SYNTEGRA CONSULTING

Camden High Street , London, NW1B 7JY

June 2024

Energy Strategy Report

Ref: 24-13248

TABLE OF CONTENTS

Quality Standards Control

The signatories below verify that this document has been prepared in accordance with our quality control requirements. These procedures do not affect the content and views expressed by the originator.

This document must only be treated as a draft unless it has been signed by the originators and approved by a director.

Revision	Initial	Rev A	Rev B	Rev C
Date	15/06/2024			
Prepared by	I. Bhatnagar			
Checked by	A.Gonzales			
Authorised by	M. Standen			

Limitations

Syntegra Consulting Ltd ("SC") has prepared this report for the sole use of client in accordance with the agreement under which our services were performed. No other warranty, expressed or implied, is made as to the professional advice included in this report or any other services provided by SC.

The conclusions and recommendations contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by SC has not been independently verified by SC, unless otherwise stated in the report.

The methodology adopted and the sources of information used by SC in providing its services are outlined in this report. The work described in this report was undertaken in **April 2024** and is based on the conditions encountered and the information available during the said period of time. The scope of this report and the services are accordingly factually limited by these circumstances.

This renewable report and energy pre-assessment modelling were generated based on the provided drawings and building information assumptions. Although every effort has been made to provide accurate content within this report, SC makes no warranty or assumes no legal liability or responsibility for the accuracy or completeness of information contained in this report.

SC also wishes to make aware that this document is guidance only on energy strategy and should not be seen as a building design document. It is the responsibility of the appointed Building Services / Design Team to develop, select and implement appropriate energy efficiency measures to ensure compliance.

Where assessments of works or costs identified in this report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

SC disclaim any undertaking or obligation to advise any person of any change in any matter affecting the report, which may come or be brought to SC's attention after the date of the report.

Certain statements made in the report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. SC specifically does not guarantee or warrant any estimate or projections contained in this report.

Costs may vary outside the ranges quoted. Whilst cost estimates are provided for individual issues in this report, these are based upon information at the time which can be incomplete. Cost estimates for such issues may therefore vary from those provided. Where costs are supplied, these estimates should be considered in aggregate only. No reliance should be made in relation to any division of aggregate costs, including in relation to any issue, site or other subdivision.

No allowance has been made for changes in prices or exchange rates or changes in any other conditions which may result in price fluctuations in the future. Where assessments of works or costs necessary to achieve compliance have been made, these are based upon measures which, in SC's experience, could normally be negotiated with the relevant authorities under present legislation and enforcement practice, assuming a pro-active and reasonable approach by site management.

Forecast cost estimates do not include such costs associated with any negotiations, appeals or other non- technical actions associated with the agreement on measures to meet the requirements of the authorities, nor are potential business loss and interruption costs considered that may be incurred as part of any technical measures.

Copyright

Abbreviations

ASHP: Air Source Heat Pump
BER: Building Emission Rate
CO_2: Carbon Dioxide
CHP: Combined Heat and Power
CSH: Code for Sustainable Homes
DHW: Domestic Hot Water
ESR: Energy Strategy Report
GHG: Green House Gas
GSHP: Ground Source Heat Pump
GLA: Great London Authority
HVAC: Heating, Ventilation, and Air Conditioning
IES VE: Integrated Environmental Solutions Virtual Environment
KWp: Kilo Watt Power
KWh: Kilo Watt Hour
LZC: Low Zero Carbon
MVHR: Mechanical Ventilation Heat Recovery
MCS: Microgeneration Certification Scheme
NPPF: National Planning Policy Framework
NCM: National Calculation Methodology
OSM: Open Street Map
PV: Photovoltaic
SBEM: Simplified Building Energy Modelling
SFP: Specific Fan Power
TER: Target Emission Rate

1. Executive Summary

This Energy Strategy Report demonstrates the predicted energy performance and carbon emissions of the proposed refurbished residential development located at **151-153 Camden High Street NW1 7JY**. The presented figures in this study are based on the most updated information provided by the design team. The development will comprise of refurbishment of **two flats, mid floor and top floor respectively.** The overall analysis took into consideration the national building regulations (i.e. **Part L 2021**) and the local policy requirements (i.e. **London Borough of Camden)**. Based on the study assumptions, the project shall comply with the council local polices and buildings regulations.

1.1 Buildings Policy Requirements

The national building regulations require buildings to comply with the relevant energy efficiency requirements. This shall be accomplished through capping the project carbon emissions below the regulated target. The London Plan recommends further reductions in the carbon emissions than the Building Regulations. In addition to the above, **Camden Local Council** requires new developments to incorporate sustainable design and construction measures. The table below summarises the best practice building regulations and local policy requirements the assessment adopted for the development.

Table 1: National and Local Policy Requirements

Policy:	Requirement	Compliance Check
Part L 1A	The dwelling primary energy rate (DPER), dwelling emission rate (DER) and dwelling fabric energy efficiency (DFEE) must not exceed the target primary energy rate (TPER), target emission rate (TER) and target fabric energy efficiency (TFEE) respectively.	The project achieves all criteria by the proposed implementation of measures including improving fabric thermal performance and efficient building services.
GLA London Plan	Major developments must meet the requirement of 35% carbon reduction against Building Regulations Part L 2021. Residential development should achieve 10% through energy efficiency measures alone.	The proposed development is considered a minor development (Domestic < 1000 m^2). The proposed scheme has achieved an approx. **67.03%** carbon reduction over Building Regulation Part L 2021 TER.
	Major developments must connect to existing or planned local heat networks, or establish a new network, wherever feasible.	The feasibility for connection to heat networks has been explored in Section 7: Be Clean.
	Monitor, verify and report on energy performance at Be Seen stage.	Installation of Smart Meters is recommended to monitor the actual in-use energy consumption to minimize the performance gap.

Camden Local Development Framework: Core Planning Strategy	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 CO2 reduction. All new residential developments will be required to demonstrate a 19% CO2 reduction below Part L 2013 Building Regulations (in addition to any requirements for renewable energy). This can be demonstrated through an energy statement or sustainability statement.	The project makes the best use of improved thermal performance fabric materials, in addition to incorporating energy efficiency and renewable technology measures to achieve approximately 67.03% reduction over Part L 2021 TER.
	Identify and implement, where viable, site-wide and area-wide decentralised energy facilities including then potential to link into a wider network.	Feasibility for connection to local CHPs and communal heating systems has been assessed in Section 7.

1.2 Assessment Methodology and Strategies

The adopted methodology to mitigate the project's CO_2 emissions is in alignment with the London Plan's Energy Hierarchy Guidance. Compliance with the energy hierarchy suggestions (i.e. >35% reduction over Part L baseline) automatically demonstrates Part L compliance. Models and simulation assumptions have been carried out using **SAP** calculation method which complies with the National Calculation Methodologies (NCM).

Table 2 below explains the Energy Hierarchy stages and the suggested strategies to help the proposed development achieve the required carbon targets.

Table 2: Energy Hierarchy stages to achieve 35% reductions over Part L requirement.

Stages	Strategies
BE LEAN Carbon Efficient Design (Minimising energy demand)	• Improved fabric U-values beyond Part L1A requirements. • Energy efficient lighting fittings (i.e., LED). Further information can be found in the Be Lean Section.
BE CLEAN (Availability of CHP and communal heating systems)	• Analysis for local CHPs and communal heating systems has been assessed. Further information can be found in the Be Clean Section.
BE GREEN On-site renewable technologies (i.e. ASHP, PVs, etc)	• Use of Solar PV to further offset the reduced emissions. Further information will be presented in the Be Green section below.

BE SEEN In-use monitoring	• Installation of Smart Meters is recommended to monitor the actual operational energy use, manage it effectively and mitigate the performance gap.

Table 3: Analysis stages (as per energy hierarchy) and their corresponding carbon emissions

Analysis Stage	Dwelling Emission Rate (DER) *($KgCO_2/m^2$.annum)*	
	Flat 1	Flat 2
Notional TER	**11.57**	**11**
Baseline DER	22.39	25.49
Be-Lean DER	7.03	9.49
Be-Clean DER	7.03	9.49
Be-Green DER	4.67	2.7

The table above enlists the carbon emissions for each stage of the energy hierarchy, following the implementation of various environmental strategies relevant to each stage.

1.3 Assessment Results

The new build residential development has been simulated under four conditions to analyse the improvements hierarchy. The first simulation assesses the dwellings under the building specifications defined as limiting values by Part L 2021. The function of this first simulation is to generate the regulated carbon target (TER) and the actual Dwelling Emission Rate (DER). The second calculation analyses the carbon reductions achieved after improving the building fabric thermal performance by adopting improved thermal U-values and airtightness (i.e. Be Lean). The third stage of simulation assesses the feasibility of adopting local low-carbon energy sources like CHPs (i.e. Be Clean stage). The fourth simulation analyses the carbon reductions after considering renewable technologies as a strategy to achieve the **35%** reductions beyond **Part L 2021** requirements (i.e. Be Green).

