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19 FEBRUARY 2018

ENERGY AND SUSTAINABILITY STATEMENT
30 GLENILLA ROAD, LONDON, NW3 4AN

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REVISION	STATUS	CHECKED	DATE
0	Draft Issue for Comments	Dan Brooks	03.10.2017
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3	Final issue for planning application	Alan Harries	15.02.2018
4	Final issue for planning application	Alan Harries	19.02.2018

CONTENTS

EXECUTIVE SUMMARY

This Energy Assessment and Sustainability Statement has been prepared by Integration Consultancy Limited in support of the planning application for the proposed 30 Glenilla Road development in the London Borough of Camden.

Energy and Sustainability Achievements
Camden council seek a 19% reduction of regulated CO_2 emissions compared to Part L1A (2013). In addition, 20% of the CO_2 emission from the energy demand is also required to be met by local renewable energy.

The proposed development has been shown, via approved methodologies, to have a **19.1% improvement in carbon dioxide (CO_2) emissions** over the Target Emission Rate outlined in the national Building Regulations 2013.

The proposed design achieves its targets via the following strategies:

High-Efficiency Building.
The scheme uses high performance building fabric, low energy building services systems such as Mechanical ventilation with Heat Recovery (MVHR) and LED lighting throughout

Local Renewable Energy:
Following a Low and Zero Carbon (LZC) Technology feasibility study, it is proposed to provide 4m^2 of solar thermal collectors located on the flat roof.

Other Sustainability Credentials
The scheme will create a large modern home based on a highly efficient, air tight thermal envelope, making use of a central glazed atrium to provide excellent natural ventilation and night cooling as well as daylight access into the core of the building.

The scheme will feature solar thermal collectors and water saving devices. The site has excellent links to low energy public transportation.

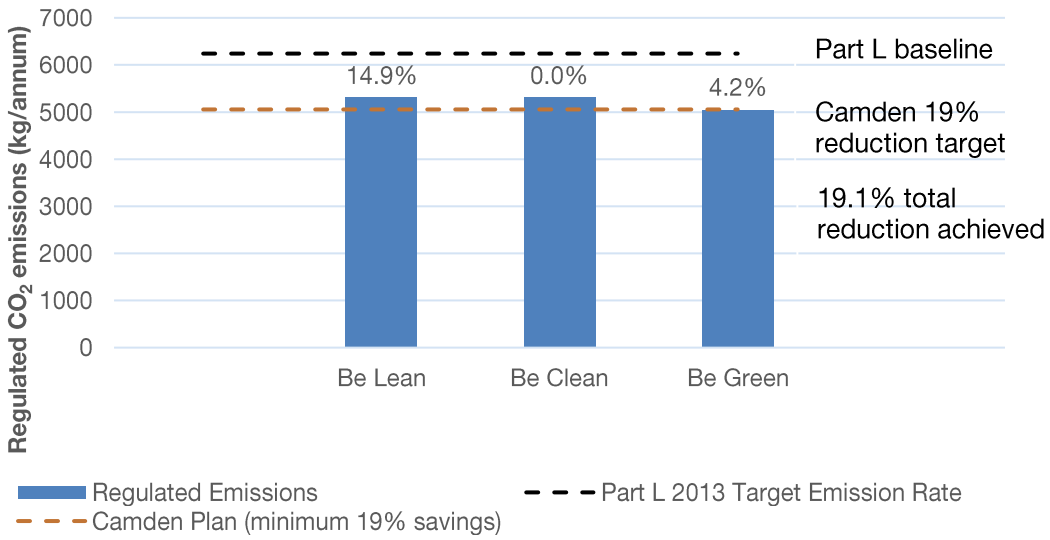


Figure 1: Summary of the scheme's regulated energy use as compared to the CO_2 emission baseline and target

The table below shows the regulated and unregulated energy use.

Location	Carbon dioxide emissions for residential units (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 (Building Regulations) Compliance	6.24	6.66
After “Be Lean” (energy demand reduction)	5.31	6.66
After “Be Clean” (heat network / CHP)	5.31	6.66
After “Be Green” (renewable energy)	5.05	6.66

Table 1: Regulated CO_2 emissions after each stage of the Energy Hierarchy

This performance can be expressed as savings between each stage in the energy hierarchy.

Location	Regulated carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from "Be Lean" (energy demand reduction)	0.93	14.9%
Savings from "Be Clean" (heat network / CHP)	0.00	0.0%
Savings from "Be Green" (renewable energy)	0.26	4.2%
Cumulative on-site savings	1.19	19.1%

Table 2: Regulated CO_2 emissions savings after each stage of the Energy Hierarchy.

1 INTRODUCTION

Integration Consultancy Limited has been appointed to undertake an Energy and Sustainability Assessment in support of the full planning application for the proposed development at 30 Glenilla Road, London NW3 4AN. The report is one of several that accompany the planning application and should be read in conjunction with these documents.

The energy assessment follows the 'Be Lean', 'Be Clean' and 'Be Green' design framework set out the London Plan.

1. 'Be lean' (energy demand minimisation through 'passive' and 'active' design measures)
2. 'Be clean' (efficient energy supply)
3. 'Be green' (renewable energy generation where feasible)

This report sets out the scheme's energy and sustainability aspirations and demonstrates, via the approved calculation methodologies, how these will be achieved through the detailed design and construction stages.

As part of this exercise, the feasibility of implementing a variety of low carbon technologies and renewable energy systems is considered based on aspects such as site location and climate, potential carbon savings, economic viability, environmental impacts and practical aspects such as integration and maintenance considerations.

THE DEVELOPMENT SITE

The site is located at 30 Glenilla Road, London.

