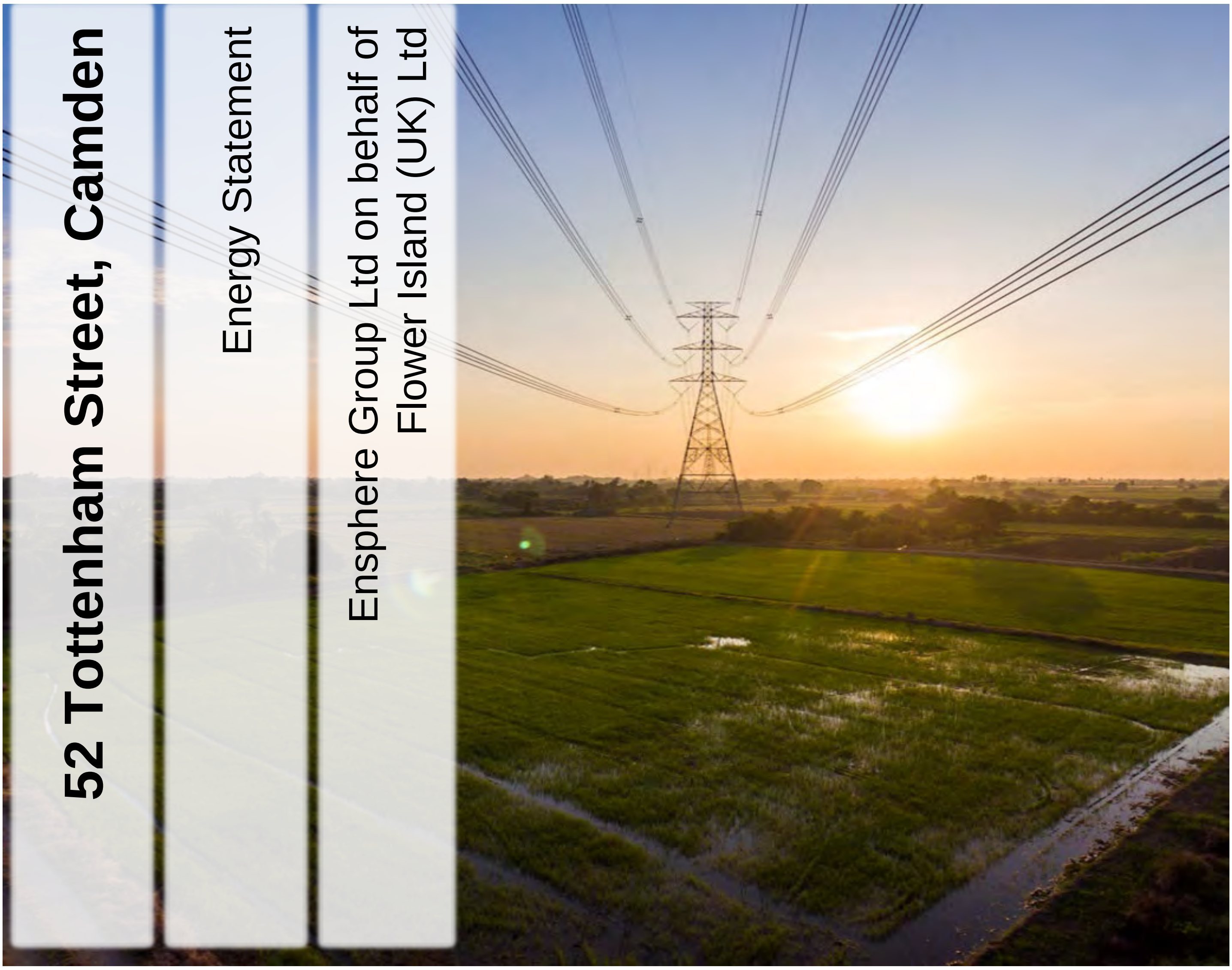
52 Tottenham Street, Camden

Energy Statement

Ensphere Group Ltd on behalf of Flower Island (UK) Ltd



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52 Tottenham Street

Energy Statement

Client Name: Flower Island (UK) Ltd)

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

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Final	V6	Pete Jeavons	Pete Jeavons	June 2020

Contents

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.

3. 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.

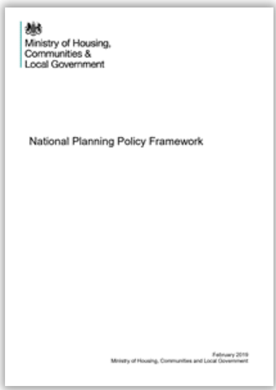
3.5 The following sections of the report review the planning policy requirements prior to establishing a baseline from which the principles of the Energy Hierarchy are applied.

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:

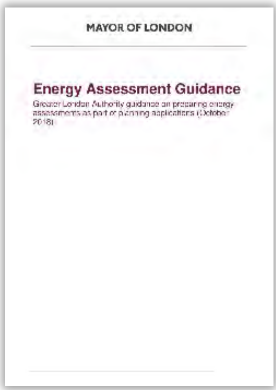
- Policy 5.2 (*Minimising Carbon Dioxide Emissions*) – includes:

- o An Energy Hierarchy: Be Lean; Be Clean; Be Green;
- o Carbon reduction targets for major developments; including a “zero carbon” target for 2019;
- o 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.