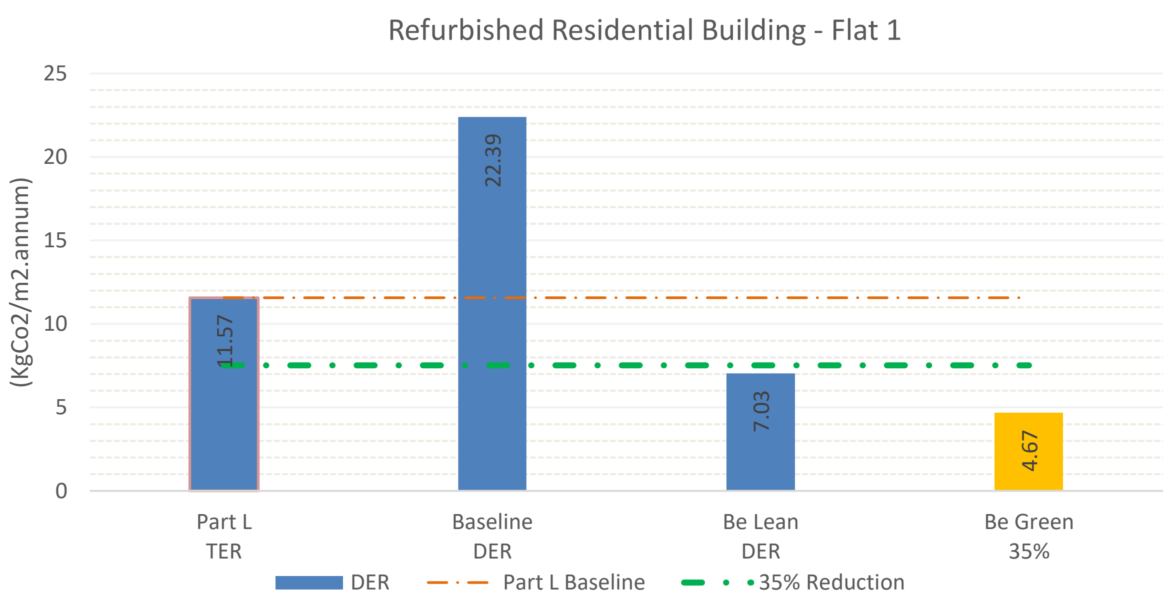


Figure 1a: Impact on Dwelling Emission Rate (DER) of the building after every stage of the proposed strategy

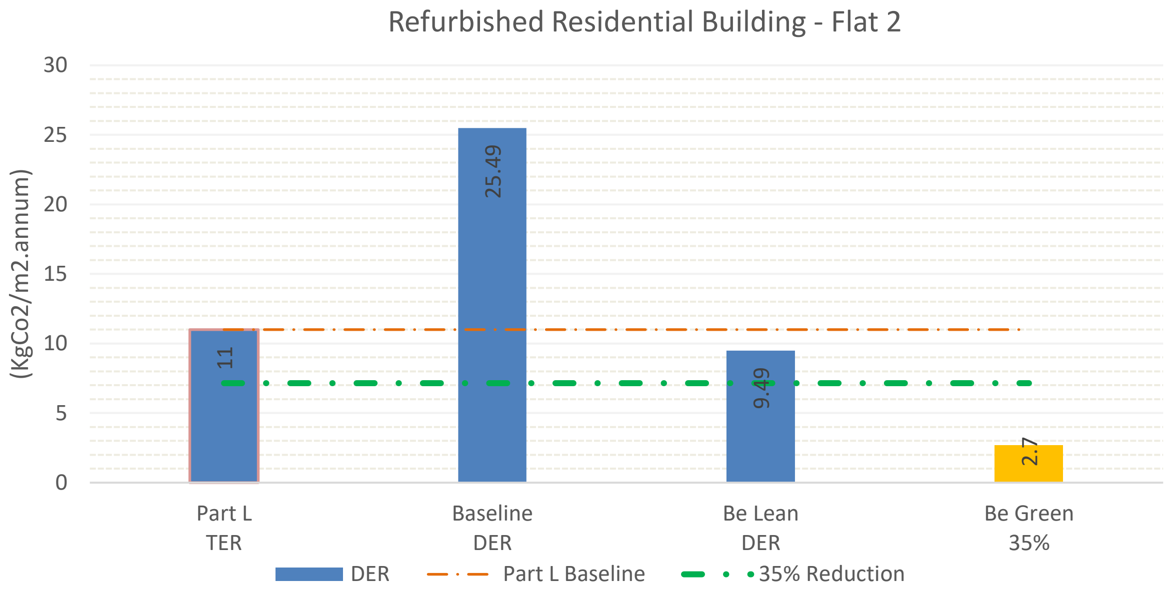


Figure 1b: Impact on Dwelling Emission Rate (DER) of the building after every stage of the proposed strategy

Results of the simulations show that the development is able to meet the overall criteria of the national and local policies i.e. >**35%** reductions over Part L through the implementation of better performing thermal envelop as well as high efficiency building services.

Additionally, the London Plan has targeted net-zero carbon for new developments. In view of this, a carbon offset calculation has been carried out in Table 4a and 4b below, as an indication of the carbon emissions that may be required to be offset.

Table 4a: Carbon offset calculation – Flat 1

CARBON REDUCTION			
Analysis Stage	**BER** *($KgCO_2/m^2$.annum)*	**Total Carbon** *(Tonnes CO_2/annum)*	**% Reduction from TER**
Notional TER	11.57	0.81	-
Building BER	22.39	1.5	-
Be-Lean BER	7.03	0.49	39.50
Be-Clean BER	7.03	0.49	39.50
Be-Green BER	4.67	0.33	**59.22**
Carbon Shortfall *(Tonnes CO_2/m^2.annum)*		**0.33**	

Table 4b: Carbon offset calculation – Flat 2

CARBON REDUCTION			
Analysis Stage	**BER** *($KgCO_2/m^2$.annum)*	**Total Carbon** *(Tonnes CO_2/annum)*	**% Reduction from TER**
Notional TER	11	0.71	-
Building BER	25.49	1.66	-
Be-Lean BER	9.49	0.61	14.08
Be-Clean BER	9.49	0.61	14.08

Be-Green BER	2.7	0.17	**76.05**
Carbon Shortfall *(Tonnes CO_2/m^2.annum)*		**0.17**	

Please refer to appendix A for further SAP calculations.

2. Introduction

This Energy Strategy Report (ESR) focuses on the energy strategies explored for two proposed flats on First floor and second floor respectively. scheme in order to make it comply with national and local policy requirements. The report presents how the annual energy consumption and related carbon emissions will be minimised to meet the regulated targeted carbon emissions **(i.e. Part L1 2021 TER)**. Furthermore, the report explains how to reach the required energy targets to achieve >**35%** carbon reductions for the development.

The assessed development is located in the in **London Borough of Camden** in the South-East of England. The development proposal has a total built up area of **136.05 m²** (please see SAP calculation reports in Appendix A) with **two flats** located at **151-153 Camden High Street NW1 7JY.**

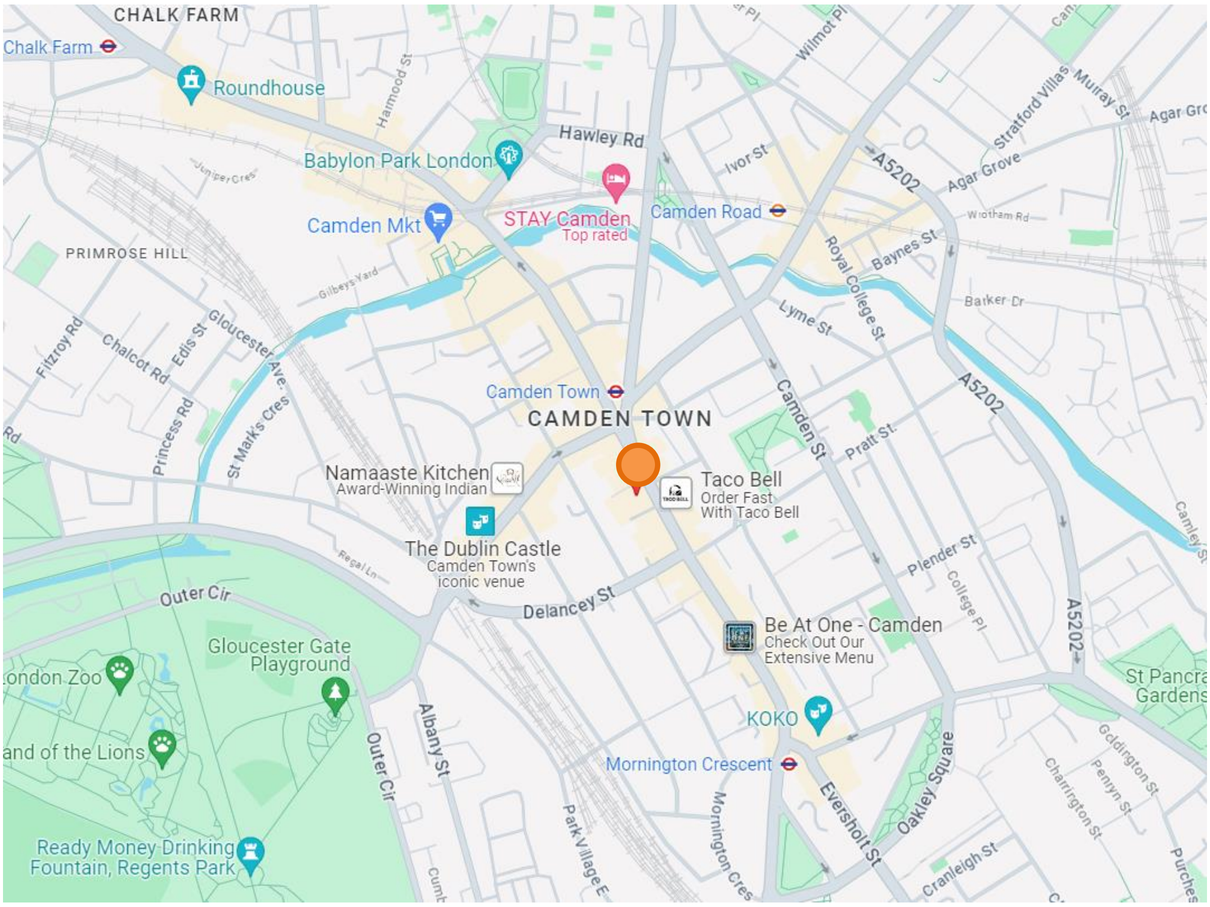


Figure 2: Site Location (marked in Orange).