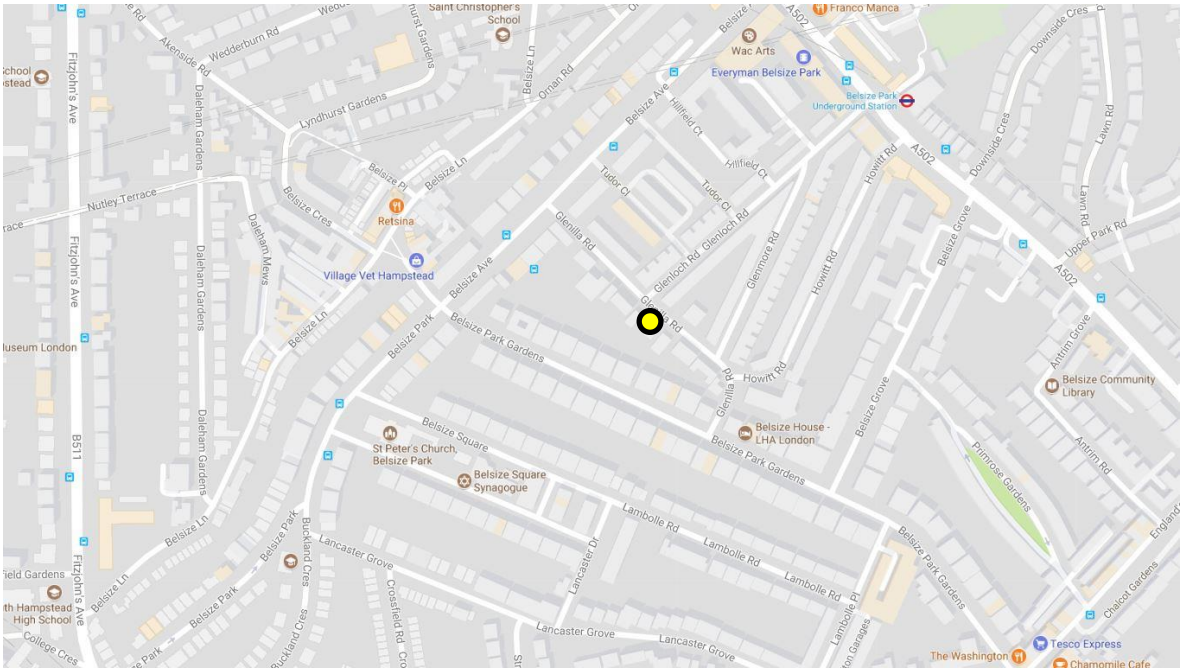


Figure 2: Site Location

Figure 3: Ariel view of site

PROPOSED DEVELOPMENT OVERVIEW

The proposed development involves the creation of new 6 bed home.

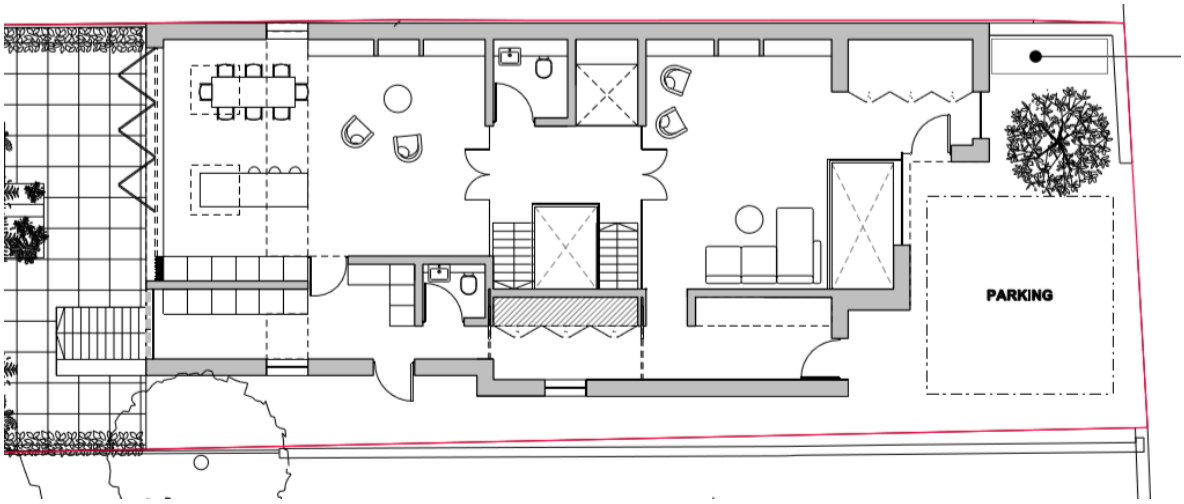


Figure 4: Proposed development – ground floor plan

The details of the proposed accommodation are summarised below.

Type	Bedrooms	Area (m^2) (GIA/GEA)
House	6 Bed	430/556 m^2

Table 3: Summary of Accommodation

ENERGY AND SUSTAINABILITY TARGET

The target is to meet Camden Councils requirement for 19% decrease of CO_2 emissions associated with regulated energy use.

The development aims to deploy viable renewable energy technology in order to align with the borough's target of 20% of CO_2 emissions associated with the development's regulated energy demand to be met by renewable energy systems where feasible.

2 POLICY REVIEW

NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

Section 10 of the NPPF relates to the challenge of climate change and flooding. Of particular relevance is paragraph 95 which supports the move to a low carbon future and states that local planning authorities should:

- plan for new developments in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards. (NB: The Government since withdrew the commitment to zero carbon homes).

The Government introduced an 'optional' housing standard related to water consumption in Building Regulations Part G which requires the consumption of wholesome water in a new dwelling not to exceed 110 litres per person per day.

