	(43)
if TF if TF Annua Reduce not mon Hot walk (44)m=	A > 13.1 A £ 13.4 I average the annual inat 125 Jan r usage ii	9, N = 1 9, N = 1 le hot wa al average litres per l Feb 106 08	+ 1,76 x eter usag not water person per Mar day for ex	ge in litre usage by day (all v Apr ach month	es per da 5% if the covater use, May vd,m = fa	ay Vd, av Welling is hot and co Jun ictor from	rerage = designed (old) Jul Table tcx	(25 x N) to achieve Aug (43)	+ 36 a water us Sep	Oct 102.08 Total = Su	Nov 106.08	Dec 110.08	1200 92	(43)
if TF if TF Annua Reduce not more Hot walk (44)n= Energy	A > 13.1 A £ 13.4 I average the annual inat 125 Jan r usage ii	9, N = 1 9, N = 1 le hot wa al average litres per l Feb 106 08	+ 1,76 x eter usag not water person per Mar day for ex	ge in litre usage by day (all v Apr ach month	es per da 5% if the covater use, May vd,m = fa	ay Vd, av Welling is hot and co Jun ictor from	designed (designed) Jul Table 1c x	(25 x N) to achieve Aug (43)	+ 36 a water u: Sep 98 08 98 08	Oct 102 08 Total = Sunth (see Tal. 133.38	9) Nov 106.08 m(44), u ables 1b, 1 145.59	0.08 110.08 c, 1d) 158.1		(44)
if TF if TF Annua Reduce not mos Hot wate (44)m= Energy (45)m=	A > 13.0 A £ 13.6 A £ 13.6 I average the annue a that 125 Jan 110.08 content of	9, N = 1 9, N = 1 9, N = 1 e hot wa al averaga litres per l Feb 106 08 hot water	+ 1,76 x ater usagiot water person per Mar day for e. 102.08 used - cak	ge in litre usage by day (all v Apr 98.08 culated m	es per da 5% if the vater use, May Vd,m = fa 94.07	Jun 190 x Vd, 1	rerage = designed in idd) Jul Table tc x 90.07 m x nm x E	(25 x N) to actilieve Aug (43) 94.07 07m/3600	+ 36 a water us Sep 98 08 114 45	Oct 102.08 Total = Sunth (see Ta	9) Nov 106.08 m(44), u ables 1b, 1 145.59	0.08 110.08 c, 1d) 158.1	1200 92 1574.6	(43)
if TF if TF Annua Reduce not more Hot wate (44)m= Energy ((45)m=	A > 13.1 A E 13.4 I average the annue at that 125 Jan 110.08 content of 163.25 taneous w	9, N = 1 9, N = 1 le hot was a average litres per litre	+ 1,76 x Iter usagnot water merson per Mar day for ex 102.08 used - calc 147.34	ge in litriusage by day (all v Apruch month 98.08	es per da 5% if the water use. May a Vd,m = fa 94.07 conthly = 4.	ay Vd,av welling is itel and co Jun ictor from 90.07 190 x Vd,t 106.36	derage = designed (id) Jul Table 1c x 90.07 m x nm x E 98.56 enter 0 in	(25 x N) (a actilieve Aug (43) 94.07 07m/3600 113.09 boxes (46)	+ 36 a water us Sep 98.08 98.08 114.45) to (61)	Oct 102.08 Total = Su 133.38 Total = Su	106.08 m(44)u = 106.08 m(45)u = 106.08 m(45)u = 106.08	Dec 110.08 = c, 1d) 158.1		(43)
if TF if TF Annua Reduce not more Hot walk (44)m= Energy (45)m= If instant (46)m=	A > 13.0 A £ 13.6 A £ 13.6 I average the annue a that 125 Jan 110.08 content of	9, N = 1 9, N = 1 le hot was al average litres per l Feb 106 08 hot water 142.78	+ 1,76 x ater usagiot water person per Mar day for e. 102.08 used - cak	ge in litre usage by day (all v Apr 98.08 culated m	es per da 5% if the vater use, May Vd,m = fa 94.07	Jun 190 x Vd, 1	rerage = designed in idd) Jul Table tc x 90.07 m x nm x E	(25 x N) to actilieve Aug (43) 94.07 07m/3600	+ 36 a water us Sep 98 08 114 45	Oct 102 08 Total = Sunth (see Tal. 133.38	9) Nov 106.08 m(44), u ables 1b, 1 145.59	0.08 110.08 c, 1d) 158.1		(43)
if TF if TF Annua Reduce not more Hot wate (44)m= Energy (45)m= If instant (46)m= Water	A > 13.1 A E 13.1 I average the annue a that 125 Jan 110.08 content of 163.25 taneous w 24.49 storage	9, N = 1 9, N = 1 e hot wad a verage litres per l Feb 106 08 hot water 142 78 vater heatin 21.42 loss:	+ 1,76 x ter usac flot water person per Mar day for ex 102.08 147.34 ag at point 22.1	ge in litrausage by day (all v Apr ack month 98.08 culated m 128.45 of use (m 19.27	es per da 5% if the valer use. May Vd,m = fa 94.07 conthly = 4. 123.25 co hot wate.	y Vd, av	derage = designed (id) Jul Table 1c x 90.07 m x nm x E 98.56 enter 0 in	(25 x N) to actileve Aug (43) 94.07 07m/ 3600 113.09 boxes (46)	+ 36 a water us Sep 98.08 0 kWh/mor 114.45 0 to (61) 17.17	Oct 102.08 Total = Su 133.38 Total = Su 20.01	Nov 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08 106.08	Dec 110.08 = c, 1d) 158.1		(44)
if TF if TF Annua Reduce not mos Hot walk (44)m= Energy (45)m= If instant (46)m= Water Storag If comi	A > 13.1 A £ 13.1 A £ 13.1 I average in a 1725 Jan 110.08 103.25 taneous w 24.49 storage e volum munity h	9, N = 1 9, N = 1 9, N = 1 e hot was a not ween and average litres per litres litres per	+ 1,76 x Iter usage flot water lot water Mar day for ex 102.08 147.34 used - cale 147.34 g at point 22.1 including no tale	ge in litrausage by day (all v Aprach month) 98.08 128.45 of use (m. 19.27 ng any sunk in dv	es per di 5% if the water use. May Vd,m = fa 94.07 123.25 o hot wate 18.49 olar or V welling, e	Jun volume 190.07 190 x Vd, 106.36 r storage), 15.95 WHRS enter 110	designed in design	(25 x N) to actilieve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47)	+ 36 a water us Sep 98.08 114.45 10.661) 17.17 ame ves	Oct 102.08 Total = Sin 133.38 Total = Su 20.01	9) Nov 106.08 m(44) 145.59 m(45) 21.84	Dec 110.08 = c, 1d) 158.1 = 23.72		(44)
if TF if TF Annua Reduce not mon Hot walk (44)m= (44)m= Energy 4 (45)m= If instant (46)m= Water Storag If comi	A > 13.4 A £	9, N = 1 9, N = 1 9, N = 1 10, N = 1	+ 1,76 x Iter usage flot water lot water Mar day for ex 102.08 147.34 used - cale 147.34 g at point 22.1 including no tale	ge in litrausage by day (all v Aprach month) 98.08 128.45 of use (m. 19.27 ng any sunk in dv	es per di 5% if the water use. May Vd,m = fa 94.07 123.25 o hot wate 18.49 olar or V welling, e	Jun volume 190.07 190 x Vd, 106.36 r storage), 15.95 WHRS enter 110	designed in Juli Juli 17able fcx 90.07 m x nm x E 98.56 enter 0 in 14.78 storage	(25 x N) to actilieve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47)	+ 36 a water us Sep 98.08 114.45 10.661) 17.17 ame ves	Oct 102.08 Total = Sin 133.38 Total = Su 20.01	9) Nov 106.08 m(44) 145.59 m(45) 21.84	Dec 110.08 = c, 1d) 158.1 = 23.72		(44)
if TF if TF Annua Reduce not most (44)m= Energy 4 (45)m= Water Storag If commont Otherw Water	A > 13.4 A £	9, N = 1 106, N = 1 106	+ 1.76 x ter usage flot water person per Mar day for es 102.08 147.34 ag at point 22.1 including no tale hot water	ge in litrusage by day (all v Apr 98.08 128.45 of use (m 19.27 ng any s ank in dver (this in	es per di 5% if the water use. May a Vd,m = fa 94.07 onthly = 4. 123.25 o hot wate. 18.49 olar or V welling, e	ay Vd, availing is shoot and color from 30.07 190 x Vd, 106.36 r storage), 15.95 WHRS enter 110 instantantantantantantantantantantantantant	designed of design	(25 x N) to actilieve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47)	+ 36 a water us Sep 98.08 114.45 10.661) 17.17 ame ves	Oct 102.08 Total = Sin 133.38 Total = Su 20.01	Nov 106.08 m(44), 53 = 50 bbs 1b, 1 145.59 m(45) 53 = 21.84	Dec 110.08 = c, 1d) 158.1 = 23.72		(43) (44) (45) (46) (47)
if TF if TF Annua Reduce not most (44)m= Energy (45)m= If instan (46)m= Water Storag If commont Otherw Water a) If m	A > 13.4 A £	9, N = 1 106 08 106 08 106 08 106 08 106 08 107 08 108 08 10	+ 1.76 x Inter usage foot water usage foot water usage foot water usage foot water usage foot foot water usage foot foot foot foot foot foot foot foo	ge in litrusage by day (all v Apr 98.08 128.45 of use (in 19.27) ng any s ank in dver (this in oss fact	es per di 5% if the water use. May Vd,m = fa 94.07 123.25 o hot wate 18.49 olar or V welling, e	ay Vd, availing is shoot and color from 30.07 190 x Vd, 106.36 r storage), 15.95 WHRS enter 110 instantantantantantantantantantantantantant	designed of design	(25 x N) to actilieve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47)	+ 36 a water us Sep 98.08 114.45 10.661) 17.17 ame ves	Oct 102.08 Total = Sin 133.38 Total = Su 20.01	Nov 106.08 m(44), 53 = 50 bbs 10, 1 145.59 m(45) = 51 21.84	Dec 110.08		(43) (44) (45) (46) (47)
if TF	A > 13.1 A ≥	9, N = 1 106, N = 1 106	+ 1.76 x ter usag feet water person per Mar day for ex 102.08 used - calc 147.34 g at point 22.1 including ind no ta hot water eclared le m Table	ge in litrusage by day (all v Apr Apr Act month) 98 08 128.45 of use (multiple of the control	ses per di 5% if the water use, Way vd,m = fa 94.07 123.25 o hot water 18.49 olar or V welling, e ncludes i	ay Vd, availing is shoot and color from 30.07 190 x Vd, 106.36 r storage), 15.95 WHRS enter 110 instantantantantantantantantantantantantant	designed old of the control of the c	(25 x N) to actilieve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47)	98 08 98 08 98 08 114 45 10 (61) 17.17 17.17 18 or each of the control of	Oct 102.08 Total = Sin 133.38 Total = Su 20.01	Nov 106.08 106.08 106.08 145.59 145.59 121.84	Dec 110.08 = c, 1d) 158.1 = 23.72		(43) (44) (45) (46) (47) (48) (49)
if TF	A > 13.1 A >	9, N = 1,	+ 1,76 x ater usa, ter usa, te	pe in literal susage by dall visage	May May Va,m = fa 123.25 o hot wate 18.49 olar or V welling, e ncludes i or is known ear	Jun 20.07 190 x Vd, av	derage = designed lotd) Juli Table fcx 90.07 m x nm x E 98.56 enter 0 in 14.78 storage 0 litres in neous conh/day):	(25 x N) to active ve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47) smbi boil	98 08 98 08 98 08 114 45 10 (61) 17.17 17.17 18 or each of the control of	Oct 102.08 Total = Sin 133.38 Total = Su 20.01	Nov 106.08 106.08 106.08 145.59 145.59 121.84	Dec 110.08 = c, 1d) 158.1 = 23.72 0		(43) (44) (45) (46) (47) (48) (49) (50)
if TF if ITF if	A > 13.1 A >	9, N = 1 le hot water health in the part of the part o	+ 1,76 x ater usa ater usa ater usa ater usa ater usa ater usa Mar 102.08 102.08 147.34 22.1 includir ind no tata ater dia a	Apr	es per di 5% if the vater use. May v. Va, m = fa 94.07 123.25 o hot wate 18.49 olar or V welling, e ncludes i	Jun 20.07 190 x Vd, av	derage = designed lotd) Juli Table fcx 90.07 m x nm x E 98.56 enter 0 in 14.78 storage 0 litres in neous conh/day):	(25 x N) to active ve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47) smbi boil	98 08 98 08 98 08 114 45 10 (61) 17.17 17.17 18 or each of the control of	Oct 102.08 Total = Sin 133.38 Total = Su 20.01	Nov 106.08 106.08 106.08 10.00 106.08 10.10 145.59 21.84	Dec 110.08 = c, 1d) 158.1 = 23.72 0		(43) (44) (45) (46) (47) (48) (49) (50)
if TF	A > 13.3 A e average A = 13.3	9, N = 1 1 1 1 1 1 1 1 1 1	+ 1,76 x ater usa ater ater ater ater ater ater ater ate	Apr	May May Va,m = fa 123.25 o hot wate 18.49 olar or V welling, e ncludes i or is known ear	Jun 20.07 190 x Vd, av	designed of design	(25 x N) to active ve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47) smbi boil	98 08 98 08 98 08 114 45 10 (61) 17.17 17.17 18 or each of the control of	Oct 102.08 Total = Sin 133.38 Total = Su 20.01	Nov 106.08 (n(44), a 145.59 (n(45), a 147)	0.08 Dec 110.08		(43) (44) (45) (46) (47) (48) (50) (51)
if TF	A > 13.1 A = 13.7 A =	9, N = 1 le hot water health in the part of the part o	+ 1.76 x ter usa ter	ge in literature of the state o	May May Va,m = fa 123.25 o hot wate 18.49 olar or V welling, e ncludes i or is known ear	Jun 20.07 190 x Vd, av	designed of design	(25 x N) to active ve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47) smbi boil	98 08 98 08 98 08 114 45 10 (61) 17.17 17.17 18 or each of the control of	Oct 102.08 Total = Sin 133.38 Total = Su 20.01	Nov 106.08 (m(44)	Dec 110.08 c, 1d) 158.1 23.72 0 0 0 0 0 0 0 0 0		(43) (44) (45) (46) (47) (48) (49) (50) (51)
if TF if TF if TF if TF Reduces Reduce	A > 13.1 A £	9, N = 1 le hot water later beat	+ 1.76 x ter usa ter	ge in literature of the second	es per di 50% if the water use. May Vd.m = In 94 07 123 25 to hot water 18.49 olar or V welling, e cludes i los fact le 2 (kW	Jun 20.07 190 x Vd, av	rerage = designed with the des	(25 x N) to active ve Aug (43) 94.07 113.09 boxes (46) 16.96 within sa (47) smbi boil	+ 36 a water un Sep 98 08 80 08 Win/more 114 45 17.17 arme ves ers) enti	Oct 102.08 100 100 100 100 100 100 100 100 100 1	Nov 106.08 (n(44)	0.08 Dec 110.08		(42) (43) (44) (45) (46) (47) (48) (50) (51) (52) (53) (54)