The domestic and non-domestic sectors play an important role in the UK economy, both as employer and generator of output. This ESR report analyses the domestic project using research and policies as guidance to make sure this development is built up to achieve positive economic, social and environmental impacts.

3. Planning Policy

3.1 National Planning Policy Framework (NPPF, February 2021)

The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible. These actions been taken for the purpose of protecting the environment and promoting a sustainable growth of the built environment.

3.2 The London Plan (March 2021)

Minimising greenhouse gas emissions Hierarchy

The London Plan is an integrated policy framework for any development being proposed in the Greater London area. It encourages projects to go beyond the national regulation targets i.e. a minimum on-site reduction of at least **35%** beyond Building Regulations is required for major development. **Residential development** should achieve **10%**, and **non-residential** development should achieve **15%** through energy efficiency measures.

The framework proposes that major developments should reduce the overall embodied greenhouse gas emissions and operational carbon emissions in accordance with the following energy hierarchy:

A. **Be Lean:** make buildings use less energy and manage demand during operational phases.
B. **Be Clean:** exploit local energy supply resources (i.e. District and communal heating) to deliver energy efficiently.
C. **Be Green:** exploring opportunities for renewable energy resources by producing, storing and using renewable energy on-site.
D. **Be Seen:** monitor, verify and report on energy performance (Part L Criteria 4 and 5).

Further guidance within the framework states that proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

3.3 London Borough of Camden

Camden Local Development Framework: Core Planning strategy and Development policies.

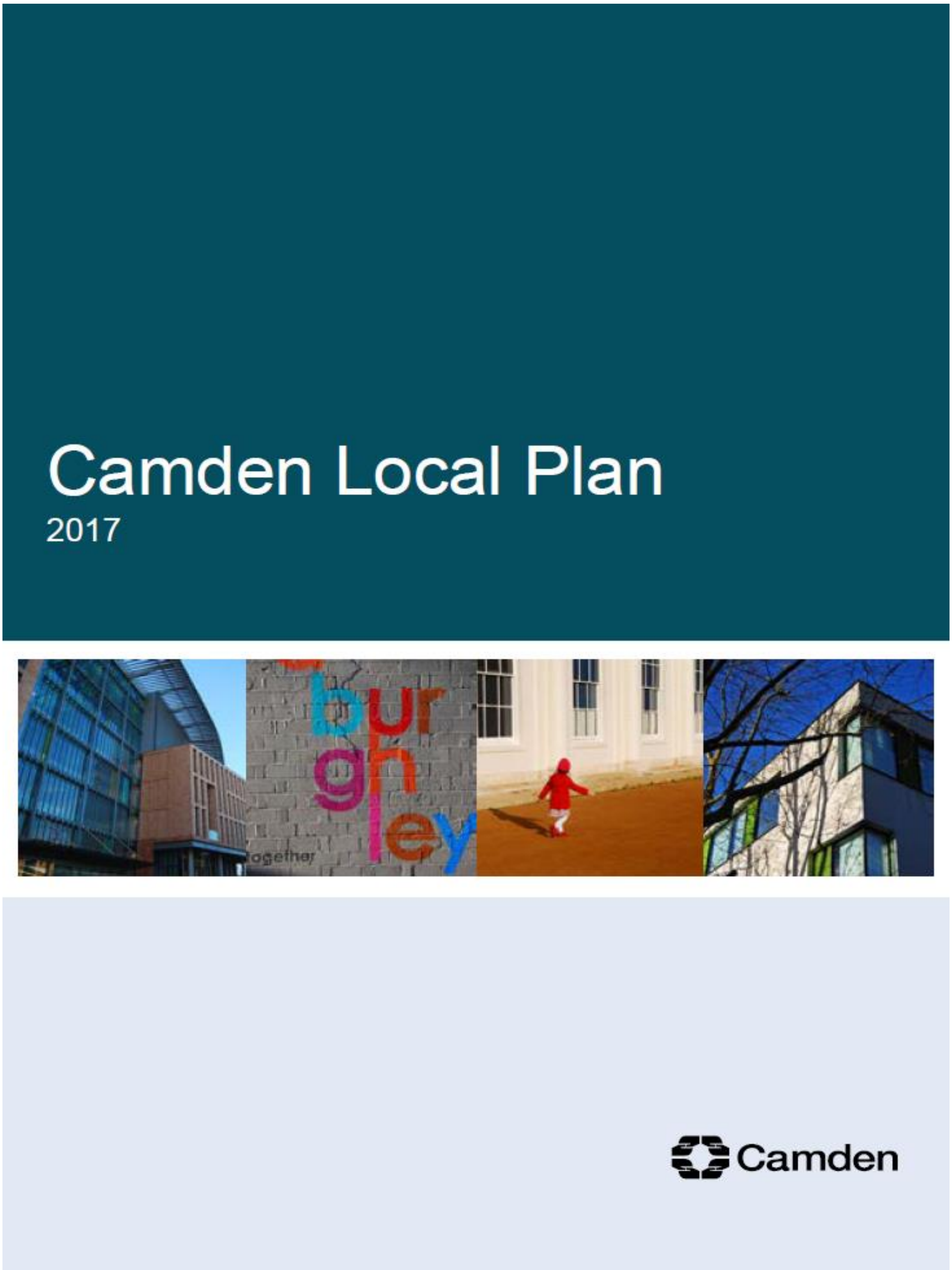


Figure 3: Camden Local Plan, Strategic Policies (adopted 2010)

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 emissions have been met;
c. ensure that the location of 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, King's 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.

- The Council commissioned two borough wide carbon reduction studies to ensure that local planning policy appropriately responds to the carbon emissions reduction challenge. Our first study, 'Delivering a low carbon Camden', considered carbon reduction scenarios to 2050 to align with the long-term national 80% carbon dioxide reduction target within the Climate Change Act 2008. Our later 2010 study focused specifically on the challenges of achieving a carbon dioxide reduction target of 40% by 2020.

- Both studies concluded that meeting borough carbon dioxide reduction targets depends on the growth of Combined Heat and Power (CHP) led decentralized energy networks; the extensive thermal improvement of existing housing stock; behaviour change; the significant deployment of appropriate renewable technologies; and the steady decarbonisation of the national electricity grid.

The energy hierarchy

- 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. It is understood that some sustainable design measures may be challenging for listed buildings and some conservation areas and we would advise developers to engage early with the Council to develop innovative solutions.

- The energy hierarchy is a sequence of steps that minimise the energy consumption of a building. Buildings designed in line with the energy hierarchy prioritise lower cost passive design measures, such as improved fabric performance over higher cost active systems such as renewable energy technologies. The following diagram shows a simplified schematic of the energy hierarchy, which is explained further in supplementary planning document Camden Planning Guidance on sustainability.

  1. Be lean - use less energy
  2. Be clean - supply energy efficiently
  3. Be green - use renewable energy

- 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 CO2 reduction**. All new residential development will also be required to demonstrate a 19% CO2 reduction below Part L 2013 Building Regulations (in addition to any requirements for renewable energy). This can be demonstrated through an energy statement or sustainability statement.**

4. Assessment Methodology

4.1 The Energy Hierarchy

The energy hierarchy is a classification of different methods to improve energy performance in a parallel sequence. This includes primarily a focus on reducing energy use by avoiding unnecessary consumption, to then improving the efficiency of energy systems to minimise loss. This is followed by exploiting renewable energy sources and low carbon energy solutions for energy needs. Finally, any remaining demand can be catered for by conventional fuel sources and carbon offsetting solutions.

The Energy Strategy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. The following hierarchy should be used to assess applications:

- **BE LEAN** – By using less energy and considering the further energy efficiency measure in comparison to the baseline building.
- **BE CLEAN** – By supplying energy efficiently. Clean energy use looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy (e.g. CHP, District Heat Networks).
- **BE GREEN** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.
- **BE SEEN –** By monitoring, verifying, and reporting on energy performance to use energy mode effectively.