LONDON PLAN 2016

Regional policy in London is controlled by The Greater London Authority and is set out in The London Plan adopted in March 2016. The Plan sets out policy and guidance in the London context and identifies a number of objectives related to improving London as a workplace and living place. Additional guidance is provided by "Energy Planning, Greater London Authority guidance on preparing energy assessments" (March 2016).

The dominant condition stipulated in terms of energy and sustainability is for all major developments to achieve at least a 35% reduction in regulated carbon dioxide emissions beyond the minimum targets stated in Part-L 2013 of the Building Regulation.

For major residential accommodation developments, the London Plan has adopted "Zero Carbon" from 1st October 2016. The remaining regulated carbon dioxide emissions to 100% are to be off-set through a cash-in-lieu contribution to the local borough to secure delivery of carbon dioxide savings elsewhere.

In addition, The London Plan states that all major development proposal will seek to reduce carbon dioxide emissions by at least 20 per cent through the use of on-site renewable energy generation wherever feasible.

The concept of sustainable development is cardinal to all policies within the London Plan which covers areas such as Places, People, Economy, Response to Climate Change, Transport, and Living Places and Spaces. Chapter 5 of the London Plan sets out a range of policies in relation to climate change, including climate change mitigation and adaptation, waste, aggregates, contaminated land and hazardous substances.

Key policies within the London Plan applicable to the proposed development are:

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 on 2010 Building Regulations**
2016 – 2031	Zero carbon (from 1 October 2016)

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

D As a minimum, the energy assessment should include the following details:

a) calculation of the energy demand and carbon dioxide emissions covered by Building Regulations and, separately, the energy demand and carbon dioxide emissions that are not covered by the Building Regulations at each stage of the energy hierarchy

b) proposal to reduce carbon dioxide emissions through the energy efficient design of the site, building and services

c) proposals to further 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.

E 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 5.7 – RENEWABLE ENERGY

5.42 There is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20 per cent through the use of on-site renewable energy generation wherever feasible.

The London Plan states that "This approach will also help ensure that the development industry in London is prepared for the introduction of 'Nearly Zero Energy Buildings' by 2020" (as required by the European Energy Performance of Buildings Regulation which requires periodic review of Building Codes to ensure cost optimal review of energy efficiency standards and that all new buildings are 'nearly zero energy buildings' by 2020).

The "Energy Planning, Greater London Authority guidance on preparing energy assessments" (March 2016), provides the definition of Zero Carbon:

ENERGY PLANNING. Greater London Authority guidance on preparing energy assessments (March 2016)

Definition

5.3 'Zero carbon' homes are homes forming part of major development applications where the residential element of the application achieves at least a 35 per cent reduction in regulated carbon dioxide emissions (Beyond Part L 2013) on-site. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere (in line with policy 5.2E).

Other key policies within the London Plan applicable to the proposed development and addressed in this report are:

5.3 – Sustainable Design & Construction

This provides guidance on issues related to air pollution and minimum emission standards for combustion plant.

5.3 – Sustainable Design & Construction

Emissions standards have been developed based on the latest technology, viability and the implication for carbon dioxide emissions of any abatement measures to reduce the NOx and PM10 emissions from the plant. The emission standards are provided in Appendix 7 and target minimum standards. Plant proposed within developments is to comply with these standards, in addition to the development meeting the overall 'air quality neutral' benchmarks.

- 5.6 – Decentralised Energy in Development Proposals
- 5.8 – Innovative Energy Technologies
- 5.9 – Overheating & Cooling

This section states that Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the cooling hierarchy.

- 5.15 – Water Use & Supplies

This provides additional guidance on water consumption:

5.15 – Water Use & Supplies

Policy 5.15 B "designing residential development so that mains water consumption would meet a target of 105 litres or less per head per day". (Footnote 24: Excluding an allowance of 5 litres or less per head per day for external water consumption)

CAMDEN LOCAL PLAN (JUNE 2017)

The Camden Local Plan reinforces and develops the London Plan's stance on aspects such as energy efficiency, renewable energy and water use.

POLICY CC1 CLIMATE CHANGE MITIGATION

8.6 The Council's Sustainability Plan 'Green Action for Change' commits the Council to seek low and **where possible zero carbon buildings**. New developments in Camden will be expected to be designed to minimise energy use and CO_2 emissions in operation through the application of the energy hierarchy.

8.8 All developments involving five or more dwellings and/or more than 500 sqm of (gross internal) any floorspace will be required to submit an energy statement demonstrating how the energy hierarchy has been applied to make the fullest contribution to CO_2 reduction. All new residential development will also be required to demonstrate a **19% CO_2 reduction below Part L 2013 Building Regulations** (in addition to any requirements for renewable energy).

8.11 The Council will expect developments of five or more dwellings and/or more than 500 sqm of any gross internal floorspace to achieve a **20% reduction in carbon dioxide emissions from on-site renewable energy generation** (which can include sources of site related decentralised renewable energy), unless it can be demonstrated that such provision is not feasible. This is in line with stage three of the energy hierarchy 'Be green'. The 20% reduction should be calculated from the regulated CO_2 emissions of the development after all proposed energy efficiency measures and any CO_2 reduction from non-renewable decentralised energy (e.g. CHP) have been incorporated.

Resource efficiency and demolition

8.17 All proposals for substantial demolition and reconstruction should be fully justified in terms of the optimisation of resources and energy use, in comparison with the existing building. Where the demolition of a building cannot be avoided, we will expect developments to divert 85% of waste from landfill and comply with the Institute for Civil Engineer's Demolition Protocol and either reuse materials on-site or salvage appropriate materials to enable their reuse off-site. We will also require developments to consider the specification of materials and construction processes with low embodied carbon content.