(57)m= Primar Primar	o er contains	0 s dedicate			month			((56)m = (55) × (41)	m				
(57)m= Primar Primar	0	s dedinate	0	0	0	0	0	0	0	0	0	0	1	(56)
Primar Primar		· AUGILIANDI	d solar sto	rage, (57)	m = (56)m	x [(50) - (H11)] - (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appen	dix H	
Primar	ry circuit	0	0	0	0	0	0	0	0	0	0	0	1	(57)
Primar		loss (an	nual) fro	m Table	3							0	i	(58)
	ry circuit	100000000000000000000000000000000000000			month (59)m =	(58) + 36	55 × (41)	m				-	
(mod	dified by	factor fr	om Tabl	e H5 if t	here is s	olar wa	ter heatin	ng and a	cylinde	r thermo	stat)			
(59)m=	0	.0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	culated	for each	month ((61)m =	(60) ÷ 30	35 × (41)m						
(61)m=	50.96	46.03	50.96	48.37	47.94	44.42	45.9	47.94	48.37	50.96	49.32	50.96		(61)
Total h	neat requ	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	+ (59)m + (61)m	
(62)m=	214.21	188.81	198.3	176.82	171.19	150.78	144.45	161.03	162.81	184.33	194.9	209.06	1	(62)
Solar Di	HW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	y) (enter '0	if no sola	r contributi	on to water	er heating)	
(add a	dditiona	l lines if	FGHRS	and/or V	WWHRS	applies	, see Ap	pendix (3)					
(63)m=	0	.0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter											
(64)m=	214.21	188.81	198.3	176.82	171.19	150.78	144.45	161.03	162.81	184.33	194.9	209.06		
								Out	out from w	ater heater	(enmust)		2156.7	(64)
Heat g										·		100	1	
	ains from	m water	heating,	kWh/m	onth 0.25	[0.85	× (45)m	+ (61)m	1 + 0.8	x [(46)m	+ (57)m	+(59)n	1	
inclu	67.02	58.98 m in calc	61.73 culation	518	52.97 only if c	46,47	44.24	49.59	50.14	57.09	60.74	65.31		(65)
inclu 5	67.02 ude (57) ude (57) olic gain	58.98 m in calc eins (s es (Table	61.73 culation of tible 5 5), Wat	51 8 of (65)m 1 5a ts	52.97 only if c	46,47 ylinder i	44.24 s in the o	49.59 dwelling	50.14 or hot w	57.09 rater is fr	60.74 om dom	65.31 munity		(65)
inclu 5 Metab	67.02 ude (57) mal ga olic gain Jan	58,98 m in calc ains (s as (Table	61.73 culation of tible 5 5), Wate Mar	518 of (65)m 5a ts Apr	52.97 only if c	46,47 ylinder i Jun	44.24 s in the o	49 59 dwelling Aug	50.14 or hot w	57.09 ater is fr	60.74 om dom	65.31 munity		
inclu 5 Metab	67.02 ude (57) mal ga olic gain Jan 138.69	58.98 m in calc eins (s es (Table Feb	61.73 culation of tole 5 5), Wat Mar 138.69	51.8 of (65)m 52 ts Apr 138.69	52.97 only if c May 138.69	46,47 ylinder i Jun 138.69	44.24 s in the o	49 59 dwelling Aug 138.69	50.14 or hot w Sep 138.69	57.09 rater is fr	60.74 om dom	65.31 munity		(66)
include includ	67.02 ude (57) mal ga olic gain Jan 138.69	58.98 m in calculations (Stable Feb. 138.69) (calculations)	61.73 culation of 101e 5 5), Wat Mar 138.69 ted in Ap	51 8 of (65)m 5a ts Apr 138.69 opendix	May 138.69	Jun 138.69	44.24 s in the o Jul 138.69 r L9a), a	Aug 138.69	Sep 138.69	57.09 rater is fr Oct 138.69	60.74 om com Nov 138.69	Dec 138.69		(66)
inclu 5 Metab (66)m= Lightin (67)m=	67.02 Ude (57) Unal 98 Olic gain Jan 138.69 ug gains 23.42	58.98 m in calculations (S. Table Feb. 138.69 (calculations)	61.73 culation of tole 5 5), Wate Mar 138.69 ted in Ap	51 8 of (65)m 5a ts Apr 138.69 opendix 12.81	52.97 pnly if c May 138.69 L, equati	Jun 138.69 ion L9 o	Jul 138.69 r L9a), a	Aug 138.69 Iso see	Sep 138.69 Table 5	57.09 rater is fr Oct 138.69	60.74 om dom	65.31 munity		
inclus Metabo (66)m= Lightin (67)m= Applia	87.02 ude (57) unal 98 olic gain Jan 138.69 ng gains 23.42 nces ga	58.98 m in calculations (S. Tables Feb. 138.69 (calculations) (calculations) (calculations) (calculations)	61.73 bulation of 101e 5 5), Wat Mar 138.69 ted in Ap 16.91 ulated in	51.8 of (65)m tu 5a tts Apr 138.69 ppendix 12.81	May 138.69 L, equati 9.57	Jun 138.69 ion L9 o 8.08 uation L	Jul 138.69 r L9a), a 8.73	Aug 138.69 Iso see 11.35	Sep 138.69 Table 5 15.23	57.09 ater is fr Oct 138.69 19.34 ble 5	00.74 om dom Nov 138.69	Dec 138.69		(66) (67)
inclu 5 Metab (66)m= Lightin (67)m= Applia (68)m=	87.02 ude (57) mal 98 olic gain Jan 138.69 ag gains 23.42 nces ga 262.67	58,98 m in calcelins (9 s (Table 138.69 (calcula: 20.8 ins (calc	61.73 culation of 101e 5 5), Watt Mar 138.69 ted in Ap 16.91 ulated in 258.52	51.8 of (65)m 52 ts Apr 138.69 ppendix 12.81 Appendix 243.9	52.97 only if c May 138.69 L, equati 9.57 dix L, equ 225.44	Jun 138.69 fon L9 o 8.08 uation L	Jul 138.69 r L9a), a 8.73 13 or L1 196.51	Aug 138.69 Iso see 11.35 3a), also	Sep 138.69 Table 5 15.23 see Ta 200.65	Oct 138.69 19.34 ble 5 215.27	60.74 om com Nov 138.69	Dec 138.69		(66)
inclusion inclus	87.02 ude (57) nal ga olic gain 138.69 ng gains 23.42 nces ga 262.67 ng gains	58,98 m in calculations (s. 138,69 138,69 (calculations (calculations (calculations (calculations))) 265,39 (calculations (calculations))	61.73 culation of able 5: 5), Watt Mar 138.69 ted in Ap 16.91 ulated in 258.52 ted in Ap	51.8 of (65)m tu 52 ts Apr 138.69 ppendix 12.81 Append 243.9 ppendix	52.97 only if c May 138.69 L, equati 9.57 dix L, equ 225.44 L, equat	Jun 138.69 ion L9 o 8.08 uation L 208.1	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a	Aug 138.69 Iso see 11.35 3a), also 193.78	Sep 138.69 Table 5 15.23 see Ta 200.65	Oct 138.69 19.34 ble 5 215.27	Nov 138.69 22.58	Dec 138.69 24.07 251.08		(66) (67) (68)
inclu Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m=	87.02 ude (57) una 98 olic gain 138.69 ug gains 23.42 nces ga 262.67 ng gains 36.87	58.98 m in calculations (s. 138.69 138.69 (calculations (c	61.73 bulation of ble 5 5), Wat Mar 138.69 ted in Ap 16.91 ulated in 258.52 ted in Ap 36.87	51.8 of (65)m 1.52 ts Apr 138.69 ppendix 12.81 Append 243.9 ppendix 36.87	52.97 only if c May 138.69 L, equati 9.57 dix L, equ 225.44	Jun 138.69 fon L9 o 8.08 uation L	Jul 138.69 r L9a), a 8.73 13 or L1 196.51	Aug 138.69 Iso see 11.35 3a), also	Sep 138.69 Table 5 15.23 see Ta 200.65	Oct 138.69 19.34 ble 5 215.27	00.74 om dom Nov 138.69	Dec 138.69		(66) (67)
inclu Metab (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m=	olic gains Jan 138.69 g gains 23.42 nces ga 262.67 ng gains 36.87 s and fai	58.98 m in calculation (gradual) s (Table Feb. 138.69 (calculation (calculation)) 20.8 ins (calculation) (calculation) 36.87 ns gains	61.73 ble 5 5), Wat Mar 138.69 ted in Ap 16.91 ulated in 258.52 sted in Ap 36.87 (Table 5	Apr 138.69 ppendix 12.81 Appendix 243.9 ppendix 36.87	52.97 only if c May 138.69 L, equati 9.57 dix L, equat L, equat L, equat	Jun 138.69 ion L9 o 8.08 uation L 208.1 ion L15 36.87	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 36.87	Aug 138.69 Iso see 11.35 3a), also 193.78), also se 36.87	Sep 138.69 Table 5 15.23 See Ta 200.65 ee Table 36.87	Oct 138.69 19.34 ble 5 215.27 5 36.87	Nov 138.69 22.58 233.73	Dec 138.69 24.07 251.08 36.87		(66) (67) (68) (69)
inclu Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	87.02 dde (57) mal ge olic gain Jan 138.69 g gains 23.42 nces ga 262.67 ng gains 36.87 s and fal	58.98 m in calculation (gradual) s (Table Feb 138.69 (calculation (calculation) 20.8 ins (calculation) 36.87 ns gains 3	61.73 culation of tole 5 5), Wat Mar 138.69 ted in Ap 16.91 ulated in 258.52 ted in Ap 36.87 (Table 5	51.8 of (65)m in 5a ts Apr 138.69 opendix 12.81 Appendix 243.9 opendix 36.87 5a)	52.97 only if c May 138.69 L, equati 9.57 dix L, equat 225.44 L, equat 36.87	Jun 138.69 ion L9 o 8.08 uation L 208.1 ion L15 36.87	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a	Aug 138.69 Iso see 11.35 3a), also 193.78	Sep 138.69 Table 5 15.23 see Ta 200.65	Oct 138.69 19.34 ble 5 215.27	Nov 138.69 22.58	Dec 138.69 24.07 251.08		(66) (67) (68)
inclu Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses	87.02 olic gain Jan 138.69 og gains 23.42 nces ga 262.67 ng gains 36.87 s and fai	58.98 m in calce pins (s. s (Table Feb 138.69 (calcular 20.8 ins (calc 265.39 (calcular 36.87 ns gains 3	61.73 culation of able 5 5), Wat Mar 138.69 ted in Ap 16.91 ulated in 258.52 ted in Ap 36.87 (Table 5 3	518 Apr 138.69 pendix 12.81 Appendix 243.9 pependix 36.87 5a) 3 tive value	52.97 only if c May 138.69 L, equati 9.57 dix L, equat 225.44 L, equat 36.87	Jun 138.69 ion L9 o 8.08 uation L 208 1 ion L15 36.87	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 36.87	Aug 138.69 Iso see 11.35 3a), also 193.78 36.87	50.14 or hot w Sep 138.69 Table 5 15.23 see Ta 200.65 see Table 36.87	Oct 138.69 19.34 ble 5 215.27 15.36.87	Nov 138.69 22.58 233.73 36.87	Dec 138.69 24.07 251.08 36.87		(68) (67) (68) (69)
incluing inc	67.02 de (57) land 93 olic gain 138.69 g gains 23.42 nces ga 262.67 ng gains 36.87 s and far s e.g. ev	58.98 m in calce lins (s. s (Table 138.69 (calculat 20.8 ins (calculat 36.87 ns gains 3 raporatio -110.95	61.73 culation of able 5 5), Wate Mar 138.69 ted in Ap 16.91 ulated in Ap 36.87 (Table 5 3 n (negat	51.8 of (65)m in 5a ts Apr 138.69 opendix 12.81 Appendix 243.9 opendix 36.87 5a)	52.97 only if c May 138.69 L, equati 9.57 dix L, equat 225.44 L, equat 36.87	Jun 138.69 ion L9 o 8.08 uation L 208.1 ion L15 36.87	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 36.87	Aug 138.69 Iso see 11.35 3a), also 193.78), also se 36.87	Sep 138.69 Table 5 15.23 See Ta 200.65 ee Table 36.87	Oct 138.69 19.34 ble 5 215.27 5 36.87	Nov 138.69 22.58 233.73	Dec 138.69 24.07 251.08 36.87		(66) (67) (68) (69)
incluing inc	olic gains 138.69 g gains 23.42 nces ga 262.67 ng gains 3 s.e.g. ev -110.95 heating	58.98 m in calcular sections (gradular sections) (alcular 20.8 ins (calcular 36.87 ins gains 3 vaporation -110.95 gains (T	61.73 ulation of the second o	51 8 of (65)m Table 52 Apr 138.69 ppendix 12.81 Appendix 243.9 ppendix 36.87 5a) 3 tive valu -110.95	52.97 May 138.69 L, equati 9.57 dix L, equat 225.44 L, equat 36.87 3 es) (Tab	Jun 138.69 ion L9 o 8.08 uation L 208.1 ion L15 36.87	Jui 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 38.87	Aug 138.69 lso see 11.35 3a), also se 36.87 3	Sep 138.69 Table 5 15.23 See Table 200.65 see Table 36.87	Oct 138.69 19.34 ble 5 215.27 36.87 3	Nov 138.69 22.58 233.73 36.87	Dec 138.69 24.07 251.08 36.87 3		(68) (68) (68) (70)
inclu Metab (66)m= Lightin (67)m= Applia Cookir (68)m= Cookir (70)m= Losses (70)m= Water (72)m=	87.02 de (57) nal ge olic gain Jan 138.69 g gains 23.42 nces ga 262.67 ng gains 36.87 s and fai 3 s e.g. ev -110.95 heating 90.08	58.98 m in calcular separation (along the separation of the separa	61.73 ulation of the second o	518 Apr 138.69 pendix 12.81 Appendix 243.9 pependix 36.87 5a) 3 tive value	52.97 only if c May 138.69 L, equati 9.57 dix L, equat 225.44 L, equat 36.87	Jun 138.69 ion L9 o 8.08 uation L 208.1 ion L15 36.87 3 le 5)	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 36.87	Aug 138.69 1so see 11.35 3a), also 193.78), also se 36.87	Sep 138.69 Table 5 15.23 See Ta 200.65 Table 36.87	Oct 138.69 19.34 ble 5 215.27 3 -110.95	Nov 138.69 22.58 233.73 36.87 3	Dec 138.69 24.07 251.08 36.87 3 87.78		(68) (67) (68) (69)
inclu Metab (66)m= Lightin (67)m= Applia Cookir (68)m= Cookir (70)m= Losses (70)m= Water (72)m=	87.02 de (57) nal ge olic gain Jan 138.69 g gains 23.42 nces ga 262.67 ng gains 36.87 s and fai 3 s e.g. ev -110.95 heating 90.08	58.98 m in calcular sections (gradular sections) (alcular 20.8 ins (calcular 36.87 ins gains 3 vaporation -110.95 gains (T	61.73 ulation of the second o	51 8 of (65)m Table 52 Apr 138.69 ppendix 12.81 Appendix 243.9 ppendix 36.87 5a) 3 tive valu -110.95	52.97 May 138.69 L, equati 9.57 dix L, equat 225.44 L, equat 36.87 3 es) (Tab	Jun 138.69 ion L9 o 8.08 uation L 208.1 ion L15 36.87 3 le 5)	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 36.87	Aug 138.69 1so see 11.35 3a), also 193.78), also se 36.87	Sep 138.69 Table 5 15.23 See Ta 200.65 Table 36.87	Oct 138.69 19.34 ble 5 215.27 36.87 3	Nov 138.69 22.58 233.73 36.87 3	Dec 138.69 24.07 251.08 36.87 3 87.78		(68) (68) (68) (70)