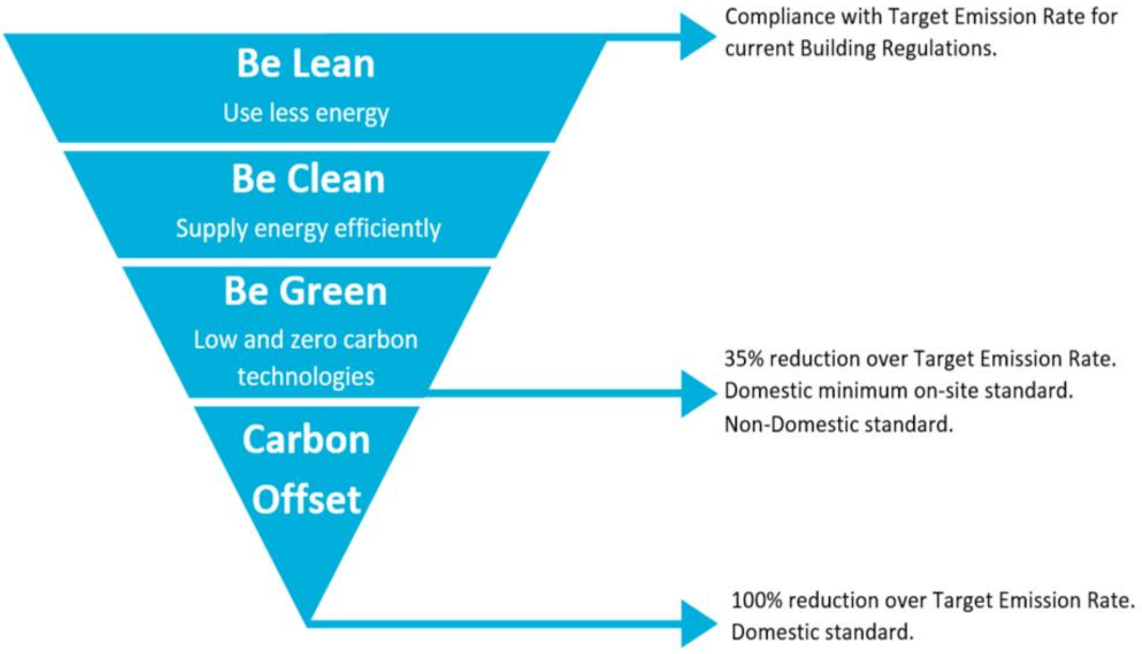


Figure 4: GLA Energy Hierarchy

4.2 Modelling strategy.

The Government approved software; **SAP 10** has been utilised to carry out the project compliance simulations (i.e. SAPs) according to the National Calculation Methodology (NCM). Simulated Models are built to assess the actual building BER against the notional building TER. The notional building used to determine carbon dioxide targets (TER) is the same size and shape as the actual buildings, constructed to concurrent regulated specifications (i.e. **Part L 2021**).

The building has been modelled entirely to the notional building specifications in order to meet the carbon targets and the limiting fabric and buildings services parameters. However, for differences in fabric design and glazing areas, baseline buildings sometimes are expected to exceed the notional TER. Therefore, further improvements to the baseline building parameters (e.g. fabric, HVAC, lightings, renewables) are made to meet the required compliance targets. The approved document (i.e. **Part L 2021**) however, encourages developers to vary the specification provided the same overall level of carbon dioxide emissions is achieved or bettered. It is important to note that SAP is not intended to be used as a building design tool but to inform the designers design decisions.

Syntegra received architectural drawings and project relevant documents. Received information is used to undertake the ultimate energy assessments and supporting the modelling assumptions. The document references are listed in the table below.

Table 5: Reference documents list, as used for energy analysis.

No.	Document Name	Format	Received Date
1	151-153 Camden High St 2024 PLANNING MONO	dwg	08-05-2024
2	151-153 Camden High St_TENDER_MARCH24	dwg	08-05-2024

5. BASELINE - Target Emission Rate (TER) & Actual Building Rate (DER)

The baseline (known as Target Emission Rate), as calculated in line with the Building Regulation 2021, is the maximum amount of carbon dioxide a development is allowed to emit. The Target Emission Rate (TER) includes carbon dioxide emissions which are covered by Part L2 of the Building Regulations, known as regulated emissions (space and water heating, ventilation, lighting, pumps, fans & controls). The baseline energy uses and resulting CO_2 emissions rates of the development have been assessed using the Government approved software (**SAP 10**).

This first run of simulation assesses the models under the notional building specifications defined under Part L to limit the fabric thermal heat losses. The assessment results in the regulated target values for energy consumption and carbon emissions i.e. the TER and TPER, by using the Government approved methodology (SAP).

The baseline regulated CO_2 emissions for the development are presented in the tables below:

Table 6a: Regulated Energy Use and Carbon Emissions TER at Baseline – Flat 1

Analysis Stage	DER ($kgCO_2/m^2$. year)	DPER (KWh_{PE}/m^2. year)	DFEE (kWh/m^2. year)
Notional	11.57	60.69	30.02
Baseline (Actual)	22.39	123.72	58.6

Table 7b: Regulated Energy Use and Carbon Emissions TER at Baseline – Flat 2

Analysis Stage	DER ($kgCO_2/m^2$. year)	DPER (KWh_{PE}/m^2. year)	DFEE (kWh/m^2. year)
Notional	11	58.79	45.13
Baseline (Actual)	25.49	140.51	74.98

The results of the first run showed that the Baseline BER for both the houses exceeds the regulated target emissions rate (TER) as depicted in Figure 5a and 5b below. Further improvements to the model assumptions are carried out in the following section (i.e. Be-lean) to try and achieve the suggested reductions.

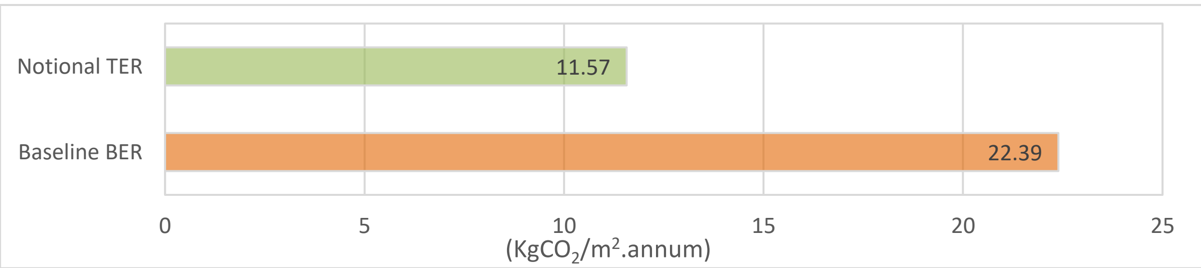


Figure 5a: Notional Building TER and Baseline BER for the proposed scheme-Flat 1

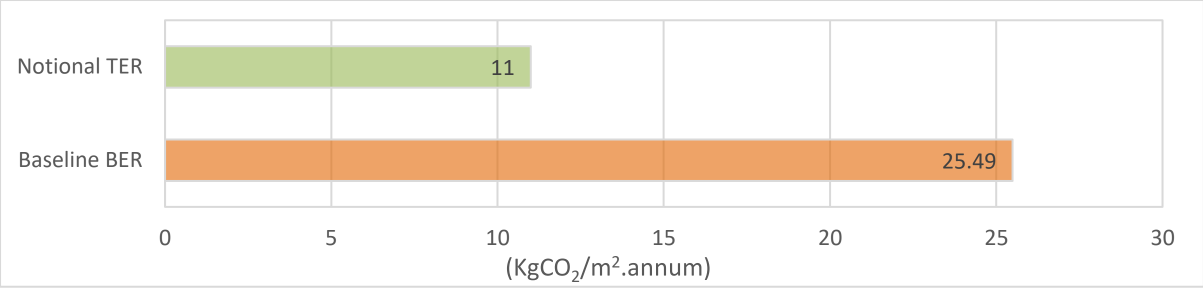


Figure 5b: Notional Building TER and Baseline BER for the proposed scheme-Flat 2

6. BE LEAN - Energy Efficient Design

This section outlines the project location, orientation and climatic conditions taken into account to determine the most feasible energy efficient measures taken in order to minimise the building's energy demand. The analysis helps reduce the energy use and CO_2 emissions beyond the Baseline benchmark on the path to achieving TER compliance (**Building Regulations 2021 Part L1**).

6.1 Site location

Figure 6: Urban view of the site surroundings (source: Google Earth)

The proposed project site is located at **151-153 Camden High Street NW1 7JY, in** the borough of **Camden, London**. The local surrounding areas are largely mid-rise residential and commercial buildings. The site is accessed from the North-East via Camden High Street, connecting to Pratt Street. It is bound on four sides by mixed use properties and small parks in the neighbourhood.

6.2 Site weather and Microclimate

The local weather and microclimate usually influence a building's energy performance. Urban design has a significant impact on microclimate and outdoor thermal comfort. Several studies in different climate regions have concluded that ventilation and shade are crucial to improve urban thermal comfort. Often the thermal conditions are improved as a consequence of good urban design including exist of proper shade and sufficient ventilation. This in turn leads to decreased occurrence of heat stress and heat-related diseases as well as grown performance of both mental and physical tasks.

London weather data has been used for thermal and energy simulations. Figure 7 represents the annual dry bulb temperature in London City. Maximum temperatures can reach up to 34.9°C in late Jun, and minimum temperatures can reach down to -2.1°C in late Feb. The buildings in this location are generally mid-rise, and the site is not expected to suffer from the Urban Heat Island effects.

The site's landscape also affects the energy demand of a building. Vegetation, landform, and any existing buildings can provide shade to a new development. For instance, if located to the south of the building, deciduous trees can be advantageous, providing shade in the summer but allowing sunshine through in the winter when they lose their leaves. However, in this case, the context is largely urban and no dense vegetation exists in the immediate vicinity of the site.