Embodied Carbon

8.19 Embodied carbon is the carbon impact associated with the production, transport, assembly, use and disposal of materials. This will include consideration of maintenance and repair but does not include the carbon emissions associated with the energy used for heating, lighting or cooling in the completed building. Additionally, the Council will expect developers to consider the service life of buildings and their possible future uses to optimise resource efficiency. The durability and lifespan of the buildings' components should be matched to its likely service life, and where appropriate the building should be designed to be flexible in terms of adaptation to future alternative uses in order to avoid the need for future demolition.

8.20 As part of the assessment of resource efficiency, all developments involving five or more dwellings and/or more than 500 sqm gross internal floor space are encouraged to assess the embodied carbon emissions associated with the development within the energy and sustainability statement. Where such an assessment has been completed we would encourage that the results are logged on the WRAP embodied carbon database in order to contribute to the embodied carbon knowledge base.

POLICY CC2 ADAPTING TO CLIMATE CHANGE

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

a. the protection of existing green spaces and promoting new appropriate green infrastructure;
b. not increasing, and wherever possible reducing, surface water run-off through increasing permeable surfaces and use of Sustainable Drainage Systems;
c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and
d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.
Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

Sustainable drainage and biodiversity

8.37 To support a sustainable approach to drainage, all development should install green roofs, permeable landscaping, green walls and combination green and blue roofs, where appropriate.

Cooling

8.41 All new developments will be expected to submit a statement demonstrating how the London Plan's 'cooling hierarchy' has informed the building design. Any development that is likely to be at risk of overheating (for example due to large expanses of south or south west facing glazing) will be required to complete dynamic thermal modelling to demonstrate that any risk of overheating has been mitigated.

8.42 Active cooling (air conditioning) will only be permitted where dynamic thermal modelling demonstrates there is a clear need for it after all of the preferred measures are incorporated in line with the cooling hierarchy.

8.43 The cooling hierarchy includes:

- Minimise internal heat generation through energy efficient design;
- Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls;
- Manage the heat within the building through exposed internal thermal mass and high ceilings;
- Passive ventilation;
- Mechanical ventilation; and
- Active cooling.

POLICY CC3 WATER AND FLOODING

8.55 Developments must be designed to be water efficient. This can be achieved through the installation of water efficient fittings and appliances (which can help reduce energy consumption as well as water consumption) and by capturing and re-using rain water and grey water on-site. Residential developments will be expected to meet the **requirement of 110 litres per person per day (including 5 litres for external water use)**.

8.57 Water can pick up pollutants running across a site, which in turn enters our combined storm water and sewer system. Developments are required to utilise Sustainable Drainage Systems (SuDS), following the drainage hierarchy (see below), to ensure that development does not harm water quality.

Drainage hierarchy

1. store rainwater for later use
2. use infiltration techniques, such as porous surfaces in non-clay areas
3. attenuate rainwater in ponds or open water features for gradual release
4. attenuate rainwater by storing in tanks or sealed water features for gradual release
5. discharge rainwater direct to a watercourse
6. discharge rainwater to a surface water sewer/drain
7. discharge rainwater to the combined sewer

8.70 Basements can affect the ability of the ground to absorb rain when soil is replaced by an impervious structure and can be particularly susceptible to flooding. The Council will not permit basement schemes which include habitable rooms and other sensitive uses for self-contained basement flats and other underground structures in areas prone to flooding. The Council shall require all new basement developments whether domestic or non-domestic to conduct a Basement Impact Assessment which considers both groundwater and surface water flooding. A Basement Impact Assessment (BIA) should

demonstrate that the impacts of the proposed development are acceptable, or that appropriate mitigation measures will be adopted.

POLICY CC4 AIR QUALITY

8.85 In Central London, one of the most significant sources of air pollution is domestic and commercial boilers, which are a key source of NO_2 (around 40%) and a small source of PM10. This can be reduced through energy efficiency and by ensuring new boilers are Ultra Low Nitrogen Oxide (NOx) (<40 mg/kWh).

POLICY CC5 WASTE

8.97 To make sure that residents and businesses can properly store and sort their waste and to make household recycling as easy as possible, the Council will require developments to provide adequate facilities for recycling and the storage and disposal of waste. Facilities for home composting will be encouraged in appropriate development schemes. We will also seek to secure the reuse of construction waste on development sites to reduce resource use and the need to transport materials.

3 DESIGN APPROACH

SUSTAINABILITY DESIGN APPROACH AND STRATEGY

Sustainability is integral to the design, construction, operation and performance of the proposed development. This involves addressing key long-term issues such as those capture by the Mayor's strategic targets as set out below.

Mayor's Strategic Targets (Sustainable Development)	**Sustainability Strategy (How the proposed development contributes to Mayor's Targets)**
CO_2 EMISSIONS An overall reduction in London's carbon dioxide emissions of 60 per cent (below 1990 levels) by 2025	✓ Meets carbon emissions target of 19% below Part L1A (2013). ✓ Buoyancy driven natural ventilation via the central atrium rooflight wells which facilitate summer time natural ventilation and free night-cooling of exposed thermal mass (see below). ✓ MHVR for winter efficiency. Heat recovery bypass for assisted summer time night-cooling when required. ✓ Smart meters for energy monitor with guidance documentation for occupants including energy benchmarks.
DECENTRALISED ENERGY 25% of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025	✓ Solar thermal panels for domestic hot water provision.
BIODIVERSITY Increase the amount of surface area greened in the Central Activities Zone by at least five per cent by 2030, and a further five per cent by 2050 and increase London's tree cover by five per cent by 2025	✓ Green roofs on 4 separate flat roof areas (as shown in Figure 5 below)
AIR QUALITY Contribute to the achievement of EU limit values for air pollution	✓ Low energy demand and local renewable energy deployment reduces the amount of fossil fuel combustion. ✓ Mechanical ventilation with heat recovery (MVHR) offers a means for occupants to filter fresh air. ✓ Fresh air taken at higher levels where pollution concentrations will be lower ✓ Excellent public transportation links (Belsize Park Station ~300m)
RECYCLING 95% of construction, demolition and excavation waste is recycled/reused by 2020, and that 80% recycling of that waste as aggregate	✓ Construction, demolition and excavation waste recycling requirement in contractor specification (construction waste management plan).