MAYOR OF LONDON

Energy Assessment Guidance

Greater London Authority guidance on preparing energy assessments as part of planning applications (October 2018)

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);
- 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 zero-carbon 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

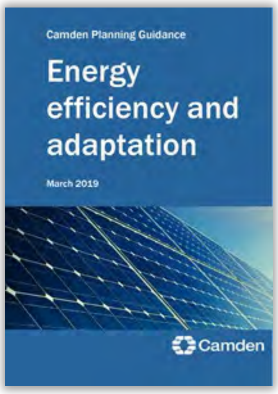
Camden Local Plan (June 2017)

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;
- 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 CO_2 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

6. Demand Reduction (Be Lean)

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

Passive Design

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

Building Massing & Orientation

6.3 The building comprises flatted accommodation, reducing surface area and increasing the number of sheltered sides. This will help limit heat losses.

6.4 The site size and proximity of neighbouring properties limits the orientation options with glazing being located on the southern side.

Passive Heating & Cooling

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

Daylighting

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

Fabric Efficiency

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

Insulation

6.8 Heat Transfer Coefficients, otherwise referred to as U-Values, are a measure of the rate of heat transfer through a building element over a given area, under standardised conditions (i.e. the rate at which heat is lost or gained through a fabric).

6.9 It is intended that the performance of the building fabric will incorporate relatively low U-Values to reduce the rate at which the buildings lose heat, preserving the heat within the space and reducing the requirement for mechanical heating.

Table 6.1 Proposed Building Fabric U-Values

Fabric Element	Part L1A (W/m^2K)	Proposed (W/m^2K)
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 $4m^3/h/m^2$ 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.

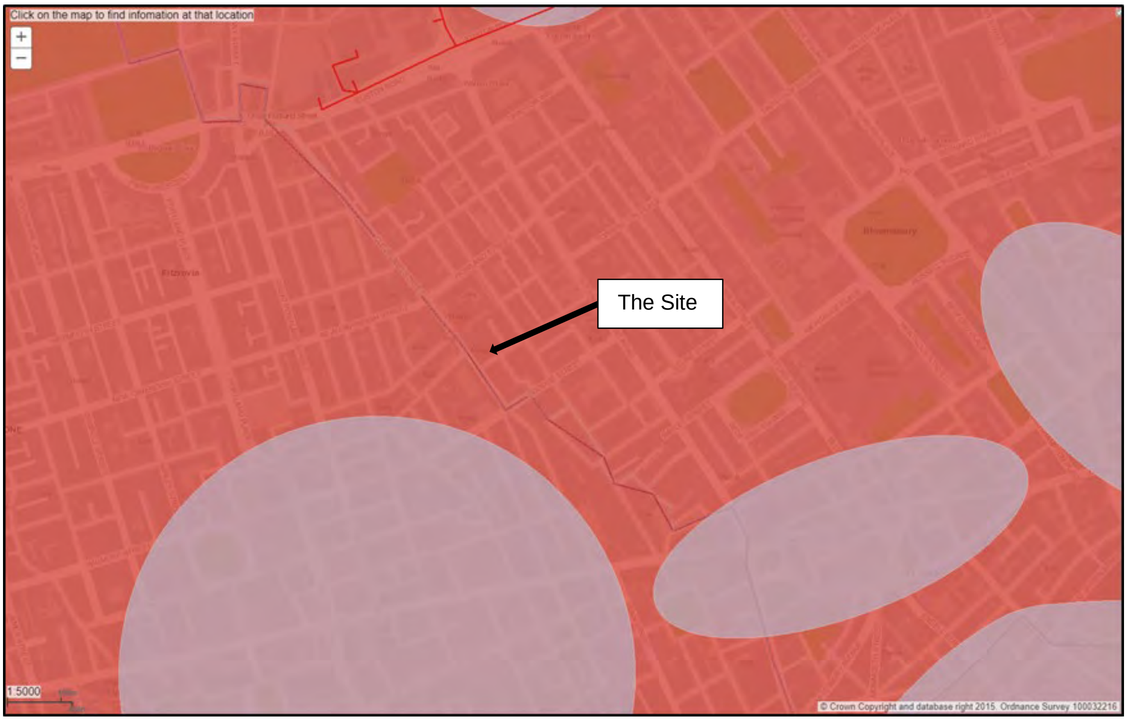
7. Heating Infrastructure (Be Clean)

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 CO_2 Emissions after Each Stage of the Energy Hierarchy (SAP10) (Residential)

Step	Carbon Dioxide Emissions (Tonnes CO_2 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 CO_2 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 CO_2 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 CO_2 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

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A. Site Plans

Basement Plan
1 : 50
Ground Floor Plan
1 : 50
30 Cleveland Street
Arthur Stanley House
Tottenham Street
0
1m
5m
N
PLANNING
DSDHA
project
52 Tottenham Street
London, W1T 4RN
drawing title
GA Plan - Level B1 & 00
drawing number
revision
297 _P20.100
A