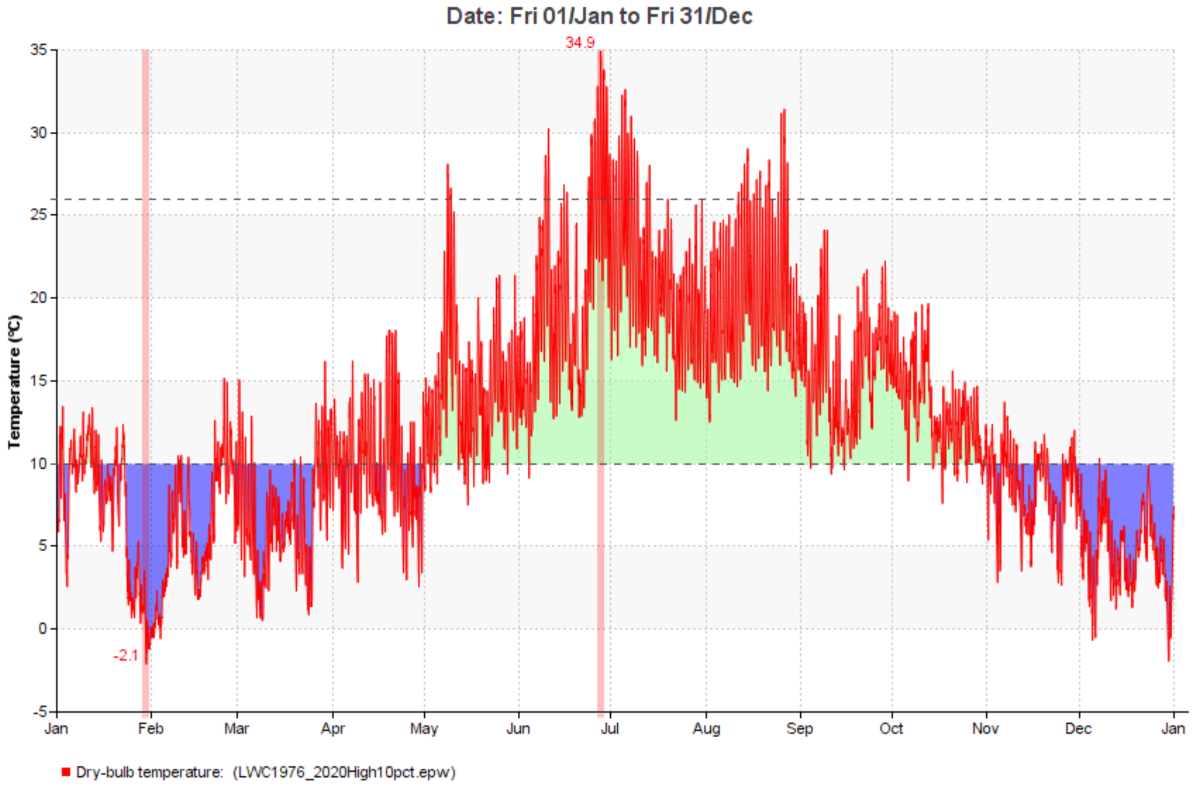


Figure 7: IES Annual Dry Bulb Temperature according to London weather file TRY05.fwt

6.3 Building Orientation, layout, and form

Building layout, orientation and form can influence many key features of the development. The design should provide for an effective use of space and appealing layout, with opportunities to benefit from natural daylight balanced with achieving solar gain without overheating. In general, a higher thermal performance can be achieved by limiting the surface area to volume ratio as this minimises heat loss through the wall area.

It should be noted that where the building footprint is extremely tight, for example in a city centre location, then the building form and orientation may have to be dictated by the available space and not by implementation of best practice measures. Invariably, planning constraints and/or the functional relationships of specific areas will result in some measure of deep planning, thus reducing the opportunity for natural ventilation and/or daylight.

In the current scenario, the proposal has been planned such that the regularly occupied spaces (i.e. living rooms, bedrooms, kitchen etc.) have ample openings to allow daylight and sunlight in. The primary axis of the building runs roughly from **South-West to North-East**; with the windows opening primarily at the front and back.

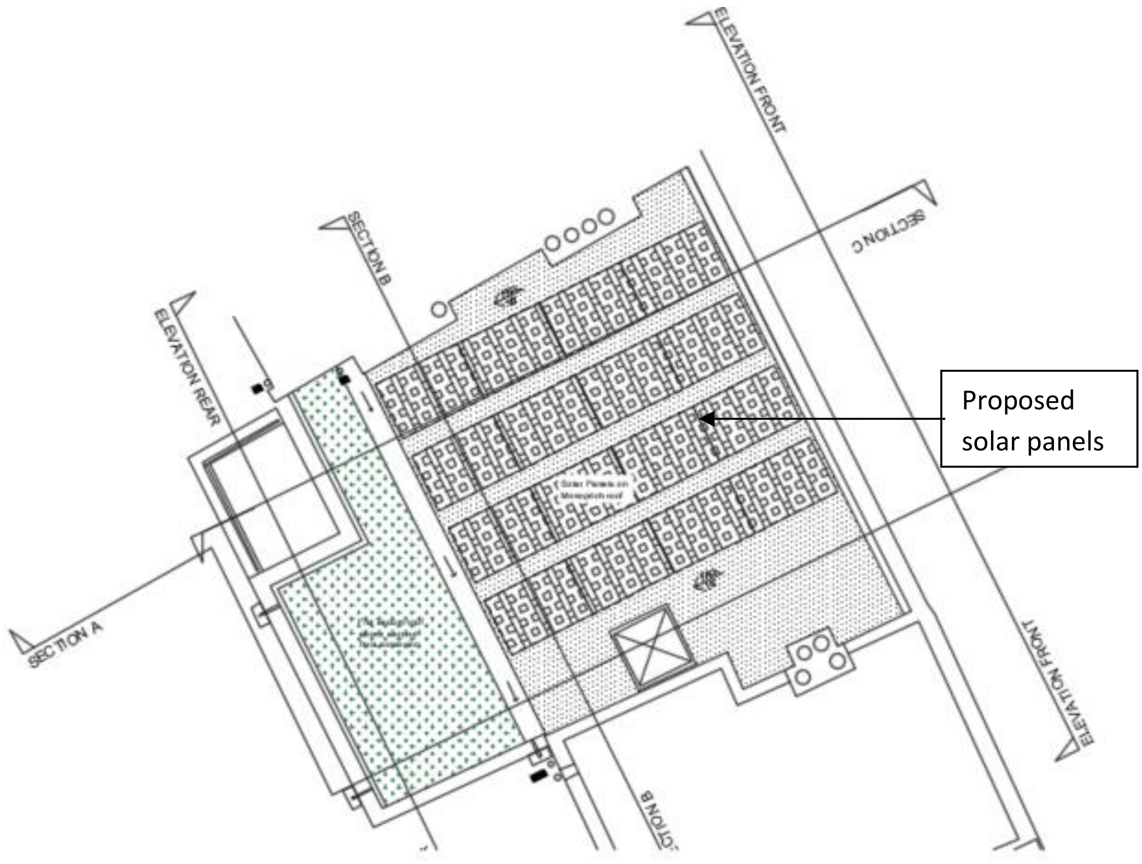


Figure 8: Proposed development: Roof plan

6.4 Building Design – Energy Efficiency Design Measures

At the 'BE LEAN' stage of the energy hierarchy, energy efficient building elements have been incorporated into the model. The heat loss of different building element is dependent upon their U-value, air permeability, and thermal bridging Y-values. Therefore, better U-values and air permeability figures than the minimum values set in **Part L1A 2021** have been suggested in this stage of assessment process.

Table 7 below presents the improved U-values used for the dwellings against the **Part L1 2021** figures as used for the Baseline. The Be Lean U-values promote a thermally efficient building fabric in order to reduce energy consumption through passive measures. The overall figures mentioned in the table below are the assumptions for the second run of simulation.

Table 7: Proposed thermal performance for construction material.

Building Type		**Residential**	
Category Specification		**Part L 1A Notional**	**Be-lean Improved values**
U-value *(W/m^2 K)*	*Wall - Existing*	*0.70*	***0.18***
	Windows	*1.4*	***1.2***
	Rooflight	*2.2*	***2***

	Roof	*0.15*	***0.11***
	Doors	*1.6*	***1.2***
Thermal Bridging *(W/mK)*	*Lintels (E1)*	*1.0*	***0.02***
	Sill (E3)	*0.1*	***0.02***
	Jamb (E4)	*0.1*	***0.02***
	Junction b/w External Wall and Ground Floor (E5)	*0.32*	***0.05***
	Party Floor (E7)	*0.28*	***0.05***
	Flat Roof (E14)	*0.16*	***0.05***
Air Permeability *($m^3/h.m^2$ at 50 Pa)*		*8.0*	***2.50***

The development will be adopting the following measures for enhanced fabric thermal performance:

- Enhanced envelope U-values - to reduce the building's heat losses and demand.
- Providing a well-sealed envelope to minimize the infiltration of cold winter air and warm air in summer.
- Minimizing thermal bridging by using accredited construction details to avoid heat losses.
- Adopting a window to wall ratio that prioritizes daylight but controls solar gain and glare – to reduce electric lighting energy consumption while mitigating overheating.
- Providing exposed thermal mass to provide passive cooling – suppresses summertime overheating to acceptable levels without the need for high energy consuming mechanical cooling systems.

6.5 Building occupancy type

The building occupancy type is dependent on the NCM building type. **C3 Residential** building type has been identified for the building. The occupancy and internal gains have been input accordingly.

6.6 Daylighting and Solar Shading Strategy

The glazing specification is carefully selected to ensure the internal environment is pleasant on all orientations by providing high insulation levels with optimized solar gain.

6.7. Cooling Hierarchy

The building regulations outline a hierarchy of measures which should be followed in order to reduce the demand for cooling within the development. Multiple strategies have been considered for this development to reduce the cooling demand and the overheating risks, as described below:

- ✓ **Reducing Solar Gains** – Minimal glazing with low G-Values have been targeted in order to minimise solar gains.
- ✓ **Minimising Internal Heat Gains** – Heat distribution infrastructure within buildings is to be designed to minimise pipe lengths and adopt pipe configurations which minimise heat loss (e.g., twin pipes). All hot water pipes are to be insulated to reduce heat escaping into occupied

spaces.

- ✓ **Thermal Mass** – Increasing the amount of exposed thermal mass can help to absorb excess heat within the building. Further investigation needs to be undertaken to try to capitalise on the thermal massing wherever possible, so as to help regulate the internal temperature.
- ✓ **Optimised ventilation** – Mechanical extraction strategies will be adopted with extract fans in wet rooms (e.g., toilets) to remove the hot, humid air. MVHR has been recommended with automatic summer bypass to reduce the peak summertime temperatures.