Orientation:	Access Facto Table 6d	or	Area m²		Flux Table 6a		g_ Table 6b	1	FF Table 6c		Gains (W)	
Southeast 0.9x	0.77] x [13.67	x	36.79	×	0.63	× [0.7] = [153.71	(77)
Southeast 0.9x	0.77	×	10.78	×	36.79	×	0.63] x	0.7	=	121.22	(77)
Southeast 0.9x	0.77	×	9.64	x	36.79	×	0.63	x [0.7] à [108.4	(77)
Southeast 0.9x	0.77	x [15.89	x	36.79	x	0.63	x [0.7] = [178.68	(77)
Southeast 0.9x	0.77] x [13.67	x	62.67	x	0.63] x [0.7	=	261.83	(77)
Southeast 0.9x	0.77	_ x [10.78] x	62.67	×	0.63] × [0.7] = [206.48	(77)
Southeast 0.9x	0.77	×	9.64	x	62.67	×	0.63	×	0.7] = [184.64	(77)
Southeast 0.9x	0.77] x [15,89	ж	62.67	×	0.63	x [0.7] = [304.35	(77)
Southeast 0.9x	0.77] x [13.67	x	85.75	×	0.63	_ x	0.7] = [358.25	(77)
Southeast 0.9x	0.77] x [10.78	x	85.75	×	0.63	x [0.7] = [282.51	(77)
Southeast 0.9x	0.77	×	9.64	x	85.75	х	0.63	x [0.7	è	252.64	(77)
Southeast 0.9x	0.77] x [15.89	x	85.75	×	0.63] x [0.7] = [416.43	(77)
Southeast 0.9x	0.77] x [13.67	x	106.25	x	0.63	x [0.7] = [443.89	(77)
Southeast 0.9x	0.77	× [10.78	x	106.25	×	0.63	×	0.7	= [350.05	(77)
Southeast 0 9x	0.77	x [9.64	x	106.25	×	0.63	x [0.7] = [313.03	(77)
Southeast 0.9	0.77	x	15 89	×	106.25	×	0.63	×	0.7	=	515 98	(77)
Southeast 0.9x	077) × [13.67	×	119.01	*	0.63	×	0.7	= [497 19	(77)
Southeast 0.9x	0.77	×	10.78	K	119.01	×	0.63	8	0.7	=	392.08	(77)
Southeast 0.9x	0.77] x	9.64] ×	119,01	×	0.63	×	0.7] = [350 62	(77)
Southeast 0.9x	0.77	×	15.89	×	119.01	×	0.63	×	0.7] = [577 94	(77)
Southeast 0.9x	0.77	×	13.67	K	118.15	×	0.63	×	0.7	= [493.6	(77)
Southeast 0.9x	0.77] x [10.78	*	118.15	×	0.63	*	0.7] = [389.25	(77)
Southeast 0.9x	0.77	×	9.64	х	118.15	×	0.63	×	0.7	F	348.08	(77):
Southeast 0.9x	0.77] x [15.89	x	118.15	x	0.63] x [0.7] = [573.76	(77)
Southeast 0.9x	0.77] x [13.67	.x	113,91	×	0.63	x [0.7] = [475,88	(77)
Southeast 0.9x	0.77] x [10.78	x	113.91	x	0.63	x [0.7	=	375.27	(77)
Southeast 0.9x	0.77	× [9.64	×	113.91	×	0.63	× [0.7] = [335.59	(77)
Southeast 0.9x	0.77	x [15.89	x	113.91	×	0.63	x [0.7	= [553.16	(77)
Southeast 0.9x	0.77	×	13.67	х	104.39	X	0.63	×	0.7] = [436.11	(77)
Southeast 0.9x	0.77] × [10,78	x	104.39	×	0.63] × [0.7] = [343.92	(77)
Southeast 0 9x	0.77	×	9.64	X	104.39	×	0.63	×	0.7	=	307.55	(77)
Southeast 0 9x	0.77	×	15.89	х	104.39	×	0.63	×	0.7] = [506.94	(77)
Southeast 0.9x	0.77	_ x [13.67	x	92.85	x	0.63	x [0.7	= [387.91	(77)
Southeast 0.9x	0.77	х	10.78	×	92.85	×	0.63	x	0.7	÷	305.9	(77)
Southeast 0.9x	0.77	x [9.64	x	92.85	×	0.63	_ x	0.7] = [273.55	(77)
Southeast 0.9x	0.77	x [15.89	x	92.85	х	0.63] x [0.7	=	450.91	(77)
Southeast 0.9x	0.77	x [13.67	×	69.27	×	0.63	x [0.7] = [289.38	(77)
Southeast 0,9x	0.77	x [10,78	x	69,27	×	0.63] × [0.7] = [228.2	(77)
Southeast 0.9x	0.77	x [9.64	x	69.27	x	0.63] x [0.7	=	204.07	(77)

Southeas Southeas Southeas Southeas Southeas Southeas Southeas	st 0.9x	0.77	×	15	1									
Southeas Southeas Southeas Southeas	st o 9x	0.77			89	x	69.27	x	0.63	x	0.7	=	336.38	(77
Southeas Southeas Southeas Southeas	Į.		×	13.	67	x x	44.07	×	0.63] x [0.7		184.11	(77
Southeas Southeas Southeas		0.77	×	10.	78	x .	44.07	×	0.63	i × Ē	0.7		145.19	(77
Southeas Southeas	st 0.9x	0.77	×	9.6	34	x Z	44.07	×	0.63	ī×Ē	0.7	=	129.84	(77
Southeas	st 0.9x	0.77	×	15.	89	x	44.07	×	0.63] x [0.7	Ti = i	214.01	(77
	st 0.9x	0.77	×	13.	67	x :	31.49	х	0.63	1 x [0.7	-	131.55	(77
Southeas	st 0.9x	0.77	×	10	78	х :	31.49	×	0.63	7 x [0.7		103.74	(77
	st 0.9x	0.77	×	9.6	54	х :	31.49	×	0.63	×	0.7	9	92.77	(77
Southeas	st 0.9x	0.77	×	15.	89	х :	31.49	×	0.63	ī x [0.7		152.91	(77
Total ga (84)m= 1	562.01 ins – i 1005.78	957.31 nternal a	1309.83 and sola 1735.85	1622 94 r (84)m = 2023 37	1817.83 = (73)m 2191.65	1804.69 + (83)m 2153.01		(83)m = S 1594.52 1933.9	1418.27 1771 41	(82)m 1058.03 1436.98	673.16 1081.43	480.96 911.49		(83
							from Tal	ble 9, Th	1 (°C)			Г	21	(85
		tor for g						12/2/100	4.4.28			1	92.	_
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.98	0.92	0.81	0.62	0.45	0,31	0.22	0.25	0.41	0.72	0.95	0.99	-	(88)
Meani	nterna	temper	ature in	living an	ea T1 (f	allow ste	ens 3 to	7 in Tabl	e 9c)					
	20.21	20.56	20.82	20.96	20.99	21	21	21	21	20.93	20.56	20.14		(87
Tempe	rature	during	eating r	veriorie in	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
	20.03	20.03	20.04	20.05	20.06	20.07	20.07	20.08	20.07	20.06	20.05	20.04		(88)
Utilicati	ion for	tor for a	aine for	rect of d	wolling	h2 m (c)	ee Table	92)		-				
(89)m=	0.98	0.91	0.77	0.58	0.41	0.27	0.18	0.2	0.36	0.67	0.93	0.98		(89)
Mooni	nterne	Itampar	atura in	the rest	of durall	na T2 //	fallow at	eps 3 to	7 in Tabl	000)	11 10000			
-	19.01	19.49	19.84	20.01	20.05	20.07	20.07	20.08	20.06	19.99	19.52	18.92		(90
L	10.41	10.10	10.01	10.01	20.40	1.0.01	20.01	20.00	100.00	LA = Livin	1 55049	35000	0.25	(91
*****			-t :== 15-		ala disa			. /4 #	A1 TO			L		
	19.31	19.76	20.08	20.25	20.28	20.3	20.3	+ (1 - fL 20.3	20.29	20.22	19.77	19.22		(92
			the Use					4e, whe			- MARK	10,22		1,75
	19.16	19.61	19.93	20.1	20.13	20.15	20.15	20.15	20.14	20.07	19.62	19.07		(93
-	-	ting requ												
		mean int				ned at st	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calcu	ilate	
Г	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisati	ion fac	tor for g	ains, hn											
(94)m=	0.97	0.9	0.77	0.58	0.41	0.27	0.18	0.2	0.36	0.67	0.92	0.98		(94
-		hmGm		4)m x (8	,									
	976.38	1256.54	1333.1	1177.93		585	374.45	394,23	640.78	967.73	998.3	893.47		(95
_	-	age exte	_		_	_	200	1 40 4		40 -				16-
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96
	ss rate 645.59		1476.59	1208.09	906.51	Lm , W	=[(39)m 374.47	x [(93)m 394.28	- (96)m 642.28	1018	1356.42	1623.26		(97