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:

a) 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;

c) 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;

b) Identify 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:

g) Working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;

h) Protecting existing decentralised energy networks (e.g. at Gower Street Bloomsbury, Kings Cross, Gospel Oak, and Somers Town) and safeguarding potential network routes; and

i) Requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

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

Policy CC2 Adapting to Climate Change [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

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SAP 2012 PERFORMANCE	SAP10 PERFORMANCE

DOMESTIC

SAP 2012 PERFORMANCE

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 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	5	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	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**118**	-
Cash in-lieu contribution (£)	**7,087**	

SAP10 PERFORMANCE

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 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**	

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NON-DOMESTIC

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

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes 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 annum)	
	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 Shortfall (Tonnes CO_2)
Total Target Savings	1	-
Shortfall	0	1
Cash in-lieu contribution (£)	**55**	-

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SITE-WIDE

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2013 baseline	8		
Be lean	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 L 2013 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)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: Unit 4

Address : Tottenham Street, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
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	(3c)
Third floor	23.08	(1d) x	2.24	(2d) =	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:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.35	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)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	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)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	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			13.67	x1/[1/(1.4)+ 0.04] =	18.12			(27)
Windows Type 2			10.78	x1/[1/(1.4)+ 0.04] =	14.29			(27)
Windows Type 3			9.64	x1/[1/(1.4)+ 0.04] =	12.78			(27)
Windows Type 4			15.89	x1/[1/(1.4)+ 0.04] =	21.07			(27)
Walls	57.62	49.98	7.64	x 0.18 =	1.38			(29)
Roof	48.79	0	48.79	x 0.13 =	6.34			(30)
Total area of elements, m²			106.41					(31)

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

Fabric heat loss, W/K = S (A x U)	(26)...(30) + (32) =	73.98	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	973.91	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	4.95	(36)

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DER WorkSheet: New dwelling design stage

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 78.93 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	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 transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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 = $Sum(39)_{1..12}$ /12= 107.8 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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	

Average = $Sum(40)_{1..12}$ /12= 1.04 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year

Assumed occupancy, N 2.77 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.08 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	110.08	106.08	102.08	98.08	94.07	90.07	90.07	94.07	98.08	102.08	106.08	110.08	

Total = $Sum(44)_{1..12}$ = 1200.92 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	163.25	142.78	147.34	128.45	123.25	106.36	98.56	113.09	114.45	133.38	145.59	158.1	

Total = $Sum(45)_{1..12}$ = 1574.6 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	24.49	21.42	22.1	19.27	18.49	15.95	14.78	16.96	17.17	20.01	21.84	23.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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 heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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	

Output from water heater (annual)$_{1..12}$ 2156.7 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(65)m=	67.02	58.98	61.73	54.8	52.97	46.47	44.24	49.59	50.14	57.09	60.74	65.31	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(67)m=	23.42	20.8	16.91	12.81	9.57	8.08	8.73	11.35	15.23	19.34	22.58	24.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(68)m=	262.67	265.39	258.52	243.9	225.44	208.1	196.51	193.78	200.65	215.27	233.73	251.08	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(69)m=	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	(69)

Pumps and fans gains (Table 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(71)m=	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	(71)

Water heating gains (Table 5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(72)m=	90.08	87.77	82.97	76.11	71.19	64.54	59.47	66.65	69.65	76.73	84.36	87.78	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(73)m=	443.77	441.57	426.02	400.43	373.81	348.32	332.31	339.39	353.14	378.95	408.27	430.53	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Southeast 0.9x	0.77	x 13.67	x 36.79	x 0.63	x 0.7	= 153.71	(77)
Southeast 0.9x	0.77	x 10.78	x 36.79	x 0.63	x 0.7	= 121.22	(77)
Southeast 0.9x	0.77	x 9.64	x 36.79	x 0.63	x 0.7	= 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	x 0.63	x 0.7	= 206.48	(77)
Southeast 0.9x	0.77	x 9.64	x 62.67	x 0.63	x 0.7	= 184.64	(77)
Southeast 0.9x	0.77	x 15.89	x 62.67	x 0.63	x 0.7	= 304.35	(77)
Southeast 0.9x	0.77	x 13.67	x 85.75	x 0.63	x 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	x 85.75	x 0.63	x 0.7	= 252.64	(77)
Southeast 0.9x	0.77	x 15.89	x 85.75	x 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	x 10.78	x 106.25	x 0.63	x 0.7	= 350.05	(77)
Southeast 0.9x	0.77	x 9.64	x 106.25	x 0.63	x 0.7	= 313.03	(77)
Southeast 0.9x	0.77	x 15.89	x 106.25	x 0.63	x 0.7	= 515.98	(77)
Southeast 0.9x	0.77	x 13.67	x 119.01	x 0.63	x 0.7	= 497.19	(77)
Southeast 0.9x	0.77	x 10.78	x 119.01	x 0.63	x 0.7	= 392.08	(77)
Southeast 0.9x	0.77	x 9.64	x 119.01	x 0.63	x 0.7	= 350.62	(77)
Southeast 0.9x	0.77	x 15.89	x 119.01	x 0.63	x 0.7	= 577.94	(77)
Southeast 0.9x	0.77	x 13.67	x 118.15	x 0.63	x 0.7	= 493.6	(77)
Southeast 0.9x	0.77	x 10.78	x 118.15	x 0.63	x 0.7	= 389.25	(77)
Southeast 0.9x	0.77	x 9.64	x 118.15	x 0.63	x 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	x 113.91	x 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	x 9.64	x 113.91	x 0.63	x 0.7	= 335.59	(77)
Southeast 0.9x	0.77	x 15.89	x 113.91	x 0.63	x 0.7	= 553.16	(77)
Southeast 0.9x	0.77	x 13.67	x 104.39	x 0.63	x 0.7	= 436.11	(77)
Southeast 0.9x	0.77	x 10.78	x 104.39	x 0.63	x 0.7	= 343.92	(77)
Southeast 0.9x	0.77	x 9.64	x 104.39	x 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	x 0.7	= 387.91	(77)
Southeast 0.9x	0.77	x 10.78	x 92.85	x 0.63	x 0.7	= 305.9	(77)
Southeast 0.9x	0.77	x 9.64	x 92.85	x 0.63	x 0.7	= 273.55	(77)
Southeast 0.9x	0.77	x 15.89	x 92.85	x 0.63	x 0.7	= 450.91	(77)
Southeast 0.9x	0.77	x 13.67	x 69.27	x 0.63	x 0.7	= 289.38	(77)
Southeast 0.9x	0.77	x 10.78	x 69.27	x 0.63	x 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)