Be Lean – Active Design Measures

The table below shows the applied 'Be Lean' active design measures incorporated within the design to demonstrate the energy strategy approach.

Table 8: Active Design Measures adopted at Be Lean Stage

No.	Measure	Explanation
1	**On-demand control**	The room by room heating and lighting controls ensure that energy efficiency is maximised in almost all spaces where the amount of air delivered is variable to suit the space.
2	**Combined Primary Storage Unit (CPSU) system**	The use of an electric CPSU boiler technology is recommended. This technology is compatible with standard radiators as well as underfloor heating systems. it's provided with a built-in hot water storage cylinder to deliver mains pressure hot water to taps, bath, shower and other hot water outlets. o Efficiency: 100.00% o Heat emitter: Radiators o Flow Temperature: 45 °C o Control: Time and temperature zone control
3	**Lighting Efficiency**	The proposed light fittings shall be 100% energy efficient fittings i.e., LED lighting. These have been found to be a cost-effective measure to reduce electrical energy use associated with artificial lighting.

The output from the building model confirms that upgrading the building fabric and incorporating efficient building systems will result in improved building performance. The building is able to meet the Part L 2021 criteria of achieving BER<TER and BPER<TPER as presented in Table 11a and 11b below.

The following table demonstrates the reduction in CO_2 emissions from the energy efficiency measures mentioned above.

Table 9a: Regulated Carbon Emissions (BER) at Be Lean Stage – Flat 1

Analysis stage	DER *($kgCO_2/m^2$. year)*	DPER *(KWh_{PE}/m^2. year)*	DFEE *(kWh/m^2. year)*
Notional	11.57	60.69	30.02

Be Lean	7.03	73.37	27.88

Table 10b: Regulated Carbon Emissions (BER) at Be Lean Stage – Flat 2

Analysis stage	**DER** *($kgCO_2/m^2$. year)*	**DPER** *(KWh_{PE}/m^2. year)*	**DFEE** *(kWh/m^2. year)*
Notional	11	58.79	45 13
Be Lean	9.49	98.52	42.76

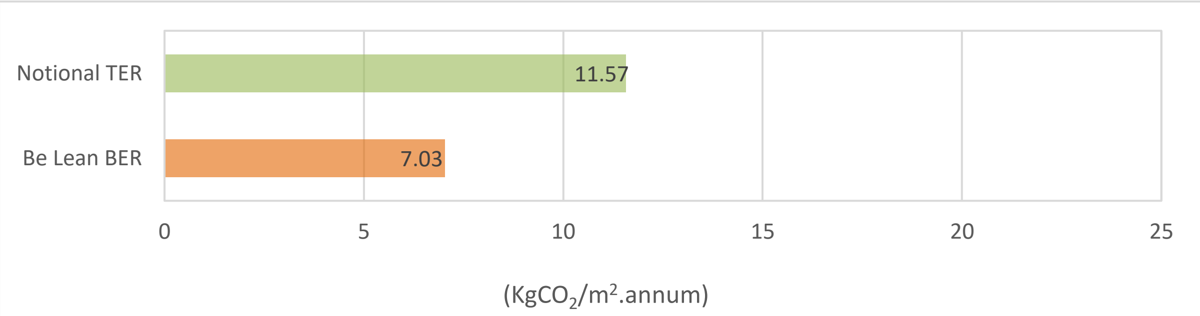


Figure 9a: Notional Building TER and Be Lean BER for the proposed scheme-Flat 1

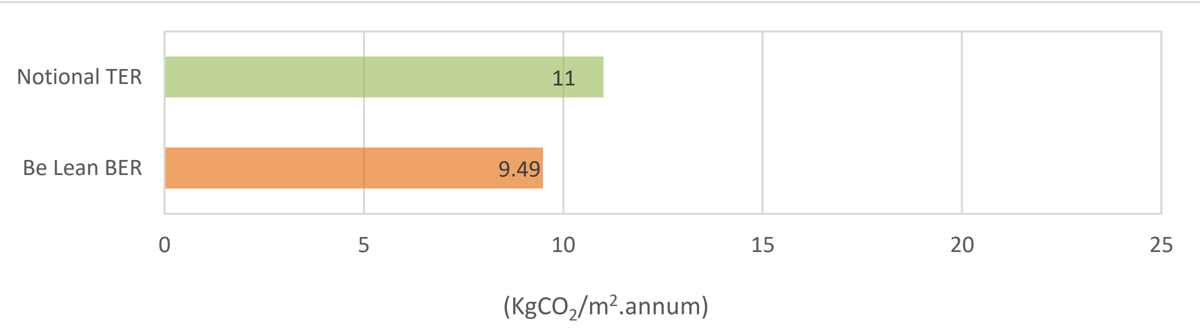


Figure 9b: Notional Building TER and Be Lean BER for the proposed scheme-Flat 2

At the 'Be Lean' stage of the energy hierarchy, high performance construction material and energy efficient building systems have been incorporated into the model, as summarized in Table 9 and Table 10 above.

The output from the energy assessment confirms that upgrading the building fabric will result in the domestic spaces meeting the Part L 2021 Requirements of achieving minimum >10% reductions from energy efficiency measures for both the flats (as presented in Table 11 a and 11b above).

Further measure related to renewable energy are suggested in the next (i.e. Be Green) stage to further reduce energy consumption.

7. BE CLEAN – CHP & Decentralised Energy Networks

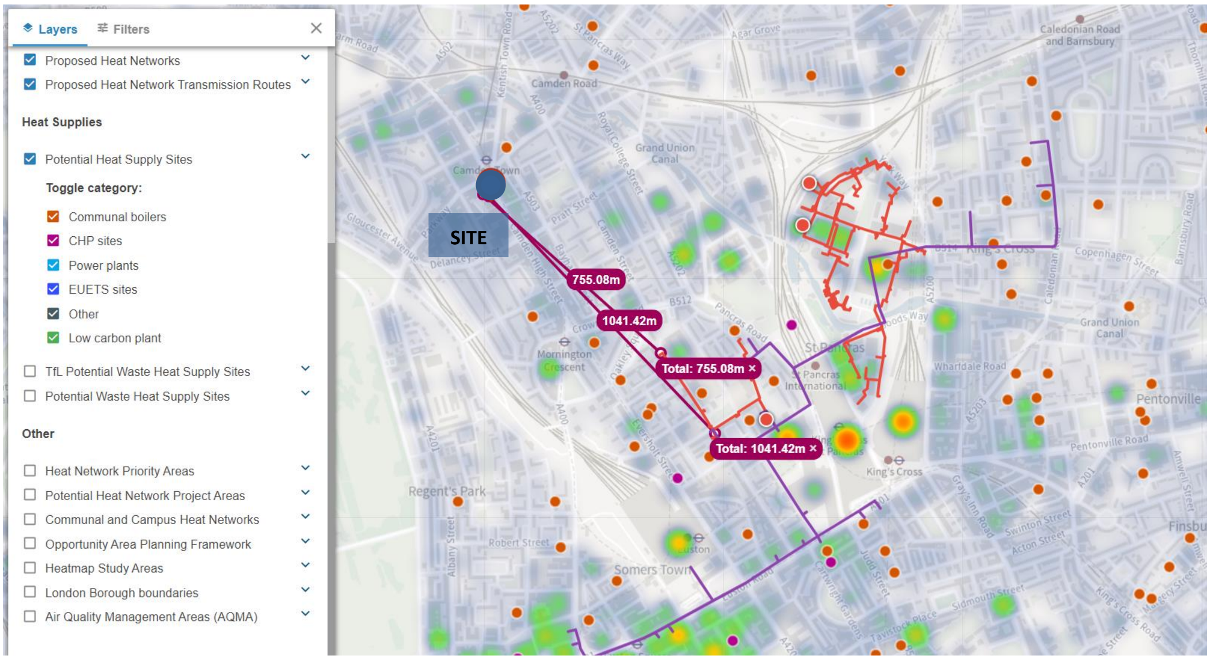
The Energy Hierarchy encourages the use of local CHP system and connection to District Heating systems to reduce CO_2 emissions further.

7.1 Decentralised Energy Network

District and community heating systems are favoured because they offer:

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

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed alongside the **London Heat Map** (refer Fig. 10 below) as part of this assessment. The map identifies that the site is not located approximately 800 m away from existing district network route while a proposed one located approximately 1050 m away. This has been demonstrated from the London Heat Map (http://www.londonheatmap.org.uk).



Existing Heat Network — Proposed Heat Network — Approx. distance between site and proposed heat network

Figure 10: London Heat Map near the site

Further information regarding the capacity, infrastructure and timeline of the existing and proposed heat networks near the site is required. However, to enable access to the nearest communal networks, the costs involved in extending the network would outweigh the advantages the development stands to gain from such a connection. **Therefore, utilisation of a local heat network is not determined as a feasible option for this development.** It is suggested that the building include provisions for future adaptability to connect to the network.

7.2 Combined Heat and Power (CHP)

The Energy Hierarchy identifies the combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP. The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

- Development with high heating load for most of the year.
- CHP operation based on maximum heat load for minimum 10 hours per day.
- CHP operation at maximum capacity of 90% of its operating period.