	e heatin	246.27	106.76	21.72	3.14	0	0.02	0	m - (95	37.4	257.85	542.96		
(98)m=	497.69	240.21	100.75	21.12	3.14	U	U			2.1	z37.65 r) = Sum(9	0.0000	1713.98	(98
		a de al das		(480-6-	26,505			Total	poi you	(MITTE) COL	y = build	C/1.33.14 -	16.48	(99
		g require			-/year								16.48	(99
		oling req												
Calcu					See Ta		1 - 64		0	Oct	Nov			
Host	Jan Jan	Feb	Mar	Apr	May 5°C inte	Jun nal tom	Jul	Aug	Sep			Dec		
(100)m		0	0	using 2	0	991.11	780.24	798 21	0	0	0	0		(10
		tor for lo		0		331-11	750.24	750.21	v	, u				112
(101)m		0	0	0	Ιo	1	1	1	0	0	0	0		(10
		ıml m (V	/atts) = ((100)m	x (101)m		_							
(102)m	_	0	0	0	0	988.33	779.45	796.96	0	0	0.	0		(10
		gains ca	lculated	for app	icable w		egion, se	e Table	10)					
(103)m		0	0	0	0	2614.6	2518.15	2357,86	0	0	0	0		(10
Spac	e coolin	g require	ement fo	r month	, whole o	welling.	continu	ous (kW	h) = 0.0	24 x [(1	03)m – (102)m]x	(41)m	
	_	zero if (104)m <	_	_						100			
(104)m	0	0	0	0	0	1170.91	1293.59	1161 31	0	.0	0	0		_
		-			-		1			= Sum		=	3625.81	(TO
- 100	d fraction	A	401				- 4		fC=	cooled	area + (4	4) =	1	(10
(106)m=	_	actor (Ta	0	0	1 0	0.25	0.25	0.25	0	0	0	0		
100)111-		0	U	-	1	0,23	0,23	0.23		= Sum	7	=	a	(10
_														
Space	cooling	requirer	nent for	month	= (104)m	× (105)	× (106)		1000	- ouni	100,1)	L	-	
	-	requirer	nent for	month	= (104)m	× (105)	× (106)	290.83	Ö	0	0	0		
	-				-				Ö		0	0	908.02	(10
(107);11:	0	0	0	ø	0				o Total	0 = Sum	0	0		(10
(107)m	cooling	requirer	0 ment in l	d cWh/m².	o //year	293 23	321,96	290.83	7 Total	ð	0	0	908.02	(10
Space	cooling	requirer	0 ment in l	d cWh/m².	0	293 23	321,96	290.83	7 Total	0 = Sum	0	0 =		(10
Space	cooling	requirer quiremen	0 ment in k	¢Wh/m².	o //year	293 23 yslems i	323,96	290.83	7 Total	0 = Sum	0	= [(10
Space Space Space Fract	cooling lergy receive heating	requirer quiremen	ment in k	«Wh/m².	/year neating s	293 23 yslems i	323,96 including	290.83	0 Total (107)	0 = Sum	0	= [8.73	(10)
Space 9a En Space Fract	e cooling lergy receive heating tion of sp	requirer quirement ng: pace hea	ment in k	«Wh/m². Ividual econda nain sys	/year neating s ry/supple item(s)	293 23 yslems i	323,96 including	290.83 micro-C (202) = 1 -	0 Total (107) (-2)	0 = Sumi (+(4)=	0	=	0 1	(10)
Space Space Space Fract Fract	e cooling lengy receive heating tion of spation of to	requirer quirement ng: pace hea pace hea stal heati	ment in kents – Industriant from stat from mention men	«Wh/m².	/year neating s ry/supple item(s)	293 23 yslems i	323,96 including	290.83	0 Total (107) (-2)	0 = Sumi (+(4)=	0	0 =	0 1	(10 (10 (20 (20 (20
Space Space Fract Fract Fract Effici	e cooling lergy rece the heating tion of spation of to ency of to	requirer quirement ng: pace hea pace hea tal heatin	ment in k at from s at from m ng from ace heat	kWh/m². kwh/m².	/year neating s ry/supple ttem(s) rstem 1	293 23 vslems i	321,96 including	290.83 micro-C (202) = 1 -	0 Total (107) (-2)	0 = Sumi (+(4)=	0	0	0 1 1 90.3	(10 (10 (20 (20 (20 (20
Space Space Fract Fract Effici	e cooling set heating tion of spation of to ency of se	requirer quirement ng: pace hea pace he	ment in least from sat from marce heat	econda nain sys main sys ing systementa	/year neating s ry/supple tem(s) rstem 1 rem 1 ry heatin	293 23 vslems i	321,96 including	290.83 micro-C (202) = 1 -	0 Total (107) (-2)	0 = Sumi (+(4)=	0	0 =	0 1	(20) (20) (20) (20) (20) (20)
Space Space Fract Fract Effici	e cooling set heating tion of spation of to ency of se	requirer quirement ng: pace hea pace hea tal heatin	ment in least from sat from marce heat	econda nain sys main sys ing systementa	/year neating s ry/supple tem(s) rstem 1 rem 1 ry heatin	293 23 vslems i	321,96 including	290.83 micro-C (202) = 1 -	0 Total (107) (-2)	0 = Sumi (+(4)=	0	0 =	0 1 1 90.3	(10 (10 (20 (20 (20 (20 (20
Space Space Fract Fract Effici	e cooling set heating tion of spation of to ency of se	requirer quirement ng: pace hea pace he	ment in least from sat from marce heat	econda nain sys main sys ing systementa	/year neating s ry/supple tem(s) rstem 1 rem 1 ry heatin	293 23 vslems i	321,96 including	290.83 micro-C (202) = 1 -	0 Total (107) (-2)	0 = Sumi (+(4)=	0	0 = [0 1 1 90.3	(10) (10) (20) (20) (20) (20) (20) (20) (20)
Space 9a En Space Fract Fract Fract Effici Effici Cooli	e cooling tere heating received the second of second of to ency of second of	requirer requirements requirements reace hea r	ment in k at from s at from m ng from ace heat ry/suppl gy Effici Mar ement (o	econda nain sys main sy ing sysi ementa ency Ra Apr	/year reating s ry/supple tem(s) restem 1 ry heatin atio May ed above	yslems i yslems i g system	noluding system n, %	290.83 micro-0 (202) = 1 - (204) = (2)	0 Total (107) (-201) = -(201) = -(201) = -(201) =	0 = Sumi (+ (4) =	0 107)	Dec	0 1 1 90 3 0	(10) (10) (20) (20) (20) (20) (20) (20) (20)
Space 9a En Space Fract Fract Fract Effici Effici Cooli	e cooling the cooling the heating tion of spation of to ency of the ency of the ency of the spation of Syste	requirer cuirements ng: pace hea pace hea tal heatin main spa seconda em Ener	ment in k at from s at from m ng from ace heat ry/suppl gy Efficie Mar	econda nain sys main sys ing syst ementa ency Ra	/year reating s ry/supple tem(s) retem 1 rem 1 ry heatin	yslems i ementary g system	including / system n, %	290.83 micro-C (202) = 1- (204) = (20	0 Total (107) (-(201) =	0 = Sum(+ (4) =	1,07)		0 1 1 90 3 0	(10) (10) (20) (20) (20) (20) (20) (20)
Space Space Space Fract Fract Effici Cooli	e cooling the endirection of spation of to ency of the ency of the	requirer requirements requirements reace hea r	ment in k at from s at from m ace heat ry/suppl gy Effici Mar ement (c 106.76	econda nain sys main sy ing sysi ementa ency Ra Apr	/year neating s ry/supple ttem(s) rstem 1 ry heatin ttio May ed above 3.14	yslems i yslems i g system	noluding system n, %	290.83 micro-0 (202) = 1 - (204) = (2)	0 Total (107) (-201) = -(201) = -(201) = -(201) =	0 = Sumi (+ (4) =	0 107)	Dec	0 1 1 90 3 0	(10) (10) (20) (20) (20) (20) (20) (20)
Space Space Space Fract Fract Effici Cooli	e cooling the endirection of spation of to ency of the ency of the	requirer aurements ng: pace hea pace hea tal heatil main spa seconda em Ener Feb g require 246.27	ment in k at from s at from m ace heat ry/suppl gy Effici Mar ement (c 106.76	econda nain sys main sy ing sysi ementa ency Ra Apr	/year neating s ry/supple ttem(s) rstem 1 ry heatin ttio May ed above 3.14	yslems i yslems i g system	noluding system n, %	290.83 micro-0 (202) = 1 - (204) = (2)	0 Total (107) (-201) = -(201) = -(201) = -(201) =	0 = Sumi (+ (4) =	0 107)	Dec	0 1 1 90 3 0	(10) (10) (20) (20) (20) (20) (20) (20) (20)
Space Space Space Fract Fract Effici Cooli	e cooling stray receive heating tion of sp tion of to ency of the	requirer culrements ng: bace head ace head atal heatil main spa seconda em Ener Feb g require 246.27	ment in k at from s at from m ace heat ry/suppl gy Effici Mar ement (c 106.76	econda nain sys main sy ing sysi ementa ency Ra Apr alculate 21.72	/year resting s ry/supple tem(s) ry heating seem 1 ry heating atio May ed above 3.14 06)	ystems of the state of the stat	noluding system n, % Jul 0	290.83 micro-C (202) = 1-(204) = (20 Aug	0 Total (107) (-2) -(201) = -(201) = -(201) = 0 Sep	0 = Sumi (+ (4) = (203)] = Oct	0 1,07) Nov	Dec 542.96	0 1 1 90 3 0	(10) (10) (20) (20) (20) (20) (20) (20) (21)
Space Space Space Space Fract Fract Effici Effici Cooli Space (211)n	e cooling stripy receive heating tion of spition of to ency of seency of see	requirer culrements ng: bace head ace head atal heatil main spa seconda em Ener Feb g require 246.27	ment in k at from s at from m grom ace heat ry/suppl gy Effici Mar ement (c 106.76 4)] } x 1 118.23	econda nain sys main sys main sys main sys ementa ency Ra Apr nalculate 21.72	/year ry/suppletem(s) rytem 1 ry heatin atio May ed above 3.14 06) 3.48	ystems of the state of the stat	noluding system n, % Jul 0	290.83 micro-C (202) = 1-(204) = (20 Aug	0 Total (107) (-2) -(201) = -(201) = -(201) = 0 Sep	0 = Sumi (+ (4) = (203)] = Oct	0 1,07) Nov 257.85	Dec 542.96	0 1 1 903 0 4 KWh/ye	(10) (10) (20) (20) (20) (20) (20) (20) (21)
Space Space Space Space Space Fract Fract Effici Effici Cooli Space (211)nn	e cooling ce heating tion of spition of to ency of the	requirer autrements and the state of the sta	ment in k at from s at from m ace heat ry/suppl gy Effici Mar ement (c 106.76 4)] } x 1 118.23	econda ain sys ing systementa Apr 21.72 20.00 + (2 24.05	/year ry/suppletem(s) rytem 1 ry heatin atio May ed above 3.14 06) 3.48	ystems of the state of the stat	noluding system n, % Jul 0	290.83 micro-C (202) = 1-(204) = (20 Aug	0 Total (107) (-2) -(201) = -(201) = -(201) = 0 Sep	0 = Sumi (+ (4) = (203)] = Oct	0 1,07) Nov 257.85	Dec 542.96	0 1 1 903 0 4 KWh/ye	(10) (10) (20) (20) (20) (20) (20) (20)