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Southeast 0.9x	0.77	x 15.89	x 69.27	x 0.63	x 0.7	= 336.38	(77)
Southeast 0.9x	0.77	x 13.67	x 44.07	x 0.63	x 0.7	= 184.11	(77)
Southeast 0.9x	0.77	x 10.78	x 44.07	x 0.63	x 0.7	= 145.19	(77)
Southeast 0.9x	0.77	x 9.64	x 44.07	x 0.63	x 0.7	= 129.84	(77)
Southeast 0.9x	0.77	x 15.89	x 44.07	x 0.63	x 0.7	= 214.01	(77)
Southeast 0.9x	0.77	x 13.67	x 31.49	x 0.63	x 0.7	= 131.55	(77)
Southeast 0.9x	0.77	x 10.78	x 31.49	x 0.63	x 0.7	= 103.74	(77)
Southeast 0.9x	0.77	x 9.64	x 31.49	x 0.63	x 0.7	= 92.77	(77)
Southeast 0.9x	0.77	x 15.89	x 31.49	x 0.63	x 0.7	= 152.91	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	562.01	957.31	1309.83	1622.94	1817.83	1804.69	1739.91	1594.52	1418.27	1058.03	673.16	480.96	(83)

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

(84)m=	1005.78	1398.88	1735.85	2023.37	2191.65	2153.01	2072.22	1933.9	1771.41	1436.98	1081.43	911.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	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	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.56	20.82	20.96	20.99	21	21	21	21	20.93	20.56	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	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)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(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)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	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)

fLA = Living area ÷ (4) = 0.25 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.31	19.76	20.08	20.25	20.28	20.3	20.3	20.3	20.29	20.22	19.77	19.22	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	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)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.9	0.77	0.58	0.41	0.27	0.18	0.2	0.36	0.67	0.92	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	976.38	1256.54	1333.1	1177.93	902.28	585	374.45	394.23	640.78	967.73	998.3	893.47	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1645.59	1623.01	1476.59	1208.09	906.51	585.3	374.47	394.28	642.28	1018	1356.42	1623.26	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m=	497.89	246.27	106.76	21.72	3.14	0	0	0	0	37.4	257.85	542.96

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1713.98 (98)

Space heating requirement in kWh/m²/year 16.48 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	991.11	780.24	798.21	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	1	1	1	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	988.33	779.45	796.96	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	2614.6	2518.15	2357.86	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1170.91	1293.59	1161.31	0	0	0	0	

Total = Sum(104) = 3625.81 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(107)m=	0	0	0	0	0	293.23	323.96	290.83	0	0	0	0

Total = Sum(107) = 908.02 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 8.73 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		4	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	497.89	246.27	106.76	21.72	3.14	0	0	0	0	37.4	257.85	542.96	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	551.37	272.72	118.23	24.05	3.48	0	0	0	0	41.42	285.54	601.29	

Total (kWh/year) =Sum(211)1...5,10...12 = 1898.09 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)1...5,10...12 = 0 (215)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	214.21	188.81	198.3	176.82	171.19	150.78	144.45	161.03	162.81	184.33	194.9	209.06

Efficiency of water heater 81 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.29	86.01	84.03	81.92	81.15	81	81	81	81	82.43	86.05	87.51	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	245.41	219.51	235.99	215.83	210.95	186.14	178.34	198.81	201	223.62	226.51	238.91