To ensure that CHP is financially viable it is essential that the unit is selected to meet the base heat load and that this load is maintained over a large proportion of the day (a figure of 14 – 17 hours per day is often quoted subject to the load profiles and gas and electricity prices) to ensure that the additional costs (maintenance) associated with running a CHP unit can be recovered. The need to run the CHP plant continuously as far as possible makes the building load profile of prime importance when reviewing the viability of such solutions and in particular the summertime heat load profile. To enable the CHP plant to run continuously when it is operating, a thermal store is often used so that excess CHP capacity can be used at a later time.

Generally, developments consisting of at least 50 residential units would obtain the benefits of the micro-CHP system. As such, **the implementation of a CHP has not been considered of this development**. In case the design team considers installing this technology, further information regarding the local system storage space will be needed.

Table 10a: Regulated Carbon Emissions (BER) at Be Clean Stage – Flat 1

Analysis stage	DER ($kgCO_2/m^2$. year)	DPER (KWh_{PE}/m^2. year)	DFEE (kWh/m^2. year)
Notional	11.57	60.69	30.02
Be Lean	7.03	60.69	30.02

Table 10b: Regulated Carbon Emissions (BER) at Be Clean Stage – Flat 2

Analysis stage	DER ($kgCO_2/m^2$. year)	DPER (KWh_{PE}/m^2. year)	DFEE (kWh/m^2. year)
Notional	11	58.79	45.13
Be Lean	9.49	98.52	42.76

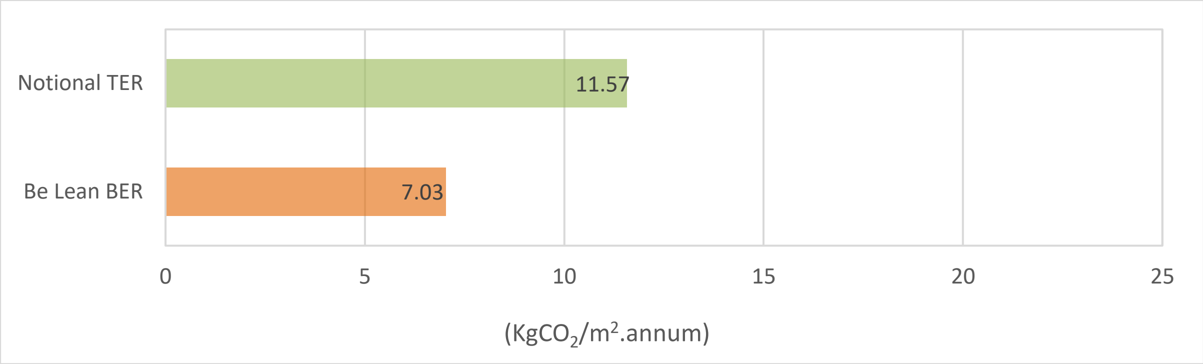


Figure 9a: Notional Building TER and Be Clean BER for the proposed scheme-Flat 1

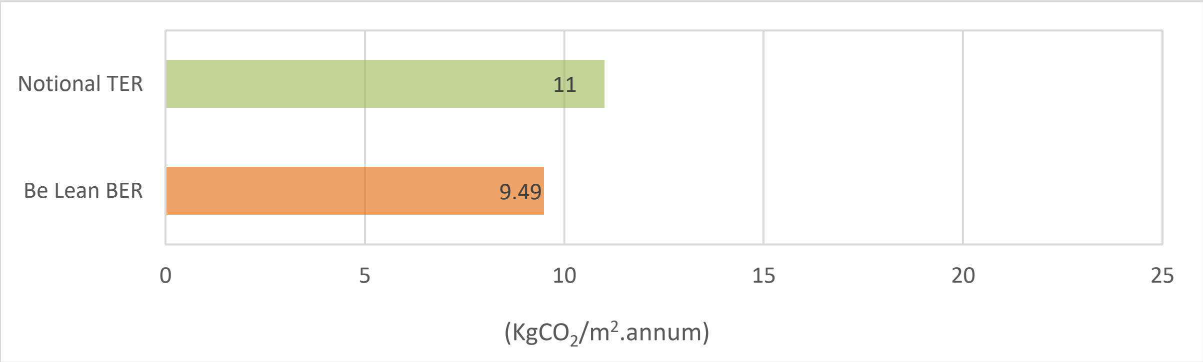


Figure 9b: Notional Building TER and Be Clean BER for the proposed scheme-Flat 2

8. BE GREEN – Renewable Energy Appraisal

In this section, viable renewable energy technologies that could reduce the development's CO_2 emissions are examined. In accordance with Policy SI 2 of the London Plan, the technical feasibility and economic viability of installing each LZC technology at the development have been assessed, so as to discount any unsuitable options at an early stage.

In determining the appropriate renewable technology for the site, the following factors are considered.

- Renewable energy resources or fuel availability of the LZC technology on the site.
- Implementation with regards the overall M&E design strategy for building type.
- Capital, operating and maintenance cost available for the project.
- Planning Permission form the local council.
- Available Grants.

The table below summarises the various low zero carbon technologies considered for the projects, and we have identified that **Photovoltaic (PV)** would be the most appropriate option in this development.

The Government has outlined its ambitions for residential and non-domestic developments to be delivered to a zero-carbon standard. It is anticipated that zero carbon development will be realised predominantly through energy efficiency measures and the use of on-site low or zero carbon energy and connected heat. However, it is recognised that it will be difficult to deliver all the carbon savings necessary to meet zero carbon standards on site through these measures alone.

Table 11: Feasibility Study of LZC Technologies

Technology Name:	Carbon Payback	Feasibility
Photovoltaic (PV)	High	**HIGH**
Air Source Heat Pump	High	**HIGH**
Biomass	High	**LOW**
Wind Power	Low	**LOW**
Hydro Power	None	**LOW**
Solar Thermal	Low	**MEDIUM**
Ground Source Heat Pumps (GSHP)	Medium	**LOW**

8.1 Non-feasible Technology

- **Air Source Heat Pumps (ASHP)**

An ASHP can meet space heating demands on site efficiently in comparison to gas boilers. Although this low carbon technology consumes electricity to operate, the heat output is much greater due to higher efficiency. However, these have higher space requirements in comparison to gas or electric boilers and require dedicated roof space.

Since there is a preference for electric boilers, the consideration for an ASHP has been discounted for this project.

- **Ground Source Heat Pumps (GSHP)**

Ground source heat pumps would be a feasible option to meet the space heating requirements at sites with ample ground space for bore holes to extract the ground heat. However, the current site does not have enough open area and is surrounded by residential buildings on all sides. Therefore, the option has not been considered in this case.

- **Solar Thermal**

The use of solar thermal for this development would be limited to domestic hot water only. The use of solar thermal for space heating would not be practical as it is not required when solar thermal is at its most effective during the summer months. Moreover, the amount of carbon offset from the system is generally lower than other technologies. As such, the technology is deemed to be unsuitable for this development.

- **Hydro power**

The project site is not close to natural water resources. Therefore, small scale hydro-electric will not be studied any further because of the location and the spatial limitations of the development.

- **Wind Power**

Wind turbines need extensive planning requirements, and they are only feasible at consistent wind speed. Moreover, there is no available wind grid located near the project location (*https://www.rensmart.com/Maps#NOABL*). Hence this option has been discounted.

Location

- Latitude: 51.53789608067689
- Longitude: -0.14101822135646166
- Height above sea level: 8 m

Wind Speeds

estimates from NOABL data

- At 10m above ground level 4.8 m/s
- At 25m above ground level 5.6 m/s
- At 45m above ground level 6.1 m/s

Solar

falling on a optimally oriented panel

- Annual Energy per m^2 1130 kWh
- Daily Energy per m^2 3096 Wh

Please note that the NOABL windspeed dataset is a model of windspeeds across the country, assuming completely flat terrain. It isn't a database of measured windspeeds. Other factors such as hills, houses, trees and other obstructions in the vicinity of the site need to be considered as well, as they can have a significant effect. If the installation of a wind turbine is considered, windspeed measurements using an anemometer need to be performed to determine what the actual figures are.

- **Biomass**

A biomass system designed for this development would be fueled by wood pellets which have high energy content. However, a biomass system would not be an appropriate technology for the site for the following reasons:

A. The burning of wood pellets releases substantially more NOx emissions when compared to similar gas boilers. As the development is situated within an urban area, the installation of a biomass boiler would further impact on the air quality in this area.
B. Pellets would need to be transported from local pellet suppliers, which causes carbon emissions into the air.

However, if a biomass system is considered at further detailed design stage, local suppliers can be found near the site as shown in the map below (http://biomass-suppliers-list.service.gov.uk).