-m-1	9 150.78	144.45 161.03	162.81	184.33	194.9	209.06	1	
Efficiency of water heater				1			81	(210
(217)m= 87.29 86.01 84.03 81.92 81.15	81	81 81	81	82.43	86.05	87.51		(21
Fuel for water heating, kWh/month								
(219)m = (64)m x 100 ÷ (217)m (219)m= 245.41 219.51 235.99 215.83 210.99	5 186.14	178.34 198.81	201	223.62	226.51	238.91	ĺ	
		ATTACA TO LANGE	al = Sum(2		,000	2000	2581.02	(219
Space cooling fuel, kWh/month.								
(221)m = (107)m+ (209) (221)m= 0 0 0 0 0	73.31	80.99 72.71	0	0 1	0	0	1	
(221)111 0 0 0	19.51	A LOS CONTRACTOR	al = Sum(2				227.01	(22
Annual totals					Vh/yea		kWh/yea	
Space heating fuel used, main system 1					viny ca		1898.09	<u> </u>
Water heating fuel used						0	2581.02	=
Space cooling fuel used						3	227.01	=
						15		
Electricity for pumps, fans and electric keep-h	not							
		out from outsid	le		- 17	3121		(23)
mechanical ventilation - balanced, extract or		out from outside	le			3121		(23)
				1	_	312.1		(23)
mechanical ventilation - balanced, extract or			de n of (230a)	(230g) =	_		342.1	- 70
mechanical ventilation - balanced, extract or central heating pump:				(230g) =			342.1 413.56	(23)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting	positive inp	şu	n of (230a)	(230g) =				(23)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year	positive inp	Sun and Sulf	n of (230a)			30	413.56	(23)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting	positive inp	surgy	n of (230a)	Emissi		30	413.55 Emission	(23) (23) (23)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting	positive inp	rgy n/year	n of (230a)	Emissi kg CO2	2/kWh	30	413.55 Emission kg CO2/ye	(23) (23) (23)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 12: E02 emission Individual eating sy Space heating (main system 1)	positive inp	rgy n/year	n of (230a)	Emissi kg CO2	2/kWh	30 tor	413.55 Emission kg CO2/yo	(23) (23) (23) (23) (26)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 12a C 2 emission Individual eating sy	positive inp	rgy //year	n of (230a)	Emissi kg CO2 0.21	2/kWh 6 9	30 tor	413.55 Emission kg CO2/ye 409.99	(23) (23) (23) (23) (26) (26)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 12a 1202 emission Individual eating sy Space heating (main system 1) Space heating (secondary) Water heating	Ene kWh (211) (215) (219)	rgy //year	n ol (230a)	Emissi kg CO2	2/kWh 6 9	30 tor	413.55 Emission kg CO2/y 409.99 0 557.5	(23) (23) (23) (23) (26) (26) (26)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 12a 202 emission Individual ealing sy. Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Ene kWh (211) (215) (219)	x x x + (262) + (263) +	n ol (230a)	Emissi kg CO2 0.21 0.51	2/kWh 6 9 6	30 tor	413.55 Emission kg CO2/y 409.99 0 557.5 967.49	(23) (23) (23) (23) (23) (23) (24) (26) (26) (26)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 12a 202 emission Individual eating sy. Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Space cooling	Ene kWh (211) (219) (261) (221)	rgy lyear x x x + (262) + (263) +	n ol (230a)	Emissi kg CO2 0.21 0.51	6 9 6 9	30 tor	413.55 Emission kg CO2/y 409.99 0 557.5 967.49 117.82	(23) (23) (23) (23) (24) (26) (26) (26) (26)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 120 202 emission Individual eating system 1) Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Space cooling Electricity for pumps, fans and electric keep-	Ene kWh (211) (219) (261) (221)	Trgy h/year x x x + (262) + (263) + x	n ol (230a)	Emissis kg CO2 0.21 0.51 0.51	2/kWh 6 9 6	30 tor = = =	413.55 Emission kg CO2/y 409.99 0 557.5 967.49 117.82	(23) (23) (23) (23) (23) (23) (23) (24) (26) (26) (26) (26) (26) (26) (26)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 120 20 2 emission Individual leading system 1) Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Space cooling Electricity for pumps, fans and electric keep-felectricity for lighting	Ene kWh (211) (215) (261) (261) (221) (231)	Trgy h/year x x x + (262) + (263) + x	n ol (230a)	Emissi kg CO2 0.21 0.51	2/kWh 6 9 6 9 9 9	30 tor = = = = = =	413.56 Emission kg CO2/y 409.99 0 557.5 967.49 117.82 177.55 214.63	(23)(23)(23)(23)(23)(25)(26)(26)(26)(26)(26)(26)(26)(26)(26)(26
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 120 002 emission Individual eating system 1) Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Space and water heating Space cooling Electricity for pumps, fans and electric keep-felectricity for lighting Total CO2, kg/year	Ene kWh (211) (215) (261) (261) (221) (231)	Trgy h/year x x x + (262) + (263) + x	n ol (230a)	Emissi kg CO2 0.21 0.51 0.51 0.51 0.51 0.51 0.51 0.51	2/kWh 6 9 6 9 9 9	30 tor = = = = = =	413.55 Emission kg CO2/yi 409.99 0 557.5 967.49 117.82 177.55 214.63	(23) (23) (23) (23) (23) (26) (26) (26) (26) (26) (26) (26) (26
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 12a CO2 emission Individual leading system 1) Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Space cooling Electricity for pumps, fans and electric keep-felectricity for lighting Total CO2, kg/year Dwelling CO2 Emission Rate	Ene kWh (211) (215) (261) (261) (221) (231)	Trgy h/year x x x + (262) + (263) + x	n ol (230a)	Emissis kg CO2 0.21 0.51 0.51	2/kWh 6 9 6 9 9 9	30 tor = = = = = =	413.55 Emission kg CO2/yi 409.99 0 557.5 967.49 117.82 177.55 214.63 1477.49 14.2	(23) (23) (23) (23) (23) (26) (26) (26) (26) (26) (26) (26) (27) (27) (27)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 120 002 emission Individual eating system 1) Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Space and water heating Space cooling Electricity for pumps, fans and electric keep-felectricity for lighting Total CO2, kg/year	Ene kWh (211) (215) (261) (261) (221) (231)	Trgy h/year x x x + (262) + (263) + x	n ol (230a)	Emissi kg CO2 0.21 0.51 0.51 0.51 0.51 0.51 0.51 0.51	2/kWh 6 9 6 9 9 9	30 tor = = = = = =	413.55 Emission kg CO2/yi 409.99 0 557.5 967.49 117.82 177.55 214.63	(23) (23) (23) (23) (23) (26) (26) (26) (26) (26) (26) (26) (26
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 12a CO2 emission Individual leading system 1) Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Space cooling Electricity for pumps, fans and electric keep-felectricity for lighting Total CO2, kg/year Dwelling CO2 Emission Rate	Ene kWh (211) (215) (261) (261) (221) (231)	Trgy h/year x x x + (262) + (263) + x	n ol (230a)	Emissi kg CO2 0.21 0.51 0.51 0.51 0.51 0.51 0.51 0.51	2/kWh 6 9 6 9 9 9	30 tor = = = = = =	413.55 Emission kg CO2/yi 409.99 0 557.5 967.49 117.82 177.55 214.63 1477.49 14.2	(23) (23) (23) (23) (23) (26) (26) (26) (26) (26) (26) (26) (27) (27) (27)
mechanical ventilation - balanced, extract or central heating pump: Total electricity for the above, kWh/year Electricity for lighting 12a CO2 emission Individual leading system 1) Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Space cooling Electricity for pumps, fans and electric keep-felectricity for lighting Total CO2, kg/year Dwelling CO2 Emission Rate	Ene kWh (211) (215) (261) (261) (221) (231)	Trgy h/year x x x + (262) + (263) + x	n ol (230a)	Emissi kg CO2 0.21 0.51 0.51 0.51 0.51 0.51 0.51 0.51	2/kWh 6 9 6 9 9 9	30 tor = = = = = =	413.55 Emission kg CO2/yi 409.99 0 557.5 967.49 117.82 177.55 214.63 1477.49 14.2	(23) (23) (23) (23) (23) (26) (26) (26) (26) (26) (26) (26) (27) (27) (27)



E. Indicative Energy Model Outputs (Be Green)



		User Details:				
Assessor Name: Software Name:	Stroma FSAP 2012	Stroma N Software	Version:	Versio	n: 1.0.4.17	
Address :	Tottenham Street, London	roperty Address. Un	it 4			
1. Overall dwelling aim	ensions:					
ann Nahma		Area(m²)	Av. Height		Volume(m	_
Ground floor		36.71 (1a)	x 2.58	(2a) =	94.71	(3a
First floor		26 (1b)	x 3.3	(2b) =	85.8	(3b
Second floor		18.23 (1c)	x 3,3	(2c) =	60.16	(30
Third floor		23.08 (1d)	x 2.24	(2d) =	51.7	(3d
Total floor area TFA = (1	1a)+(1b)+(1c)+(1d)+(1e)+(1r	104.02 (4)				_
Dwelling volume)+(3b)+(3c)+(3d)+(3	e)+(3n) = [292.37	(5)
2. Ventilation rate:					202.01	
2. Vermanormans	main secondar	ry other	total		m³ per ho	ur
Number of chimneys	heating heating	+ 0	= 0	x 40 =	0	(6a
Number of open flues	0 0	+ 0	= 0	k20 =	0	(6)
Number of intermittent fa			0	x 10 =	0	(78
			12.0	x 10 =		=
Number of passive vent		A 10	0	x 40 =	0	(7b
Number of flueless gas t	rives		0	X40 =	0	(70
1		<i>III</i> - 1		Air ch	anges per h	our
Infiltration due to chimne	eys, flues and fans = (6a)+(6b)+(7	7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
	been carried out or is intended, procee			1		
Number of storeys in t	the dwelling (ns)				0	(9)
Additional infiltration		a charter to		[(9)-1]x0.1 =	0	(10
	0.25 for steel or timber frame or present, use the value corresponding to			1	0	(11
deducting areas of open		o trie greater wan area (an	er			
If suspended wooden	floor, enter 0.2 (unsealed) or 0	.1 (sealed), else ente	er O	[0	(12
If no draught lobby, er	nter 0.05, else enter 0				0	(13
The second secon	s and doors draught stripped			Į	0	(14
Window infiltration		0.25 - [0.2 x (1-		Į	0	(15
Infiltration rate) + (12) + (13) + (15		0	(16
	, q50, expressed in cubic metre		re metre of enve	lope area	4	(17
	ility value, then (18) = [(17) + 20]+(es if a pressurisation test has been dor		hility is being used	1	0.2	(18
Number of sides shelter				ī	2	(19
Shelter factor		(20) = 1 - [0.07]	5 x (19)] =		0.85	(20
Infiltration rate incorpora	ating shelter factor	(21) = (18) x (2	(0) =	j	0.17	(21