Total = Sum(219a)1...12 = 2581.02 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(221)m=	0	0	0	0	0	73.31	80.99	72.71	0	0	0	0

Total = Sum(221)6...8 = 227.01 (221)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1898.09	
Water heating fuel used			2581.02	
Space cooling fuel used			227.01	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		312.1		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =		342.1	(231)
Electricity for lighting			413.55	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	409.99	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	557.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =				967.49	(265)
Space cooling	(221)	x	0.519	=	117.82	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	177.55	(267)
Electricity for lighting	(232)	x	0.519	=	214.63	(268)
Total CO2, kg/year			sum of (265)...(271) =		1477.49	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		14.2	(273)
El rating (section 14)					87	(274)

E. Indicative Energy Model Outputs (Be Green)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.17

Property Address: Unit 4

Address : Tottenham Street, London

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
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	(3c)
Third floor	23.08	(1d)	x	2.24	(2d)	=	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:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.17	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2	

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.35	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)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	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)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	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			13.67	x1/[1/(1.4)+ 0.04]		=	18.12			(27)
Windows Type 2			10.78	x1/[1/(1.4)+ 0.04]		=	14.29			(27)
Windows Type 3			9.64	x1/[1/(1.4)+ 0.04]		=	12.78			(27)
Windows Type 4			15.89	x1/[1/(1.4)+ 0.04]		=	21.07			(27)
Walls	57.62	49.98	7.64	x	0.18	=	1.38			(29)
Roof	48.79	0	48.79	x	0.13	=	6.34			(30)
Total area of elements, m²			106.41							(31)

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

Fabric heat loss, W/K = S (A x U)	(26)...(30) + (32) =	73.98	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	973.91	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	4.95	(36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 78.93 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	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 transfer coefficient, 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 = Sum(39)1…12 /12= 107.8 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(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	

Average = Sum(40)1…12 /12= 1.04 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year

Assumed occupancy, N 2.77 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 100.08 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	110.08	106.08	102.08	98.08	94.07	90.07	90.07	94.07	98.08	102.08	106.08	110.08	

Total = Sum(44)1…12 = 1200.92 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	163.25	142.78	147.34	128.45	123.25	106.36	98.56	113.09	114.45	133.38	145.59	158.1	

Total = Sum(45)1…12 = 1574.6 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.49	21.42	22.1	19.27	18.49	15.95	14.78	16.96	17.17	20.01	21.84	23.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.1 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.59 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.59 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)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	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	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)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)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	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(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	

Output from water heater (annual)1…12 2065.3 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.89	64.28	67.6	60.72	59.59	53.37	51.38	56.21	56.06	62.98	66.42	71.18	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	138.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.42	20.8	16.91	12.81	9.57	8.08	8.73	11.35	15.23	19.34	22.58	24.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	262.67	265.39	258.52	243.9	225.44	208.1	196.51	193.78	200.65	215.27	233.73	251.08	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	36.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	-110.95	(71)

Water heating gains (Table 5)

(72)m=	97.97	95.66	90.86	84.33	80.1	74.13	69.06	75.56	77.86	84.62	92.25	95.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	448.66	446.46	430.91	405.65	379.72	354.91	338.9	345.29	358.35	383.84	413.16	435.42	(73)

6. Solar gains:

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

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DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast	0.9x	0.77	x	13.67	x	36.79	x	0.63	x	0.7	=	153.71	(77)
Southeast	0.9x	0.77	x	10.78	x	36.79	x	0.63	x	0.7	=	121.22	(77)
Southeast	0.9x	0.77	x	9.64	x	36.79	x	0.63	x	0.7	=	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	x	0.63	x	0.7	=	206.48	(77)
Southeast	0.9x	0.77	x	9.64	x	62.67	x	0.63	x	0.7	=	184.64	(77)
Southeast	0.9x	0.77	x	15.89	x	62.67	x	0.63	x	0.7	=	304.35	(77)
Southeast	0.9x	0.77	x	13.67	x	85.75	x	0.63	x	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	x	85.75	x	0.63	x	0.7	=	252.64	(77)
Southeast	0.9x	0.77	x	15.89	x	85.75	x	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	x	10.78	x	106.25	x	0.63	x	0.7	=	350.05	(77)
Southeast	0.9x	0.77	x	9.64	x	106.25	x	0.63	x	0.7	=	313.03	(77)
Southeast	0.9x	0.77	x	15.89	x	106.25	x	0.63	x	0.7	=	515.98	(77)
Southeast	0.9x	0.77	x	13.67	x	119.01	x	0.63	x	0.7	=	497.19	(77)
Southeast	0.9x	0.77	x	10.78	x	119.01	x	0.63	x	0.7	=	392.08	(77)
Southeast	0.9x	0.77	x	9.64	x	119.01	x	0.63	x	0.7	=	350.62	(77)
Southeast	0.9x	0.77	x	15.89	x	119.01	x	0.63	x	0.7	=	577.94	(77)
Southeast	0.9x	0.77	x	13.67	x	118.15	x	0.63	x	0.7	=	493.6	(77)
Southeast	0.9x	0.77	x	10.78	x	118.15	x	0.63	x	0.7	=	389.25	(77)
Southeast	0.9x	0.77	x	9.64	x	118.15	x	0.63	x	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	x	113.91	x	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	x	9.64	x	113.91	x	0.63	x	0.7	=	335.59	(77)
Southeast	0.9x	0.77	x	15.89	x	113.91	x	0.63	x	0.7	=	553.16	(77)
Southeast	0.9x	0.77	x	13.67	x	104.39	x	0.63	x	0.7	=	436.11	(77)
Southeast	0.9x	0.77	x	10.78	x	104.39	x	0.63	x	0.7	=	343.92	(77)
Southeast	0.9x	0.77	x	9.64	x	104.39	x	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	x	0.7	=	387.91	(77)
Southeast	0.9x	0.77	x	10.78	x	92.85	x	0.63	x	0.7	=	305.9	(77)
Southeast	0.9x	0.77	x	9.64	x	92.85	x	0.63	x	0.7	=	273.55	(77)
Southeast	0.9x	0.77	x	15.89	x	92.85	x	0.63	x	0.7	=	450.91	(77)
Southeast	0.9x	0.77	x	13.67	x	69.27	x	0.63	x	0.7	=	289.38	(77)
Southeast	0.9x	0.77	x	10.78	x	69.27	x	0.63	x	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)