Table 4: Sustainability strategy in relation to Mayor's Strategic Targets

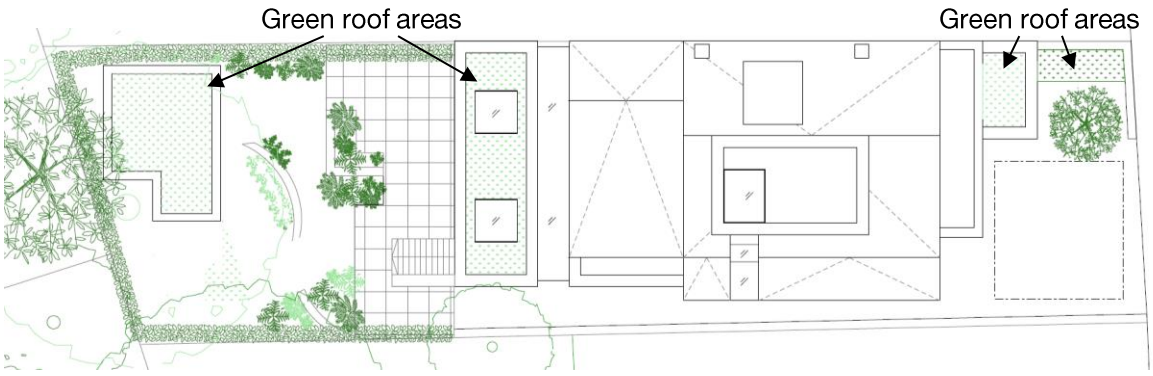


Figure 5: Green roof location

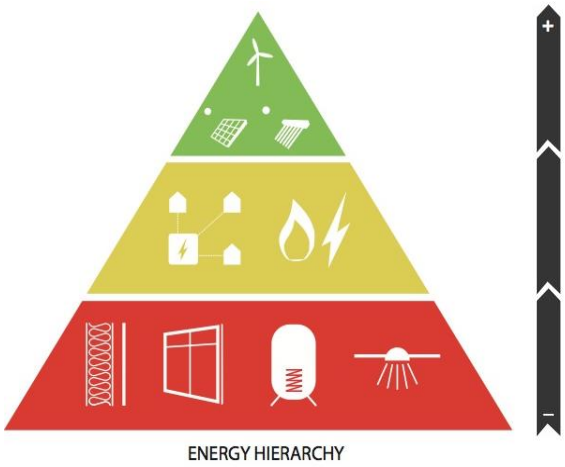
Additional aspects related to sustainable development are summarise below:

Additional sustainable development Issues	Sustainability Strategy
WATER USE On average Londoners use approximately 167 l/p.day (litres of potable water per person per day). This is 14% more than the England and Wales average, despite London already being in one of the driest parts of the country. Part G of building regulation requires 125 l/p.day and 110 l/p.day where required by planning condition such as in London (105 litres or less per head per day excluding an allowance of 5 litres or less per head per day for external water consumption)	✓ Low flow taps, showers, WCs and (where fitted) dishwashers / washing machines as required in line, where possible, to meet the target of 105 litres or less per head per day excluding an allowance of 5 litres or less per head per day for external water consumption.
HEAT ISLAND EFFECT AND OVERHEATING The heat island effect in dense urban areas increases discomfort and energy use (for cooling). With continued climate change this is expected to become a significant issue.	✓ Low risk overheating utilising natural night cooling of exposed thermal mass. ✓ Green roofs on 4 separate flat roof areas (as shown in Figure 4)
HEALTH & WELLBEING This is a key issue with the importance of fresh air recently highlighted by research into the impact of CO_2 on office worker performance.	✓ High quality architecture, landscaping, daylight and material finishes to create desirable space. ✓ Access to cleaner filtered fresh air at high level. ✓ Central atrium provides daylight deep into the core of the building.

Table 5: Sustainability strategy in relation to additional sustainable development issues

ENERGY DESIGN APPROACH – THE ENERGY HIERACHY

The energy hierarchy, as referred to in the London Plan and illustrated below, sets out a three-stage approach to strategic decision-making for the reduction of energy and associated carbon emissions.



BE GREEN - Use Renewable Energy

Energy supply derived from local renewable resources including solar irradiation, wind energy, hydropower and local heat sources such as geothermal energy. Provision of non-local options can also be considered.

BE CLEAN - Deliver Energy Efficiently

Efficient energy provision for space heating and cooling infrastructure e.g. high efficiency cooling plant, combined heat and power (CHP) or, if available, connection to a district heating/cooling networks.

BE LEAN - Minimise Energy Demand

Passive design such as optimising form, orientation and site layout, natural ventilation with thermal mass, daylight and solar shading as well as active design measures such as LED lighting and efficient mechanical ventilation with heat recovery.

Figure 6: Energy Hierarchy Methodology

This approach aims to reduce the energy consumption and consequent carbon emissions of the development while maintaining quality and without compromising occupant wellbeing and comfort.

4 ENERGY - BASELINE CALCULATIONS

Energy demand and annual CO_2 emissions are calculated using Stroma for SAP 2012[1].