(22)m=	5.1						_							
	-	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind F	actor (2	22a)m =	(22)m +	- 4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
A -E 4	-1 :- Cla					4		(04-)	(22-)					
Adjuste	0.22	0.21	0.21	0.19	helter an	0.16	0.16	0.16	(22a)m	0.18	0.19	0.2		
Calcula	O.E.C.				the appli	6.000	1 2 2 2 2 2 2	0.10	0.17	0.10	0.10	0.2		
		al ventila											0.5	(23a
					23b) = (23a) = (23a)			0.5	(23)
If bala	anced wit	h heat rec	overy: effi	ciency in 9	6 allowing f	for in-use t	actor (fron	n Table 4h) =				77.35	(23
a) If	balance	ed mech	anical v	entilation	with he	at recov	ery (MV	HR) (24a	a)m = (2	2b)m + (23b) × [1 - (23c) ÷	100]	
(24a)m=	0.33	0.33	0.32	0.3	0.3	0,27	0.27	0.27	0.28	0.3	0.3	0.31		(24
		_		-	without	_			-	2b)m + (_			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24)
					or positiv	T								
	f (22b)r	n < 0.5	(23b),		c) = (23b		_		b) m + 0	.5 × (23)	0	01		124
(74-1-	.0	The Paris of	0											
d) If	natural f (22b)r				se positive (b)m other				loft		0	0		(24
d) If (24d)m=	natural f (22b)r 0 ctive air	ventilati n = 1, th 0 change	on or when (24d	nole hou)m = (22 0 nter (24:	se positive (24) or (24)	ve input erwise (2 0 o) or (24	ventilation 24d)m = 0 c) or (24	on from 1 0 5 + [(2 0 1d) in box	loft (2b)m² x 0 x (25)	0.5]	-0	0		
d) If (24d)m=	natural f (22b)r	ventilati n = 1, th	on or when (24d	nole hou)m = (22	se positive (b)m other	ve input erwise (2	ventilatio	on from 1 0.5 + [(2	loft 2b)m² x					
d) If (24d)m= Effec (25)m	natural f (22b)r 0 ctive air	ventilati n = 1, th 0 change	on or when (24d 0 rate - e	nole hou)m = (22 0 nter (24:	se positive of the second of t	ve input erwise (2 0 o) or (24	ventilation 24d)m = 0 c) or (24	on from 1 0 5 + [(2 0 1d) in box	loft (2b)m² x 0 x (25)	0.5]	-0	0		
d) If (24d)m= Effec (25)m 3 He	natural f (22b)r 0 ctive air 0.33	ventilation = 1, the ochange of the	on or when (24d) orate - e orate - e orate - seat loss	nole hou)m = (22 0 nter (24 0.3 parame	se positive the most of the mo	ve input erwise (2 0 0) or (24 0.27	ventilation 24d)m = 0 0 0 0 0 (24	on from 0.5 + [(2) 0 0.27	loft (2b)m² x 0 x (25)	0.5] 0.3	0.3	0 0.31 k-value		(25 A X k
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	s of thermi		are not kn	own (36)	= 0.05 x (3	11)			(33) +	(36) =		Г	78.93	(37)
	ation hea		alculated	monthl	v						25)m x (5)		76,93	(31)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	31.84	31.43	31.02	28.97	28.56	26.51	26.51	26.1	27.33	28.56	29.38	30.2		(38)
Heat t	ransfer	coefficie	nt W/K						(39)m	= (37) + (38 lm			
(39)m=	_	110.36	109,95	107.9	107.49	105 44	105.44	105.03	106.26	107 49	108.31	109.13		
								1		Average =	Sum(39)	17/12=	107.8	(39)
	oss para	,	47					,	-	= (39)m =	-			
(40)m=	1.06	1.06	1.06	1.04	1.03	1.01	1.01	1.01	1.02	1.03	1.04	1.05		-
Numb	er of day	s in mo	nth (Tahi	le 1a)					4	Average =	Sum(40)	12/12=	1.04	(40)
, 100,172	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
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a lau	ater hea	ind one	av roau	romont								KWh/Ve	ric .	
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				-	_									
if TE	A £ 13	9, N = 1		a to Mes		and the same		19E . N	. 26		-	-		
if Tr Annua	A £ 13	9, N = 1 e hot wa						(25 x N)		se target o		0.08	7	(43)
if TE Annua Reduce	A £ 13	9, N = 1 le hot wa al average	hot water	usage by	5% if the I	Welling is	designed	(25 x N) to achieve		se target o		0.08		(43)
if TE Annua Reduce	A E 13 l al averag	9, N = 1 le hot wa al average	hot water	day (all w	5% if the l	Welling is	designed	la achieve	a water u	se target d		0.06 Dec		(43)
if TF Annua Reduce not mor	A £ 13 lal average the annual re that 125	9, N = 1 le hot wa al average litres per	not water person per Mar	day (all w	5% if the later use, May	welling is not and co Jun	designed old)	la achieve		100			1	(43)
if TF Annua Reduce not mon	A £ 13 laverage the annuing that 125 Jan Jan Jan	9, N = 1 le hot wa al average litres per Feb n litres per	not water person per Mar	day (all w	5% if the later use, May	welling is not and co Jun	designe() old) Jul	la achieve	a water u	100				(43)
if Tif Annua Reduce not mon Hot wal (44)m=	A £ 13 i al average the annu- te that 125 Jan ter usage i	9, N = 1 le hot wa la average litres per litres per litres per 106 08	Mar day for ea	Apr Apr Ich month	5% if the crater use, May Va,m = fa	Jun ctor from	Jul Table 1c x	Aug (43)	Sep	Oct 102 08	Nov 106.08	Dec 110.08	1200-92	
if Tif Annua Reduce not mon Hot wal (44)m=	A £ 13 i al average the annu- te that 125 Jan ter usage i	9, N = 1 le hot wa la average litres per litres per litres per 106 08	Mar day for ea	Apr Apr Ich month	5% if the crater use, May Va,m = fa	Jun ctor from	Jul Table 1c x	Aug (43)	Sep	Oct 102 08	Nov 106.08	Dec 110.08	1200 92	
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if Tf Annua Reduce not mon Hot wal (44)m= Energy (45)m=	A £ 13 average the annume that 125 Jan 110.08 content of 163.25	9, N = 1 e hot wa al averaga itres per itres per 106 08 hot water 142.78	Mar day for e. 102.08 used - cali 147.34	Apr Apr Apr Inch month 98.08 Culated m 128.45 of use (no	5% if the vater use, May Va,m = fa 94.07 onthly = 4. 123.25 o hot wate.	Jun ctor from 90,07 190 x Vd, 106,36 r storage),	designed old) Jul Table 1c x 90.07 m x nm x L 98.56 enter 0 in	Aug (42) 94.07 DTm/3600 113.09 boxes (46	98.08 98.08 98.08 114.45) to (61)	Oct 102.08 Total = Sunth (see Tital = Sunth (see Total = Sunth (see To	106.08 m(44)	Dec 110.08 = c, 1d) 158.1		(44)
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if Tiff Annual Reduced for Annua	Jan tor usage in the transport of the annual factors with the transport of transp	be hot water heating a stored loss: a stored loss: a close to the twater heating a stored loss: a close the twater heating a stored loss: a close the twater heating a stored loss: a close twater from water water from water water stored loss:	Mar day for ex- 102.08 used - calc 147.34 including at point 22.1 including at point and no talc hot water eclared is marged at the calculation of the calculation	Apr. Apr. Apr. Apr. Apr. Apr. Apr. Apr.	May Vd,m=fa 94.07 123.25 o hot wate: 18.49 or is known is kno	Jun clor from 90.07 190 x Vd, 106.36 r storage), 15.95 WHRS enter 11t instanta	Juli Juli Juli Juli Juli Juli Juli Juli	Aug (43) 94.07 PTM/3600 113.09 boxes (46 16.96 within s. 1 (47) pmbi boil (48) x (48)	98.08 98.08 114.45 0 to (61) 17.17 ame ves	Oct 102 08 Total = Sunth (see Total = Sunth 20.01	Nov 106.08 m(44)a ables 1b, 1 145.59 m(45)a 21.84 47)	Dec 110.08 = c, 1d) 158.1 = 23.72		(44) (45) (46) (47) (48) (49)
if TF Annua Reduce of Annua Re	January Strategy Stra	9, N = 1 and a warmage of the hot water heating a strong of the hot water heating a strong of the hot water heating a strong of the hot water heating a storage loss:	Mar day for es 102.08 used - calculation and no ta hot water estared is storage estared estare	usage by day fall what have been also been als	May Vd,m=fa 94.07 123.25 o hot wate: 18.49 or is known is kno	Jun clor from 90.07 190 x Vd, 106.36 r storage), 15.95 WHRS enter 11t instanta	Juli Juli Juli Juli Juli Juli Juli Juli	Aug (43) 94.07 PTM/3600 113.09 boxes (46 16.96 within s. 1 (47) pmbi boil (48) x (48)	98.08 98.08 114.45 0 to (61) 17.17 ame ves	Oct 102 08 Total = Sunth (see Total = Sunth 20.01	Nov 106.08 m(44) 145.59 m(45) 21.84 47)	110.08 = c, 1d)		(44)
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if Tif Annua	AAA 13. Jan to large in the annument of the a	he he to the he he to the he he to the he to t	not water and the water and th	Apr distribution of the control of t	93% if the variety was a special of the varie	Jun clor from 90.07 190 x Vd, 106.36 r storage), 15.95 WHRS enter 11t instanta	Juli Juli Juli Juli Juli Juli Juli Juli	Aug (43) 94.07 94.07 DTm/ 3600 113.09 boxes (46) 16.96 within si: (47) (48) x (48) x (48)	Sep 98 08 98 08 114.45 114.45 117.17 217.17	Oct 102.08 1102.08 1102.08 1102.08 1102.08 1102.08 1102.09 110	Nov	110.08		(44) (45) (46) (47) (48) (50) (51) (52) (53)
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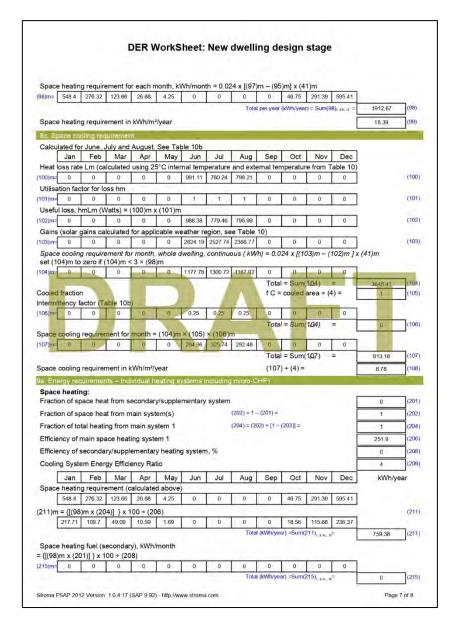
(56)m= If cylind	18.41		culateu	for each	month			((56)m =)	(55) × (41)	m				
If cylind		16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41		(56)
	er contain	s dedicate	d solar sto	rage, (57)	n = (56)m	x [(50) – ((H11)] - (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41		(57)
Prima	ry circuit	loss (ar	nual) fro	m Table	3							0		(58)
							(58) + 36							
-		-					ter heati	-						(50)
(59)m=	23.26	21.01	23.26	22.51	23.26	22,51	23,26	23.26	22.51	23.26	22.51	23.26		(59)
	loss ca	lculated	for each	month (61)m =	(60) ÷ 30	65 × (41	m						
(61)m=	. 0	0	0	0	0	0	0	0	0	0	0	0		(61)
					7,7,1000,000	494, 4,0,9			-				(59)m + (61)m	
(62)m=		180.42	189.01	168.78	164.93	146.69	140.23	154.77	154.78	175.05	185.92	199.78		(62)
							ve quantity			r contribut	ion to water	er heating)		
		1		_			, see Ap					1		(ma)
(63)m=	.0	0	0	0	0	0	0	0	0	0	0	0		(63)
WWHR		0	0	0	0	0	0	0	0	0	0	0		(63) (G
		ater hea	_								10.70			
(64)m=	204.93	180.42	189.01	168.78	164 93	146.69	140.23	154.77	154.78	175.05	185.92	199.78		100
													2065.3	188
		V	N. I			P.	1		put from w	-				Loss
- 107		_				-	× (45)m	+ (61)n	1 + 0.8	x [(46)m				J.o.
Heat 5 (65)m=		m water	heating, 67.6	kWh/me	onth 0.25	5° [0.85	× (45)m			-				(65)
(65)m=	72.89	64.28	67.6	60.72	59 59	53.37	_	+ (61)n	56.06	x [(46)m	+ (57)m	+ (59)m	1	(65)
(65)m= incl	72.89 ide (57)	64.28	67.6 culation	60 72 of (65)m	59 59 only if c	53.37	51.38	+ (61)n	56.06	x [(46)m	+ (57)m	+ (59)m	1	(65)
(65)m= incl	72.89 ide (57)	64.28 m in calc	67.6 culation	60 72 of (65)m	59 59 only if c	53.37	51.38	+ (61)n	56.06	x [(46)m	+ (57)m	+ (59)m	1	(65)
(65)m= incl	72.89 ide (57)	64 28 m in cal	67.6 culation	60 72 of (65)m	59 59 only if c	53.37	51.38	+ (61)n	56.06	x [(46)m	+ (57)m	+ (59)m	1	(65)
(65)m= incl	72.89 ude (57) emal gain olic gain	64 28 m in calc ains I	67.6 culation Table (60 72 of (65)m 52	50 59 only if c	53.37 ylinder i	51.38 s in the c	+ (61)n 56.21 Iwelling	56.06 or hot w	x [(46)m 62.98 vater is fi	+ (57)m 56 42 om com	+ (59)m 71.18 munity h	1	(65)
(65)m= inclu 5 Metab (66)m=	72.89 lide (57) challes olic gain Jan 138.69	m in calc	67.6 culation able 6 5), Wat Mar 138.69	60 72 of (65)m 52 ts Apr 138 69	50 50 only if c May 138.69	53.37 ylinder i Jun 138.69	51,38 s in the o	+ (61)n 56.21 dwelling Aug 138.69	56.06 or hot w Sep	62 98 vater is fr	+ (57)m 56 42 om com	+ (59)m 71.18 munity h	1	
(65)m= inclu 5 Metab (66)m=	72.89 lide (57) challes olic gain Jan 138.69	m in calc	67.6 culation able 6 5), Wat Mar 138.69	60 72 of (65)m 52 ts Apr 138 69	50 50 only if c May 138.69	53.37 ylinder i Jun 138.69	51 38 s in the c Jul 138 69	+ (61)n 56.21 dwelling Aug 138.69	56.06 or hot w Sep	62 98 vater is fr	+ (57)m 56 42 om com	+ (59)m 71.18 munity h	1	
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(65)m= inclu 5 Metab (66)m= Lightin (67)m= Applia (68)m= Cookin	72.89 ude (57) unal geodic gain Jan 138.69 g gains 23.42 nces ga 262.67	m in calcularins (Tables 138.69 (calcular 20.8)	67.6 culation able 6 5), Wat Mar 138.69 ted in Ap 16.91 culated ir 258.52	60.72 of (65)m to 52 ts Apr 138.69 opendix 12.81 Appendix 243.9	May 138.69 9.57 dix L, equati	Jun 138.69 on L9 o 8.08 uation L 208.1	Jul 138.69 r L9a), a 8.73	Aug 138.69 Iso see 11.35 3a), also	Sep 138 69 Table 5 15.23 See Ta	x [(46)m 62 98 vater is fr Oct 138 69 19:34 ble 5 215.27	+ (57)m 66 42 om com Nov 138 69 22.58	+ (59)m 71.18 munity h Dec 138.69	1	(66) (67)
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(65)m=inclus Metab (66)m= Lightir (67)m= Applia (68)m= Cookin (69)m= Pump: (70)m= Losse (71)m= Water	72.89 Jan 19:00 olic gain Jan 138.69 g gains 23.42 nces ga 262.67 ng gains 36.87 s and fai 0 s e.g. ev -110.95 heating	m in calculations (Tables Feb. 138.69 (calculations (calculations)	67.6 culation rable 6 culation rable 6 culation Mar 138.69 ted in Ap 16.91 ulated in 258.52 ted in A 36.87 (Table 5 0 on (negaration) rable 5)	89.72 of (65)m Apr 138.69 opendix 12.81 Appendix 243.9 opendix 36.87 5a) 0 tive valu -110.95	May 138.69 L, equati 9.57 dix L, equati 225.44 L, equati 36.87 0 es) (Tab	Jun 138.69 on L9 o 8.08 uation L 208.1 ion L15 36.87	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 36.87	Aug 138.69 (So see 11.35 3a), aisc 193.78 0	Sep 138.69 Table 5 15.23 See Table 36.87 0	(46)m 62 98 vater is fr Oct 138.69 19.34 ble 5 215.27 2 5 36.87	+ (57)m B6 42 om com Nov 138.69 22.58 233.73 36.87 0 -110.95	+ (59)m 71 18 munity h Dec 138.69 24.07 251.08 36.87 0 -110.95	1	(66) (67) (68) (69) (70)
(65)m=incli 5 Metab (66)m= (66)m= Lightir (67)m= Applia (68)m= Cookin (69)m= Pumps (70)m= Losse (71)m= Water (72)m=	72.89 de (57) contains of the contains of th	m in calculations (Table Feb. 138.69 (Calculations)	67.6 culation able 5 5), Wat Mar 138.69 ted in Ap 16.91 ulated ir 258.52 ted in A 36.87 (Table 5 0 on (nega -110.95 able 5)	80.72 of (65)m ts Apr 138.69 opendix 12.81 of Appendix 243.9 opendix 36.87 of Appendix 36.87 of Appendix diversity of Appendix diver	May 138.69 L, equati 9.57 dix L, equati 225.44 L, equat 36.87	Jun 138.69 on L9 o 8.08 uation L 15 36.87 0 le 5) -110.95	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 36.87 0	Aug 138.69 11.35 3a), aisc see 0 -110.96 75.56	Sep 138.69 Table 5 15.23 200.65 ee Table 3 36.87 0 -110.95 77.86	X ((46)m) 62 98 atter is fr Oct 138 69 19.34 bble 5 215.27 2 5 36.87 0 -110.95	+ (57)m 66 42 Nov 138 69 22.58 233.73 36.87 0 -110.95	+ (59)m 71 18 munity h Dec 138.69 24.07 251.08 36.87 0 -110.95	1	(66) (67) (68) (69) (70)
(65)m= inclu Metab (66)m= Lightin (67)m= Applia (68)m= Cookin (69)m= (70)m= Losse Losse Vater (72)m= Total	72.89 de (57) date (57) date (58) de (58) de (57) date (58) de	64 28 m in calc s (Table Feb 138 69 (calcula 20.8 ins (calc 265.39 (calcula 36.87 ns gains 0 vaporatic -110.95 gains (Table 95.66 gains =	57.6 Sulation alog 6 55), Wat Mar 138.69 16.91 ulated in Ar 16.91 258.52 ted in Ar 36.87 (Table 6 0 on (nega -110.95 able 5) 90.86	80.72 of (65)m 52 ts Apr 138.69 ppendix 12.81 Appendix 243.9 ppendix 36.87 5a) 0 tive valu -110.95	May 138.69 L, equati 25.44 L, equat 36.87 0 es) (Tab	Jun 138.69 on L9 o 8.08 Juation L 208.1 ion L15 36.87 0 le 5) -110.95	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a; 36.87 0 -110.95 69.06 om * (67)m*	Aug 138.69 (50.50 cm) 138.69 (50.50 cm) 138.69 (50.50 cm) 13.35 (50.50 cm) 13.37 (50.50 cm)	Sep 138.69 Table 5 15.23 200.65 ee Table 36.87 77.86	Oct 138.69 19.34 19.34 19.35 215.27 5 38.87 -110.95 84.62 (700)m + (770)m +	+ (57)m \$6.42 orn corn Nov 138.69 22.58 233.73 38.87 0 -110.95 92.25	+ (59)m 71.18 munity h Dec 138.69 24.07 251.08 36.87 0 -110.95 67 95.67 im	1	(66) (67) (68) (69) (70) (71)
(65)m=inclus Metab (66)m= Lightir (67)m= Applia (68)m= Cookin (69)m= Pump: (70)m= Losse (71)m= Water	72.89 Jan 19:00 olic gain Jan 138.69 g gains 23.42 nces ga 262.67 ng gains 36.87 s and fai 0 s e.g. ev -110.95 heating	m in calculations (Tables Feb. 138.69 (calculations (calculations)	67.6 culation rable 6 culation rable 6 culation Mar 138.69 ted in Ap 16.91 ulated in 258.52 ted in A 36.87 (Table 5 0 on (negaration) rable 5)	89.72 of (65)m Apr 138.69 opendix 12.81 Appendix 243.9 opendix 36.87 5a) 0 tive valu -110.95	May 138.69 L, equati 9.57 dix L, equati 225.44 L, equati 36.87 0 es) (Tab	Jun 138.69 on L9 o 8.08 uation L 208.1 ion L15 36.87	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 36.87	Aug 138.69 (So see 11.35 3a), aisc 193.78 0	Sep 138.69 Table 5 15.23 See Table 36.87 0	(46)m 62 98 vater is fr Oct 138.69 19.34 ble 5 215.27 2 5 36.87 0	+ (57)m B6 42 om com Nov 138.69 22.58 233.73 36.87 0 -110.95	+ (59)m 71 18 munity h Dec 138.69 24.07 251.08 36.87 0 -110.95	1	(66) (67) (68) (69) (70)
(65)m= inclu Metab (66)m= Lightin (67)m= Applia (68)m= Cookin (69)m= (70)m= Losse Losse Vater (72)m= Total	72.89 de (57) contains of the first of the	m in calculations (Table Feb. 138.69 (Calculations)	67.6 culation able 5 5), Wat Mar 138.69 ted in Ap 16.91 ulated ir 258.52 ted in A 36.87 (Table 5 0 on (nega -110.95 able 5)	89.72 of (65)m Apr 138.69 opendix 12.81 Appendix 243.9 opendix 36.87 5a) 0 tive valu -110.95	May 138.69 L, equati 9.57 dix L, equati 225.44 L, equati 36.87 0 es) (Tab	Jun 138.69 on L9 o 8.08 uation L 15 36.87 0 le 5) -110.95	Jul 138.69 r L9a), a 8.73 13 or L1 196.51 or L15a 36.87 0	Aug 138.69 11.35 3a), aisc see 0 -110.96 75.56	Sep 138.69 Table 5 15.23 200.65 ee Table 3 36.87 0 -110.95 77.86	X ((46)m) 62 98 atter is fr Oct 138 69 19.34 bble 5 215.27 2 5 36.87 0 -110.95	+ (57)m 66 42 Nov 138 69 22.58 233.73 36.87 0 -110.95	+ (59)m 71 18 munity h Dec 138.69 24.07 251.08 36.87 0 -110.95	1	(66) (67) (68) (69) (70)