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Southeast	0.9x	0.77	x	15.89	x	69.27	x	0.63	x	0.7	=	336.38	(77)
Southeast	0.9x	0.77	x	13.67	x	44.07	x	0.63	x	0.7	=	184.11	(77)
Southeast	0.9x	0.77	x	10.78	x	44.07	x	0.63	x	0.7	=	145.19	(77)
Southeast	0.9x	0.77	x	9.64	x	44.07	x	0.63	x	0.7	=	129.84	(77)
Southeast	0.9x	0.77	x	15.89	x	44.07	x	0.63	x	0.7	=	214.01	(77)
Southeast	0.9x	0.77	x	13.67	x	31.49	x	0.63	x	0.7	=	131.55	(77)
Southeast	0.9x	0.77	x	10.78	x	31.49	x	0.63	x	0.7	=	103.74	(77)
Southeast	0.9x	0.77	x	9.64	x	31.49	x	0.63	x	0.7	=	92.77	(77)
Southeast	0.9x	0.77	x	15.89	x	31.49	x	0.63	x	0.7	=	152.91	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ...(82)m

(83)m=	562.01	957.31	1309.83	1622.94	1817.83	1804.69	1739.91	1594.52	1418.27	1058.03	673.16	480.96	(83)

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

(84)m=	1010.67	1403.77	1740.74	2028.59	2197.55	2159.6	2078.81	1939.81	1776.63	1441.87	1086.32	916.38	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 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	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.56	20.82	20.96	20.99	21	21	21	21	20.93	20.56	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.47	20.47	20.47	20.48	20.48	20.49	20.49	20.5	20.49	20.48	20.48	20.48	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(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)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(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)

fLA = Living area ÷ (4) = 0.25 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	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)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	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)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.91	0.79	0.6	0.43	0.29	0.2	0.23	0.39	0.7	0.93	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	985.71	1276.36	1366.74	1222.61	951.56	634.05	423.66	443.13	689.8	1006.83	1013.87	901.26	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1722.81	1687.56	1532.96	1259.66	957.27	634.54	423.71	443.22	692.1	1069.67	1418.57	1701.55	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(98)m=	548.4	276.32	123.66	26.68	4.25	0	0	0	0	46.75	291.39	595.41

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1912.87 (98)

Space heating requirement in kWh/m²/year 18.39 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	991.11	780.24	798.21	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	1	1	1	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	988.38	779.46	796.99	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	2624.19	2527.74	2366.77	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1177.78	1300.72	1167.92	0	0	0	0	

Total = Sum(104) = 3646.41 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(107)m=	0	0	0	0	0	294.96	325.74	292.48	0	0	0	0

Total = Sum(107) = 913.18 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 8.78 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		251.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		4	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	548.4	276.32	123.66	26.68	4.25	0	0	0	0	46.75	291.39	595.41	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	217.71	109.7	49.09	10.59	1.69	0	0	0	0	18.56	115.68	236.37	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 759.38 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	204.93	180.42	189.01	168.78	164.93	146.69	140.23	154.77	154.78	175.05	185.92	199.78

Efficiency of water heater 262.58 (216)

(217)m=	262.58	262.58	262.58	262.58	262.58	262.58	262.58	262.58	262.58	262.58	262.58	262.58	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	78.04	68.71	71.98	64.28	62.81	55.86	53.41	58.94	58.94	66.67	70.81	76.08

Total = Sum(219a)$_{1...12}$ = 786.54 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	73.74	81.44	73.12	0	0	0	0