The amount of carbon emission reductions achieved by the proposed scheme is compared to the notional Target Emission Rate (TER) which forms the baseline comparison target. This notional building/dwelling is produced by the energy model and intends to replicate the actual building in terms to area, form, orientation and usage. The fabric parameters and system efficiencies for this notional building meets and, in some parts, exceeds the minimum requirements for compliance with Part L of the 2013 Building Regulations as summarised in the table below.

For dwellings, as part of the 2013 Part L (Part L1A) of the building regulations, the Target Fabric Energy Efficiency (TFEE) sits alongside TER. The TFEE is the minimum fabric energy performance requirement for a new dwelling. The Dwelling Fabric Energy Efficiency (DFEE) rate is the actual fabric energy performance of the new dwelling. The DFEE must not exceed the TFEE. It is expressed as the amount of energy demand in kWh/(m^2.year). The TFEE is 15% higher than the notional FEE and so if the actual dwelling is constructed entirely to the notional dwelling specifications it will meet the fabric energy efficiency targets. However, the notional dwelling is not prescriptive and specifications can be varied provided that the TFEE rate is achieved or bettered. To prevent poor performance of individual elements, limiting fabric values are retained in Table 2 of approved document L1A and limiting building services efficiencies are set out in the Domestic Building Services Compliance Guide.

The Notional Building baseline requirements are:

Element	**Building Regulations 2013 for domestic (non-domestic)**	
	U Value (W/m^2K)	**G Value**
External Walls	0.18 (0.26)	-
Floor	0.13 (0.22)	-
Roof	0.13 (0.18)	-
Windows	1.4 (1.6)	0.63 (0.4)
External Opaque Doors	1.0	-
External Glazed Doors	1.2	-
Air Tightness	5.0 (3.0) m3/m2/h @50Pa	
Liner thermal transmittance	Standardised Psi values SAP Appendix R	
Size of building	Same as proposed dwelling	
Opening areas (windows and doors)	Same as actual dwelling up to 25% of total floor area	
Ventilation type	Natural with extract fans	
Air-conditioning	None	
Heating source	Mains Gas (89.5% SEDBUK 2009)	
Heating emitters and controls	Radiators. Time and temperature zone control. Weather compensation.	
Hot water storage	Gas boiler heated. Thermostat control. 150 litres. Separate time control.	
Lighting	100% low energy lighting	
Thermal Mass parameter (TMP)	Medium (250kJ/m^2K)	

Table 6: Notional Dwelling (Building) Specification (Table 4 SAP 2012)

[1] October 2013 updated June 2014 to include RdSAP 2012 and with minor corrections December 2014.

Following this first step of the analysis which details the baseline notional building CO_2 emissions, the "Be Lean", "Be Clean" and "Be Green" scenarios are presented for comparison.

Both "regulated" energy (e.g. space heating, hot water, cooling, lighting, pumps and fans) and "unregulated" energy (e.g. appliances, equipment and cooking) are presented based on BRE methodology values. Sample output from the software is presented in the Appendix for reference.

The CO_2 emission associated with regulated energy consumption are given below.

Ref	Bedrooms	TER (kg.CO_2/m^2/yr.)
House	6 bed	12.54
Total Baseline		**12.54**

Table 7: Baseline Regulated Carbon Emissions

The total baseline CO_2 emissions (associated with both the regulated and the unregulated energy consumption) are summarised below.

Ref	Bedrooms	Regulated Carbon Emissions (kg.CO_2/yr.)	Unregulated Carbon Emissions (kg.CO_2/yr.)	Total Carbon Emissions (kg.CO_2/yr.)
House	6 bed	6,241	6,656	12,897
Total Baseline Emissions		**6,241**	**6,656**	**12,897**

Table 8: Total Baseline Carbon Emissions

5 ENERGY - “BE LEAN”

The incorporation of appropriate passive and active energy efficiency measures can significantly reduce energy demands. These measures are often integral to the building form and fabric and cannot be readily remedied or retrofitted once the building has been constructed.

The augmentation of these design strategies begins by identifying site-specific challenges and opportunities, considering the microclimate, location and surroundings and applying them to the building form, façade and orientation.

CLIMATE ANALYSIS

The London climate is heating dominated, hence the key passive measure to be implemented are high levels of insulation and air-tightness. Temperatures in the summer can occasionally rise above comfortable levels and this will tend to intensify as a consequence of the climate change and further urbanisation.

The diurnal temperature variations are high with an average daily temperature swing of 8-10°C even during peak summer. This creates potential for passive summertime cooling using night-time cooling via openable windows or mechanical ventilation.