Orientation:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	×	13.67	×	36.79	×	0.63	×	0.7] = [153.71	(77)
Southeast 0.9x	0.77	x	10.78	x	36.79	×	0.63	x	0.7	= [121.22	(77)
Southeast 0.9x	0.77	x	9.64	×	36.79	×	0.63	×	0.7] à [108.4	(77)
Southeast 0.9x	0.77	x	15.89	×	36.79	×	0.63	x	0.7] = [178.68	(77)
Southeast 0.9x	0.77	х	13.67	x	62.67	x	0.63	x	0.7	=	261.83	(77)
Southeast 0.9x	0.77	х	10.78	×	62.67	X	0.63	×	0.7	=	206.48	(77)
Southeast 0.9x	0.77	×	9.64	×	62.67	X	0.63	×	0.7] = [184.64	(77)
Southeast 0.9x	0.77	x	15,89	X	62.67	×	0.63	x	0.7	=	304.35	(77)
Southeast 0.9x	0.77	x	13.67	х	85.75	×	0.63	×	0.7	= [358.25	(77)
Southeast 0.9x	0.77	x	10.78	x	85.75	x	0.63	x	0.7] = [282.51	(77)
Southeast 0.9x	0.77	x	9.64	х	85.75	х	0.63	x	0.7	ė.	252.64	(77)
Southeast 0.9x	0.77	x	15.89	x	85.75	×	0.63	×	0.7] = [416.43	(77)
Southeast 0.9x	0.77	х	13.67	x	106.25	x	0.63	x	0.7	=	443.89	(77)
Southeast 0.9x	0.77	x	10.78	х	106.25	х	0.63	×	0.7	=	350.05	(77)
Southeast 0 9x	0.77	x	9.64	x	106.25	×	0.63	×	0.7] = [313.03	(77)
Southeast 0.9	0.77	x	15.89	X	106.25	×	0.63	×	0.7	=	515.98	(77)
Southeast 0.9x	0.77	x	13.67	*	119.01	×	0.63	×	0.7	=	497 19	(77)
Southeast 0.9x	0.77	x	10.78	N	119.01	×	0.63	8	0.7	=	392.08	(77)
Southeast 0.9x	0.77	x	9.64	×	119.01	×	0.63	×	0.7	= [350 62	(77)
Southeast 0.9x	0.77	x	15.89	×	119.01	×	0.63	×	0.7	= [577 94	(77)
Southeast 0.9x	0.77	x	13.67	×	118.15	×	0.63	×	0.7	= [493.6	(77)
Southeast 0.9x	D.77	x	10.78	*	118.15	x	0.63	*	0.7	5	389.25	(77)
Southeast 0.9x	0.77	x	9.64	X	118.15	x	0.63	×	0.7	= [348.08	(77):
Southeast 0.9x	0.77	x	15.89	x	118.15	x	0.63	x	0.7] = [573.76	(77)
Southeast 0.9x	0.77	x	13.67	×	113,91	х	0.63	×	0.7] ≓ [475 88	(77)
Southeast 0.9x	0.77	х	10.78	x	113.91	x	0.63	x	0.7] = [375.27	(77)
Southeast 0.9x	0.77	×	9.64	х	113.91	×	0.63	×	0.7	= [335.59	(77)
Southeast 0.9x	0.77	×	15.89	×	113.91	Х	0.63	×	0.7	=	553.16	(77)
Southeast 0.9x	0.77	×	13.67	ж	104.39	×	0.63	×	0.7	=	436.11	(77)
Southeast 0.9x	0.77	x	10.78	x	104.39	×	0.63	×	0.7	= [343.92	(77)
Southeast 0 9x	0.77	x	9.64	×	104.39	×	0.63	x	0,7	=	307.55	(77)
Southeast 0 9x	0.77	x	15.89	x	104.39	X	0.63	x	0.7	-	506.94	(77)
Southeast 0.9x	0.77	X	13.67	x	92.85	X	0.63	х	0.7	₽.	387.91	(77)
Southeast 0.9x	0.77	х	10.78	×	92.85	×	0.63	×	0.7	=	305.9	(77)
Southeast 0.9x	0.77	x	9.64	x	92.85	×	0.63	×	0.7	= [273.55	(77)
Southeast 0.9x	0.77	x	15.89	×	92.85	х	0.63	×	0.7	=	450.91	(77)
Southeast 0.9x	0.77	×	13.67	×	69.27	×	0.63	×	0.7	-	289.38	(77)
Southeast 0.9x	0.77	x	10,78	×	69,27	×	0.63	×	0.7	=	228.2	(77)
Southeast 0.9x	0.77	x	9.64	x	69.27	x	0.63	x	0.7	=	204.07	(77)

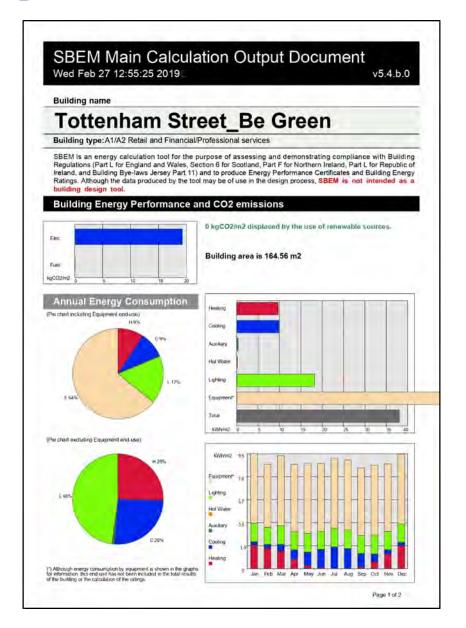
Southe														
	ast 0.9x	0.77	x	15.	89	x (69.27	x	0.63	x	0.7	=	336.38	(77
Southe	ast 0.9x	0.77	×	13.	67	x Z	14.07	×	0.63	×	0.7	1	184.11	(77
Southe	asto 9x	0.77	×	10.	78	× Z	14.07	×	0.63	i × i	0.7	= 1	145.19	(77
Southe	ast 0.9x	0.77	×	9.6	34	x Z	14.07	×	0.63	īχĒ	0.7	=	129.84	(77
Southe	ast 0.9x	0.77	×	15.	89	x Z	14.07	*	0.63	i x i	0.7	-	214.01	(77
Southe	ast 0.9x	0.77	×	13.	67	x :	31.49	x	0.63	7 x [0.7	=	131.55	(77
Southe	ast 0.9x	0.77	×	10	78	x S	31.49	×	0.63	×	0.7	×	103.74	(77
Southe	ast 0.9x	0.77	×	9,6	54	x S	31.49	x.	0.63	×	0.7	9	92.77	(77
Southe	ast 0.9x	0.77	×	15.	89	x :	31.49	×	0.63	T x [0.7	=	152.91	(77
(83)m= Total ((84)m=	gains – i	957.31 nternal a 1403.77	1309.83 ind solai 1740.74	1622.94 (84)m = 2028.59	1817.83 = (73)m 2197.55	+ (83)m 2159.6	10.00	(83)m = S 1594.52 1939.81	1418.27 1776.63	1058.03	673.16 1086.32	480.96 916.38		(83
	perature						from Tal	ble 9, Th	1 (°C)				21	(85
Utilis	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	able 9a)						-	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.98	0.92	0.8	0.62	0.45	0.31	0.22	0.25	0.41	0.72	0.95	0.99		.(88)
Mear	interna	temper	ature in	living an	ea T1 (fo	ollow ste	ps 3 to	7 in Tabl	e 9c)					
(87)m=	20.22	20.56	20.82	20.96	20.99	21	21	21	21	20.93	20.56	20.15		(87
Tem	perature	during h	eating r	eriods in	rest of	dwelling	from Ta	able 9 T	h2 (°C)					
(88)m=	20.47	20.47	20.47	20.48	20.48	20.49	20.49	20 5	20.69	20 48	20.48	20.48		(88)
Utilis	ation fac	tor for a	ains for	rest of d	welling	h2 m (se	ee Table	9a)	V					100
(89)m=	0.98	0.91	0.79	0.6	0.43	0.29	0.2	0.22	0.38	0.69	0.94	0.99		(89)
Maai	n interna	I tompor	atura in	the rest	of dwalli	ng T2 /f	follow etc	one 3 to	7 in Tah	lo 90)				
(90)m=	19.73	20.07	20.32	20.45	20 48	20.49	20.49	20.5	20.49	20.43	20.08	19.68		(90
,		Section 2	700000		1 20000	20000			1232	fLA = Livin	g area ÷ (4	1)=	0.25	(91
			-t /F-		ata akina		. A . T4		A1 TO					
Mean	19.85	20.19	20.44	20.57	20.61	20.62	20.62	20.62	20.61	20.55	20.2	19.79		(92
(92)m=	y adjustr										200,00	10.70		1
	19.85	20.19	20.44	20.57	20.61	20.62	20.62	20.62	20.61	20.55	20.2	19.79		(93
Apply														
(93)m=	ace hea						11 -4	Table 0		at Ti.m=(76)m an	d re-calc	ulate	
Apply (93)m=						ed at st	ep 1101	Table 9	D, SO tha	.,.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				
Apply (93)m=	i to the					Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Apply (93)m= 8.50 Set T the u	i to the tilisation	factor fo	or gains Mar	using Ta	ble 9a						Nov	Dec		
Apply (93)m= 8. So Set 1 the u	i to the r tilisation	factor fo	or gains Mar	using Ta	ble 9a						Nov 0.93	Dec 0.98		(94
Apply (93)m= 8. Set T the u Utilis (94)m= Usefi	i to the ritilisation Jan ation factors 0.98	Feb tor for g 0.91 hmGm	Mar Mar ains, hm 0.79 W = (94	Apr : 0.6 1)m x (8	May 0.43	Jun 0.29	Jul 0.2	Aug 0.23	Sep 0.39	Oct	0.93	0.98		
Apply (93)m= 8. So Set T the u Utilis (94)m= Usefi (95)m=	Jan ation factors of the still sation factors of the still	Feb tor for g 0.91 hmGm 1276.36	Mar ains, hm 0.79 W = (94	Apr : 0.6 4)m x (8	0.43 4)m 951.56	Jun 0.29 634.05	Jul	Aug	Sep	Oct	1351			(94
Apply (93)m= 8. Set T the u Utilis (94)m= Usefi (95)m=	Jan ation factors at gains, 985.71	Feb tor for g 0.91 hmGm 1276.36	Mar ains, hm 0.79 . W = (94 1366.74	Apr : 0.6 4)m x (8 1222.61 perature	0.43 4)m 951.56 e from Ti	Jun 0.29 634.05 able 8	Jul 0.2 423.66	Aug 0.23 443.13	Sep 0.39 689.8	Oct 0.7	0.93	0.98 901.26		(95
Apply (93)m= 8. Set T the u Utilis (94)m= Usefi (95)m= Mont (96)m=	Jan ation factors of the still sation factors of the still	Feb tor for g 0.91 hmGm 1276.36 age exte	or gains Mar ains, hm 0.79 W = (9- 1366.74 rnal tem 6.5	0.6 4)m x (8 1222.61 perature	0.43 4)m 951.56 e from Ti	Jun 0.29 634.05 able 8 14.6	Jul 0.2 423.66	Aug 0.23 443.13	0.39 689.8	0.7 1006.83	0.93	0.98		