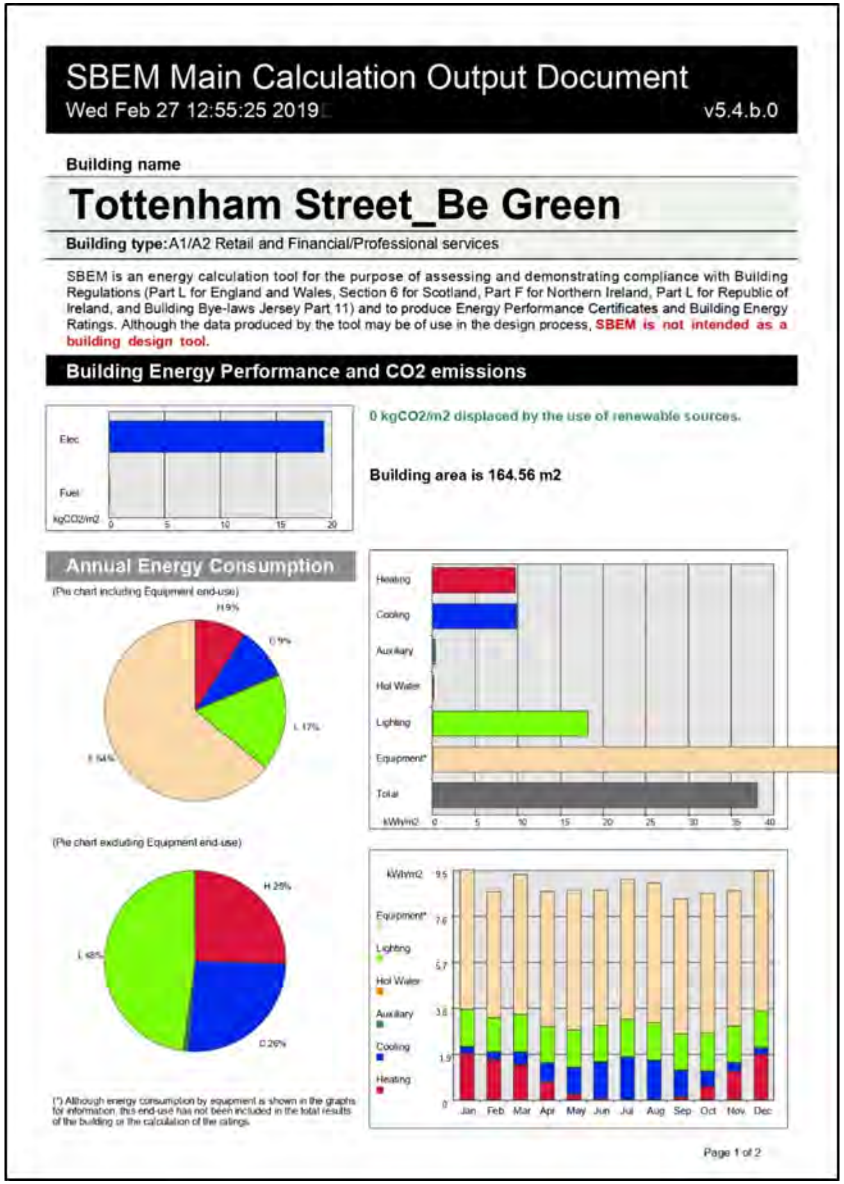
Total = Sum(221)$_{6...8}$ = 228.3 (221)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			759.38	
Water heating fuel used			786.54	
Space cooling fuel used			228.3	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		312.1		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =		312.1	(231)
Electricity for lighting			413.55	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	394.12	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	408.22	(264)
Space and water heating	(261) + (262) + (263) + (264) =				802.33	(265)
Space cooling	(221)	x	0.519	=	118.49	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	161.98	(267)
Electricity for lighting	(232)	x	0.519	=	214.63	(268)
Total CO2, kg/year	sum of (265)...(271) =				1297.43	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =				12.47	(273)
El rating (section 14)					88	(274)

ensphere



SBEM Main Calculation Output Document

Wed Feb 27 12:55:25 2019 v5.4.b.0

Building name

Tottenham Street_Be Green

Building type: A1/A2 Retail and Financial/Professional services

SBEM is an energy calculation tool for the purpose of assessing and demonstrating compliance with Building Regulations (Part L for England and Wales, Section 6 for Scotland, Part F for Northern Ireland, Part L for Republic of Ireland, and Building Bye-laws Jersey Part 11) and to produce Energy Performance Certificates and Building Energy Ratings. Although the data produced by the tool may be of use in the design process, **SBEM is not intended as a building design tool.**

Building Energy Performance and CO2 emissions

0 kgCO2/m2 displaced by the use of renewable sources.