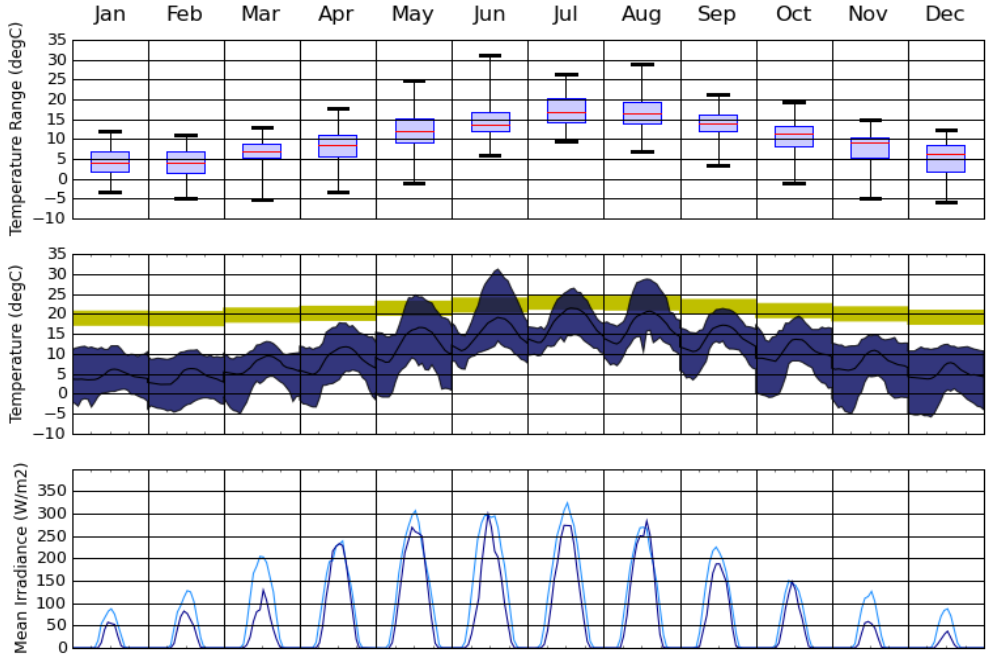


Figure 7: Average historic climate data for London

BUILDING FABRIC PERFORMANCE & INSULATION

High levels of insulation are proposed as summarised later in this section. This will significantly reduce energy consumption and ensure optimum occupant comfort all year round by retaining heat in the winter and reducing heat gains in the summer.

This is particularly relevant for glazed surfaces that can be a cause of overheating in summer or overcooling and condensation formation in winter. Highly-insulated glazing will also improve occupant comfort by reducing radiant temperature asymmetry which can be a comfort issue especially during the winter months.

AIR TIGHTNESS & INFILTRATION

A high target air-permeability rate has been selected as summarised later in this section. The key to achieving high levels of airtightness is the build quality of construction. Selection of Accredited or Improved Robust Details improves air-tightness of the building envelope in practice. Air tightness testing procedures shall be performed in accordance with the recommendations set out in CIBSE TM 23 and the ATTMA TS1.

THERMAL BRIDGING

Minimising thermal bridging is an important aspect of the design. The approach to limiting thermal bridging is to implement Accredited or Improved Robust Details to all elements of the construction.

NATURAL VENTILATION & THERMAL MASS

Daytime natural ventilation is essential to remove excess heat during the summer months and enables the provision of high air quality. When used in combination with exposed thermal mass, natural ventilation will reduce high internal daily temperature fluctuations and minimise the overheating risk in the summer. Therefore, occupant comfort can be maintained with reduced reliance on mechanical cooling systems.

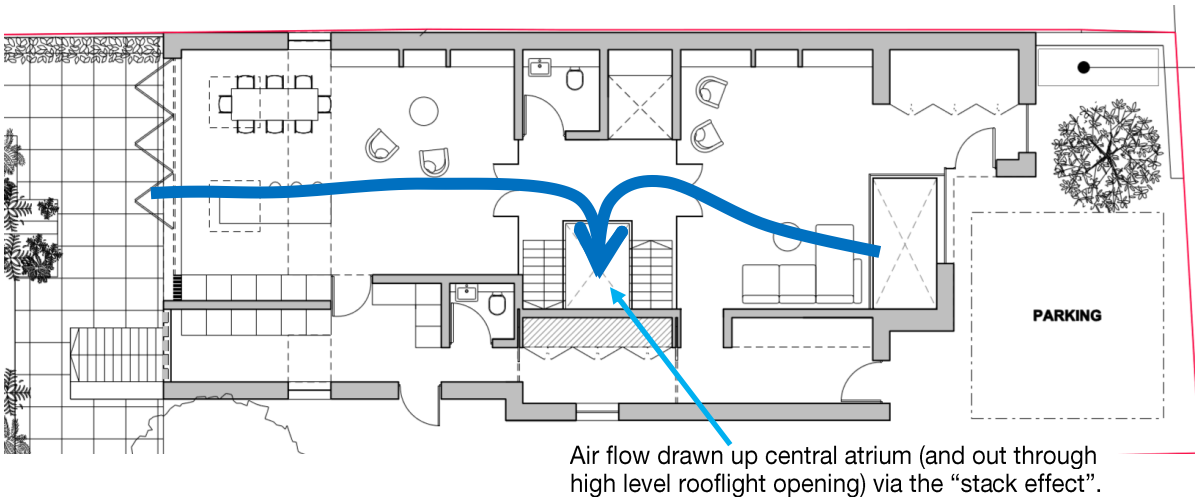


Figure 8: Natural ventilation cooling strategy

Summer day time: The central atrium allows for excellent natural ventilation potential via natural buoyancy (the so-called “stack effect”). The air flowrate is direction proportional to the stack height therefore the height atrium will allow good natural ventilation in summer.

Summer night-time: Secure openings in the dining room are and the drawing room lightwell allow the passage of cool night time air across the main living room and kitchen areas. This will cool the exposed thermal mass over the course of the night and help provide a cool environment during peaks summer days.

SOLAR EXPOSURE AND DAYLIGHT

Maximising exposure to solar energy and daylight is essential to reduce reliance on artificial lighting, reducing winter daytime heating requirements and to contribute to the general wellbeing of occupants. The glazed atrium design allows for daylight penetration deep into the building’s core.

Fenestration on the facades are sized and located to maximise natural daylight to provide amenity and reduce artificial lighting energy use. Internal shading can be incorporated to minimise the risk of overheating and glare without overly compromising daylight availability.

ACTIVE BUILDING SERVICES SYSTEMS

All building services systems will be in accordance with, and where possible exceed, the energy minimum requirements of efficiency outlined in the Building Service Compliance Guide 2013.

The heating and hot water distribution will be provided via a central heating high-efficiency gas-fired boiler.

The development will be provided with high-efficiency mechanically ventilation with heat recovery as per Building Regulations Part F System 4. The system will have a summer bypass to support night-time free cooling of thermal mass.