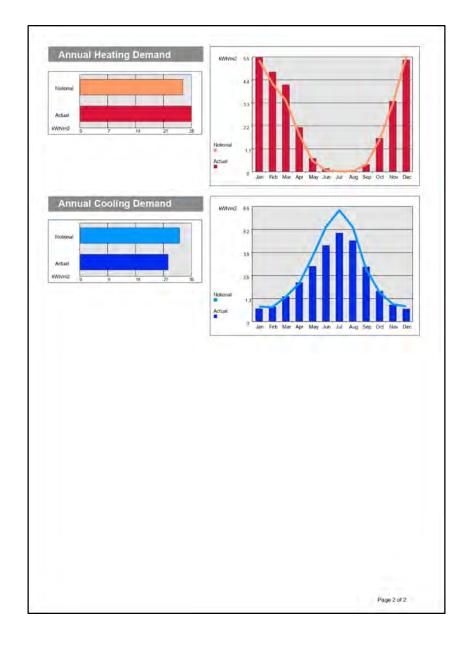




20	04.93 18		189.01	168.78	164.93	146.69	140.23	154.77	154.78	175.05	185.92	199.78		
Efficiency	of water	r heate	er										262.58	(210
(217)m= 26	62.58 26	2.58	262.58	262.58	262.58	262.58	262.58	262.58	262.58	262.58	262.58	262.58		(21
Fuel for w (219)m =														
(219)m= 7		3.71	71.98	64.28	62.81	55.86	53.41	58.94	58.94	66.67	70.81	76.08		
								Tota	1 = Sum(2	19a) =			786.54	(219
Space co				nth.										
(221)m=		0 (209)	0	0	0	73.74	81.44	73.12	0	0	0	0		
		_						Tota	1 = Sum(2	21),, =			228.3	(22
Annual to	otals									k	Nh/year		kWh/yea	ar .
Space he		el usec	d, main	system	1							1	759.38	
Water he	ating fue	used										Í	786.54	=
Space co	oling fue	used	6.7									j	228.3	
Electricity	for pum	ps, far	ns and	electric	keep-ho	t						,		
					115		nut from	n outside				3121		(23)
mechani	ical venti	lation	- balan	ced, ext	tract or p									
1000	ical venti	1000		No. of Concession, Name of Street, or other Persons, Name of Street, or ot	-	ositive in	put II of	STATE OF THE PARTY.		(230m)	-	1011	242.1	-
Total elec	tricity for	r the a	bove, k	(Wh/yea	ar	ems indu	dir	sum	of (230a)				312.1	(23)
Total elec Electricity	etricity for for lighti	r the a ing	bove, k	(Wh/yea	ar	ems inclu Ene kWi	dir ergy h/year	sum	of (230a)	Emiss kg CO		tor	413.55 Emission kg CO2/ye	(23: (23: (23: (23:
Total electricity 12 Space he	for lighting the strict of the	r the a ing on ain sy	bove, k	(Wh/yea	ar	ems inclu Ene kWi (211)	ergy h/year	sum	of (230a)	Emiss kg CO	2/kWh	tor = [413.95 Emission kg CO2/ye	(23) (23) (23) (26)
Total electricity 12 Space he	tricity for lighting for lighting the lighting (material)	r the a ing on ain sy	bove, k	(Wh/yea	ar	Ene kWi (211)	ergy h/year	sum	of (230a)	Emiss kg CO:	2/kWh	tor = [= [413.95 Emission kg CO2/ye 394.12	(23) (23) (23) (26) (26)
Total electricity 12 Space he Space he Water hea	otricity for lighting for lighting controls of the control of the	on ain sys	stem 1)	(Wh/yea	ar	Ene KWI (211) (215) (219)	ergy h/year) x) x	sum cro-CHF	of (230a)	Emiss kg CO	2/kWh	tor = [413.55 Emission kg CO2/yo 394.12 0 408.22	(23) (23) (23) (24) (26) (26)
Total electricity 127 Space he Space he Water he Space an	ctricity for lighting the string (materials) at the string (see atting and water I	on ain sys	stem 1)	(Wh/yea	ar	Ene KWI (211) (215) (219) (261)	ergy h/year) x) x) x	sum	of (230a)	Emiss kg CO:	2/kWh	tor = [= [413.95 Emission kg CO2/ye 394.12	(23) (23) (23) (24) (26) (26) (26)
Total electricity 12 Space he Space he Water hea	ctricity for lighting the string (materials) at the string (see atting and water I	on ain sys	stem 1)	(Wh/yea	ar	Ene KWI (211) (215) (219) (261) (221)	ergy h/year) x) x) + (262)	sum cro-CHF	of (230a)	Emiss kg CO:	2/kWh	tor = [= [413.55 Emission kg CO2/yo 394.12 0 408.22	(23) (23) (23) (24) (26) (26)
Total electricity 127 Space he Space he Water he Space an	eating (meating (seating ad water heating)	r the a ing an ain sys econda	stem 1)	Wh/yea	ar	Ene KWI (211) (215) (219) (261) (221) t (231)	bry h/year) x) x) x) + (262)) x	sum cro-CHF	of (230a)	Emiss kg CO: 0.5	2/kWh	tor = [= [413.55 Emission kg CO2/ye 394.12 0 408.22 802.33	(23) (23) (23) (24) (26) (26) (26)
Total electricity Space he Space he Water he: Space an Space co	ctricity for lighting the cating (material (seating (seating and water booling of for pummer).	ain sylecondar	stem 1)	Wh/yea	ar	Ene KWI (211) (215) (219) (261) (221)	bry h/year) x) x) x) + (262)) x	sum cro-CHF	of (230a)	Emiss kg CO: 0.5 0.5 0.5 0.5	2/kWh	tor = [= [= [413.95 Emission kg CO2/y 394.12 0 408.22 802.33 118.49	(23: (23: (23: (26: (26: (26: (26: (26: (26:
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BRUKL Output Document

₩ HM Government

Compliance with England Building Regulations Part L 2013

Project name

Tottenham Street Be Green

As designed

Date: Wed Feb 27 12:55:26 2019

Administrative information

Building Details

Address: Address 1, Address 2, London, Postcode

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.4.5.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: V7.0.10

BRUKL compliance check version: v5.4.b.0

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Pete Jeavons

Telephone number: Phone

Address: 52 Grosvenor Gardens, London, SW1W 0AU

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

CO. emission rate from the notional building, kgCO./m².annum	19.9			
Target CO, emission rate (TER), kgCO ₂ /m²,annum	19.9			
Building CO, emission rate (BER), kgCO;/m².annum	19.2			
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 **Building fabric**

Element	Ualimi	UnCale	U.Cat:	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 rooflights	2.2	7.4	1.4	PL000000 W-1_00
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	40	-	"No external vehicle access doors"
High usage entrance doors	3.5	· .	a -	"No external high usage entrance doors"

15- - Calculated maximum extremos element U-values (W(m*K)) U-c- Calculated unra weighted average U-values (W/(m/K))

There might be more than our surface where the maximum Ulyatic occurs.

"Automatic U-value check by the fool does not apply to curtain walls whose limiting standard is smallar to that for windows "Display windows and similar glazing are included from the U-value check

t) 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
m ² /(h.m²) at 50 Pa	10	10

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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/(1/s)]	HR efficiency
This system	3,08	2.94	-		2
Standard value	2.5*	2.6	N/A	N/A	N/A

Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NO * Standard shown is for all types ≥12 kW output, except absorption and gas engine heat pumps. For types ≃12 kW output, refer to EH 14625 for imming standards.

1- SYSTO001-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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	100	SFP [W/(Vs)]									HR efficiency	
ID of system type	A	В	C	D	E	F	G	H	1	HRE	terriciency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
Resi cycle storage -1F	6	-	50					100			N/A	
Plant room -1F		-				-					N/A	
Store -1F	-	-	10		-	-	-	-	-	-	N/A	
Refuse holding -1F	2 5	2	4	4		-		-	24		N/A	
Circulation area -1F	47	-		4.			2	-	2+	-	N/A	
Circulation area GF	A.	-	7	-	200	-	4.	ŭ.	10	-	N/A	
Toilet GF	0.3	-	4	-		-		2	-	~	N/A	
Commercial GF			40	W				à-		-	N/A	

General lighting and display lighting	Lumine	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Resi cycle storage -1F	80			16
Plant room -1F	-80	4	*	185
Store-1F	-80	L.	4.	14

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General lighting and display lighting	Lumine	ous effic			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W	
Standard value	50	60	22	-	
Refuse holding -1F	80	-	7	13	
Circulation area -1F	~	60	÷	94	
Circulation area GF		60	,	119	
Toilet GF		80	-	51	
Commercial GF	8	60	22	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	
Resi cycle storage -1F	N/A.	N/A	
Plant room -1F	N/A	N/A	
Store -1F	N/A.	N/A	
Refuse holding -TF	N/A	N/A	
Circulation area -IF	N/A	N/A	
Circulation area GF	NO 1 82911	NO	
Toilet GF	N/A	N/A	
Commercial GF	YES (+149.3%)	NO	

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters Actual Notional Area [m²] 164.6 164.6 External area [m²] 358.1 358.1 Weather LON LON Infiltration [m³/hm²@ 50Pa] 10 5 Average conductance [W/K] 97.65 136.34 Average U-value [W/m²K] 0.27 0.38 Alpha value* [%] 16.5 24.87

Building Use

Alou	Dunumy Type
)	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est/Takeaways

- B1 Offices and Workshop businesses
- B2 to B7 General Industrial and Special Industrial Groups
- B8 Storage or Distribution
- C1 Hotels
- C2 Residential Institutions: Hospitals and Care Homes
- C2 Residential Institutions: Residential schools
- C2 Residential Institutions: Universities and colleges
- C2A Secure Residential Institutions

Residential spaces

- D1 Non-residential Institutions: Community/Day Centre D1 Non-residential Institutions: Libraries, Museums, and Galleries
- D1 Non-residential Institutions: Education
- D1 Non-residential Institutions: Primary Health Care Building
- D1 Non-residential Institutions: Crown and County Courts
- D2 General Assembly and Leisure, Night Clubs, and Theatres Others: Passenger terminals
- Others: Emergency services
- Others: Miscellaneous 24hr activities
- Others: Car Parks 24 hrs
- Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	9.68	10.61
Cooling	9.8	8.92
Auxiliary	0.27	0.36
Lighting	18.16	19.34
Hot water	0.08	0.09
Equipment*	67.99	67.99
TOTAL**	37.99	39.31

^{*} Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is not of any electrical energy disclosed by CNR consenters. If applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	202.51	208.39
Primary energy* [kWh/m²]	113.7	117.68
Total emissions [kg/m²]	19.2	19.9

45

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



H	HVAC Systems Performance									
Sys	System Type Heat dem Cool dem Heat con Cool con Aux con Heat Cool Heat gen Cool ge MJ/m2 MJ/m2 kWh/m2 kWh/m2 kWh/m2 SSEEF SSEER SEFF SEER									Cool gen SEER
[ST	[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
	Actual	100.3	102.2	9.7	9.8	0.3	2.88	2.9	3.09	4.08
	Notional	92.8	115.6	10.6	8.9	0.4	2.43	3.6		

Heat dom [MJm2]
Cool dom [MJm2]
Cool dom [MJm2]
Heat dom [MJm2]
Lool dom [MJm2

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Key Features

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

Building fabric

Element	Ul-typ.	Uistin	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	2	"No external personnel doors"
Vehicle access & similar large doors	1.5	4	"No external vehicle access doors"
High usage entrance doors	1.5	14	"No external high usage entrance doors"
Class = Typical individual element U-values (W/gm²			Uses = Meiman individual element U-values [W/(m²K)]

Air Permeability	Typical value	This building	
m//(h.m/) at 50 Pa	5	10	

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F. General Notes



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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