Building area is 164.56 m2

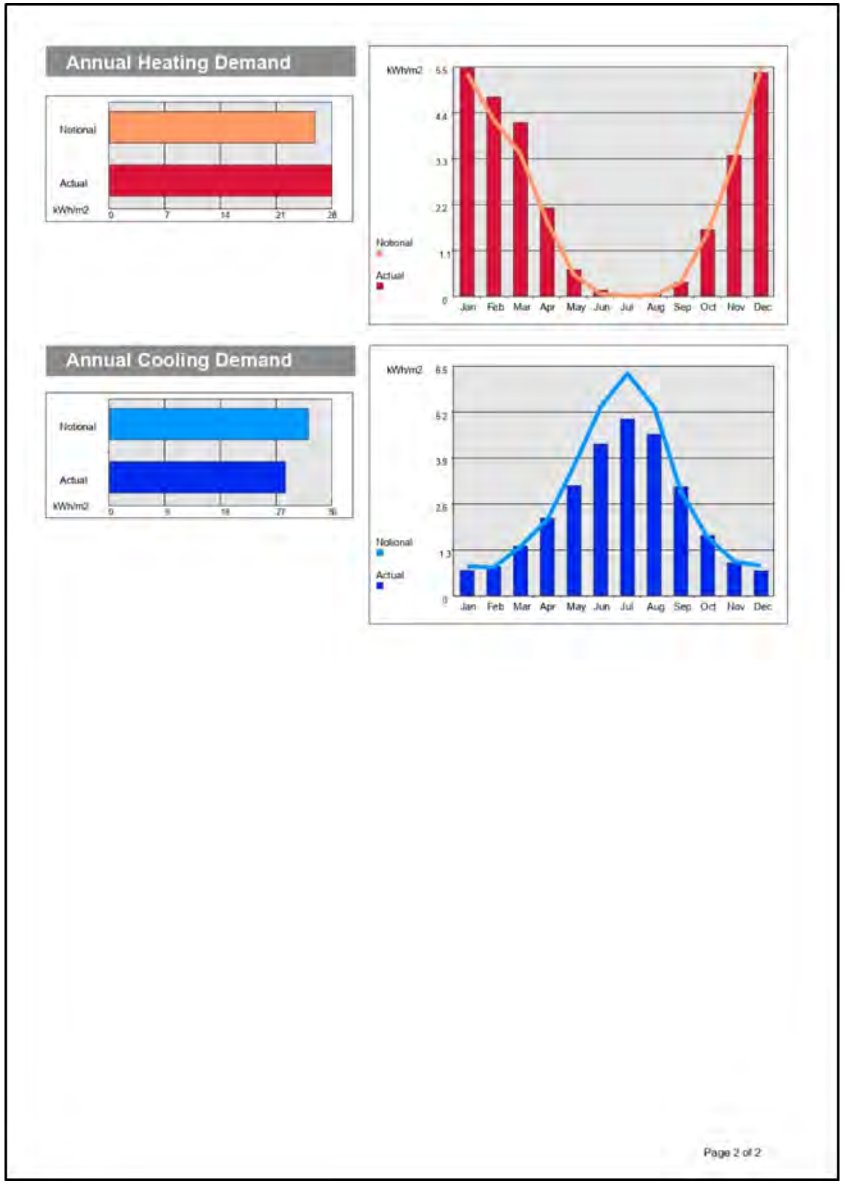
Annual Energy Consumption

(Pie chart including Equipment end-use)

(Pie chart excluding Equipment end-use)

(*) Although energy consumption by equipment is shown in the graphs for information, this end-use has not been included in the total results of the building or the calculation of the ratings.

Page 1 of 2



Annual Heating Demand

Annual Cooling Demand

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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.b.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 CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	19.9
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	19.9
Building CO_2 emission rate (BER), $kgCO_2/m^2$.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 displayed in red.

Building fabric

Element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	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	1.4	1.4	PL000000_W-1_O0
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	10

Building services

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

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

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.09	2.94	-	-	-
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 EN 14825 for limiting standards.

1- SYST0001-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
B	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
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
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	-	-	-	-	-	-	-	-	-	-	N/A
Plant room -1F	-	-	-	-	-	-	-	-	-	-	N/A
Store -1F	-	-	-	-	-	-	-	-	-	-	N/A
Refuse holding -1F	-	-	-	-	-	-	-	-	-	-	N/A
Circulation area -1F	-	-	-	-	-	-	-	-	-	-	N/A
Circulation area GF	-	-	-	-	-	-	-	-	-	-	N/A
Toilet GF	0.3	-	-	-	-	-	-	-	-	-	N/A
Commercial GF	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Resi cycle storage -1F	80	-	-	16
Plant room -1F	80	-	-	185
Store -1F	80	-	-	14

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Refuse holding -1F	80	-	-	13
Circulation area -1F	-	80	-	94
Circulation area GF	-	60	-	118
Toilet GF	-	60	-	51
Commercial GF	-	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 -1F	N/A	N/A
Circulation area -1F	N/A	N/A
Circulation area GF	NO (-32%)	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?	NO
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* [%]	24.87	16.5

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

Building Use

% Area	Building Type
100	**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 net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

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

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

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HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] 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	----	----

Key to terms

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

Key Features

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

Building fabric

Element	U_{i-Typ}	U_{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	RM000000_W1
Floor	0.2	0.22	RM000000_F
Roof	0.15	0.13	RM000001_C
Windows, roof windows, and rooflights	1.5	1.4	PL000000_W-1_O0
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

U_{i-Typ} = Typical individual element U-values [W/(m²K)] U_{i-Min} = Minimum individual element U-values [W/(m²K)]

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	10

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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