Figure 9: Typical domestic mechanically ventilation with heat recovery (MVHR) system.

Low-energy fixed lighting, generally comprising of high efficacy LED fittings will be installed throughout the development.

COOLING AND OVERHEATING

The cooling and overheating strategies are summarised in the table below using the cooling hierarchy which has been applied to the design.

Hierarchy Measure	Application to proposed development
1. MINIMISE INTERNAL HEAT GAINS Minimise internal heat generation through energy efficient design.	✓ Low energy LED lighting.
2. MINIMISE EXTERNAL HEAT GAINS Reduce the amount of heat (from solar irradiation and high outside air temperatures) that can enter the building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls.	✓ High-level of insulation ✓ Internal blinds with light coloured external facing surfaces (with relatively high reflective properties).
3 & 4 HEAT MANAGEMENT AND PASSIVE VENTILATION Manage heat within the building through exposed internal thermal mass and high ceilings as well as natural ventilation strategies such as night cooling, the stack effect and promotion of cross-flow ventilation.	✓ Excellent day time natural ventilation potential ✓ Comprehensive night time ventilation strategy via central atrium.
5. MECHANICAL VENTILATION	✓ Mechanical Ventilation with Heat Recovery (MVHR) is specified. System will have “heat recovery by-pass” mode in order to be operable in summer night-cooling mode to supplement natural ventilation flow if required.
6. ACTIVE COOLING Ensuring they are the lowest carbon options.	✓ The requirement for active cooling is minimised by the design of the building especially the ability of the central atrium to cool the core thermal mass of the building during the night time.

Table 9: Cooling and overheating hierarchy application

The scheme has used the Overheating Checklists in the design process as provided in the GLA Guidance on preparing Energy Assessment. These are intended to assist designers to identify potential overheating risks in residential accommodation early in the design process. Please refer to the Appendix for the completed Checklists.

Criterion 3 of Part L 2013 of the Building Regulations relates to limiting the effects of heat gains in the summer (as set out in Appendix P of SAP 2012 for dwellings).

From the Checklists and the SAP calculations, the proposed development is considered to have a relatively low overheating risk.

As part of the “Be Lean” approach, seeking to minimise energy demand, the building fabric has been specified to meet or exceed the minimum fabric parameters outlined in Part L of the Building Regulation 2013 as per table below.

Element	Building Regulations 2013 Notional Building (limit)		Enhanced Building Fabric Improvement for the proposed development	
	U Value (W/m²K)	G Value	U Value (W/m²K)	G Value
External Walls	0.18 (0.3)	-	0.14	-
Ground Floor	0.13 (0.25)	-	0.11	-
Roof	0.13 (0.20)	-	0.1	-
Windows	1.40 (2.0)	0.63	1.0	0.63
External Doors	1.0	-	1.0	-
External Glazed Doors	1.2	-	1.0	-
Air Tightness	5.0 m³/m²/h (10)		3.0 m³/m²/h	
Thermal Bridging	Accredited details		Accredited details	
Heating source	Mains Gas (89.5% SEDBUK 2009)		Mains Gas (89.5% SEDBUK 2009)	
Heating emitters	Radiators		Radiators	
Heating control	Time and temperature zone control.		Time and temperature zone control.	
Lighting	100% low energy lighting		100% low energy lighting	
Ventilation type	Natural with extract fans		MVHR	

Table 10: Proposed development and baseline comparison "Notional" SAP building

The energy demand and annual carbon emissions calculation have been carried out using BRE accredited energy compliance software Stroma for SAP 2012[2]. Sample details of the SAP calculations are presented in the appendices.

"Be Lean" Total Carbon Emissions

The CO_2 emissions associated with regulated energy consumption are given below.

Ref	Bedrooms	DER (kg.CO_2/m²/yr.)
House	6 bed	10.67
Total "Be Lean"		**10.67**

Table 11: Be Lean Regulated Emissions

The CO_2 emission associated with unregulated energy consumption are the same as calculated for the baseline scenario. Therefore, the total "Be Lean" CO_2 emission associated with regulated and unregulated energy consumption is summarised below.

Ref	Bedrooms	Regulated Carbon Emissions (kg.CO_2/yr.)	Unregulated Carbon Emissions (kg.CO_2/yr.)	Total Carbon Emissions (kg.CO_2/yr.)
House	6 bed	5,310	6,656	11,965
Total "Be Lean" Emissions		**5,310**	**6,656**	**11,965**

Table 12: Total Be Lean Carbon Emissions

[2] October 2013 updated June 2014 to include RdSAP 2012 and with minor corrections December 2014.

6 ENERGY – "BE CLEAN"

GAS FIRED COMBINED HEAT AND POWER (CHP)

Combined heat and power (CHP) systems are now available for individual houses, group residential units and small non-domestic premises. Large commercial CHPs are also now relatively common in premises which have a simultaneous demand for heat and electricity for long periods, such as hospitals, recreational centres, hotels and multi-residential and mix-use developments. Compared with using centrally generated grid supplied electricity, CHP offers a more efficient and economic method of supplying energy demand, due to the utilisation of the heat which is normally rejected to the atmosphere from central generating stations, and by reducing network distribution losses due to local generation and use. It is not a renewable energy technology, but installed in the appropriate manner there is potential for overall energy, carbon and cost savings. CHP technology is also readily integrated into buildings providing that its spatial requirements and flue can be accommodated.

Whilst MicroCHP units are available for small developments CHP is not generally recommended and GLA guidance suggests following need not install CHP:

- Small-medium residential development (less than 500 apartments)
- Non-domestic developments with a simultaneous demand for heat and power less than 5000 hours per annum (offices/schools)

Therefore, CHP is not considered a viable option for this development.