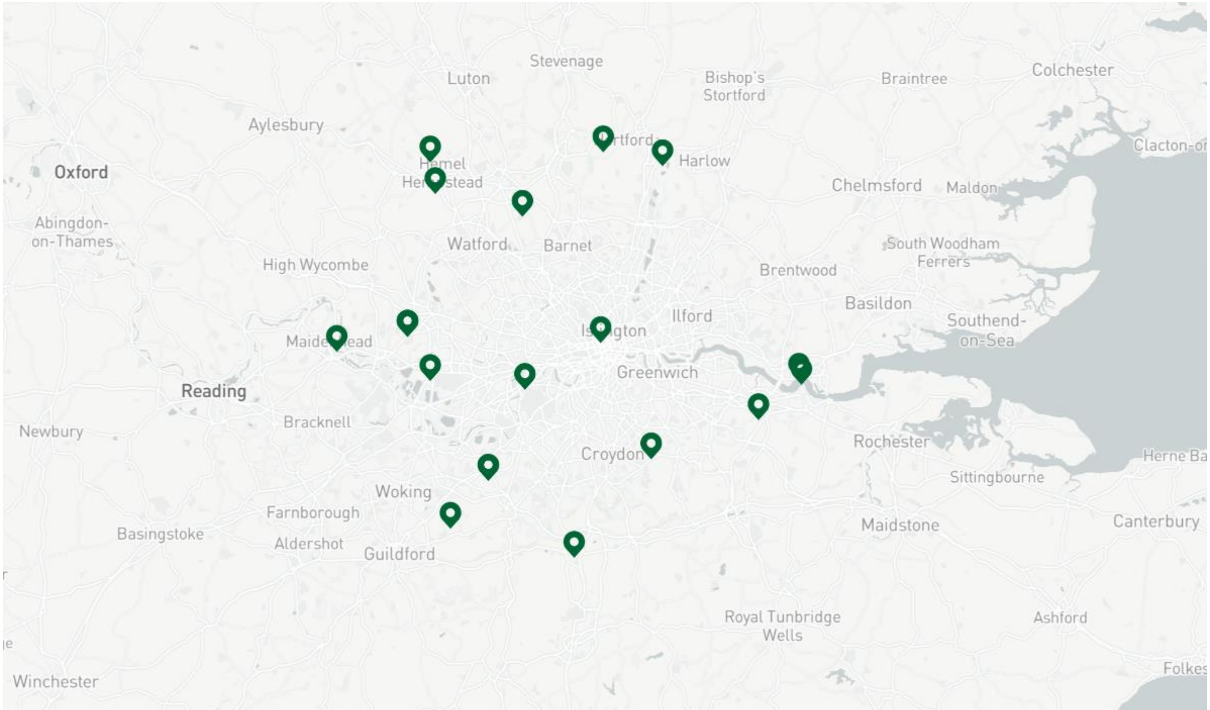


Figure 12: Biomass suppliers locations proximity to the project location.

8.2 Proposed Technology

- **Photovoltaic (PV)**

Solar PV could be one of the suitable renewable technologies for the project due to the following reasons:

A. The installation of PV is much simpler when compared to other renewable technologies.
B. There is sufficient roof space available to install enough PV modules to have a significant impact on carbon emissions of the development.
C. PV panels sited on the roof within an urban area are less visually intrusive when compared to wind turbines.

Table 15: Suggested solar PV specifications.

Property	General specification
Orientation	Southwest
Inclination	30°
Plant size	6.5 kWp
Array size	16 panels @ 250 W per panel
Total PV area	Approx. 31.5 m^2 (assuming 1.94 m^2/panel)
Overshading	Modest

In summary, 6.5 kWp solar PV plant for both the flats is recommended in order to maximise the PV capacity for installation over the roof area of the development. Monocrystalline silicon panels (405 W per panel) spread over approx. 31.5 m^2 of roof space should be able to provide the required output. However, the proposed PV panels are subject to further consideration at detailed design stages. In order to qualify both the installer and the equipment, the system must be certified under the Microgeneration Certification Scheme (MCS).

Given the proposed LZC technologies on the site (i.e., **PV**), the overall CO_2 reduction at BE GREEN stage can be calculated as shown below.

Table 12a: Regulated Carbon Reduction at Be-Green Stage - Flat 1

Analysis stage	DER *($kgCO_2/m^2$. year)*	DPER *(KWh_{PE}/m^2. year)*	DFEE *(kWh/m^2. year)*
Notional TER	11.57	60.69	30.02
Be Green	4.67	54.47	27.88

Table 13b: Regulated Carbon Reduction at Be-Green Stage - Flat 2

Analysis stage	DER *($kgCO_2/m^2$. year)*	DPER *(KWh_{PE}/m^2. year)*	DFEE *(kWh/m^2. year)*

Notional TER	11	58.79	45.13
Be Green	2.7	52.73	42.76

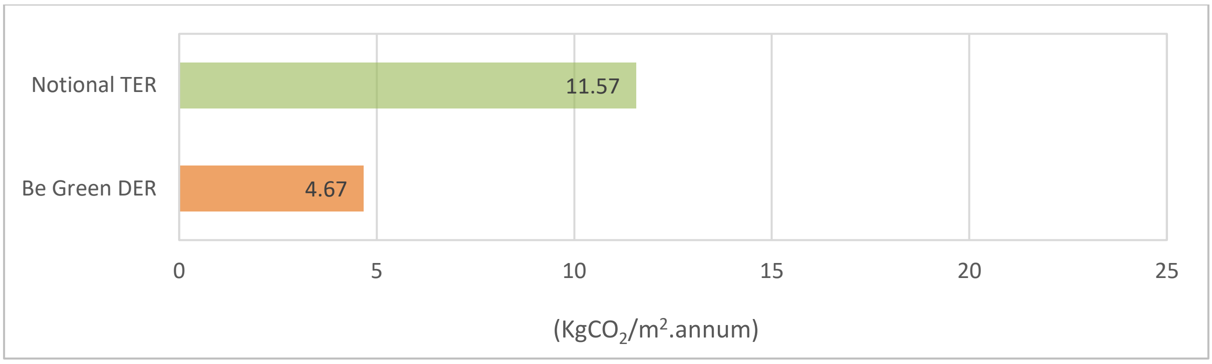


Figure 13a: Notional Building TER and Be Green BER for the proposed scheme-Flat 1

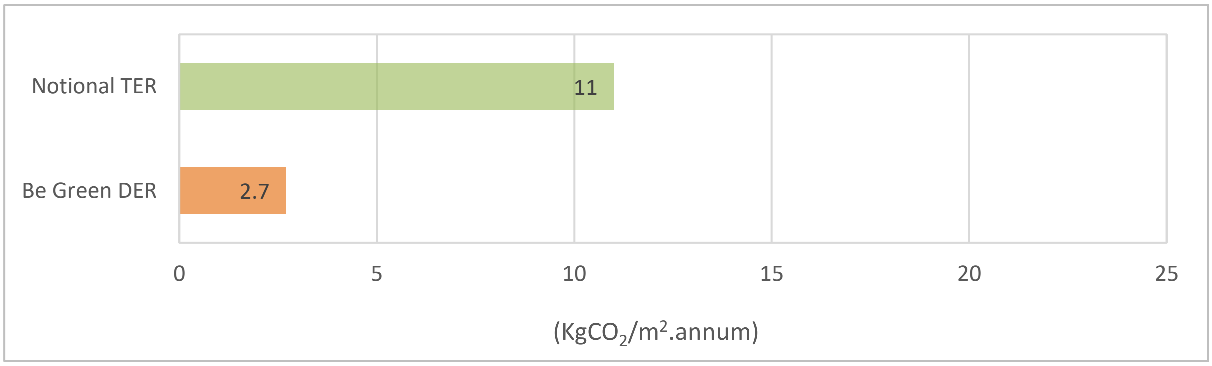


Figure 13b: Notional Building TER and Be Green BER for the proposed scheme-Flat 2

9. Conclusion

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at **151-153 Camden High Street, NW1 7JY.**

Based on the information provided by the design team, the study has been done on **two upper floor flats.** The study results show that **high thermal performance building fabric and efficient heating systems** are keys to achieve building regulations compliance. Moreover, electric CPSU Pump and Solar PV proposed in Be Green proved to be a major measure to achieve the >**35%** reductions beyond **Part L 2021** requirements. The carbon savings from each stage are shown in the charts below. Given the total cumulative carbon savings, the proposed development shall meet the planning requirements.

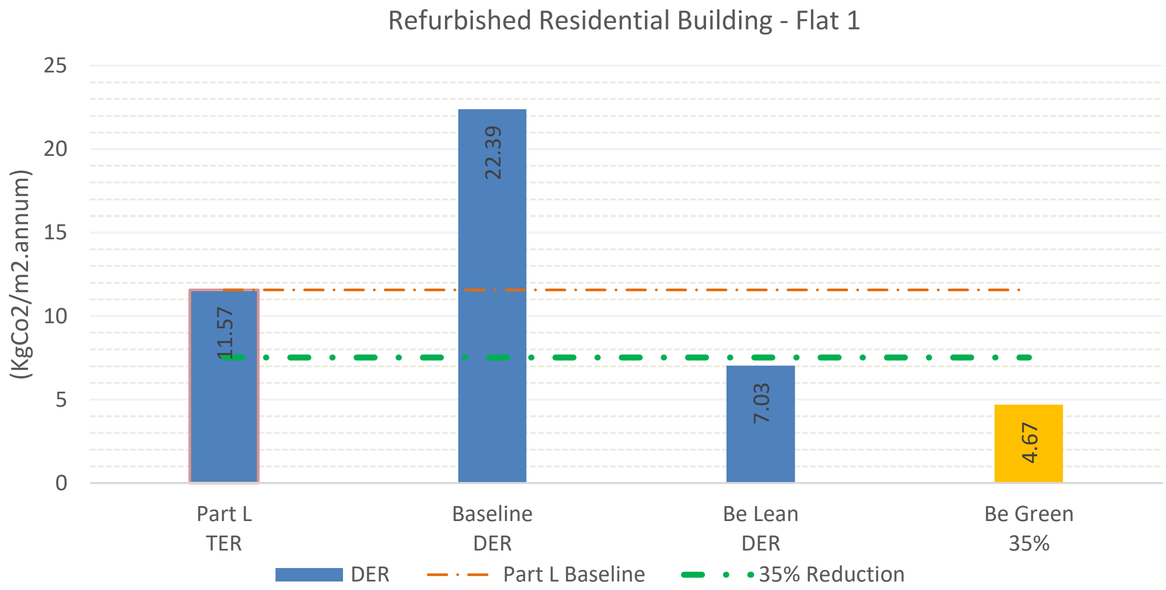


Figure 14: Carbon Emissions Reductions after each stage of the Energy Hierarchy-Flat 1

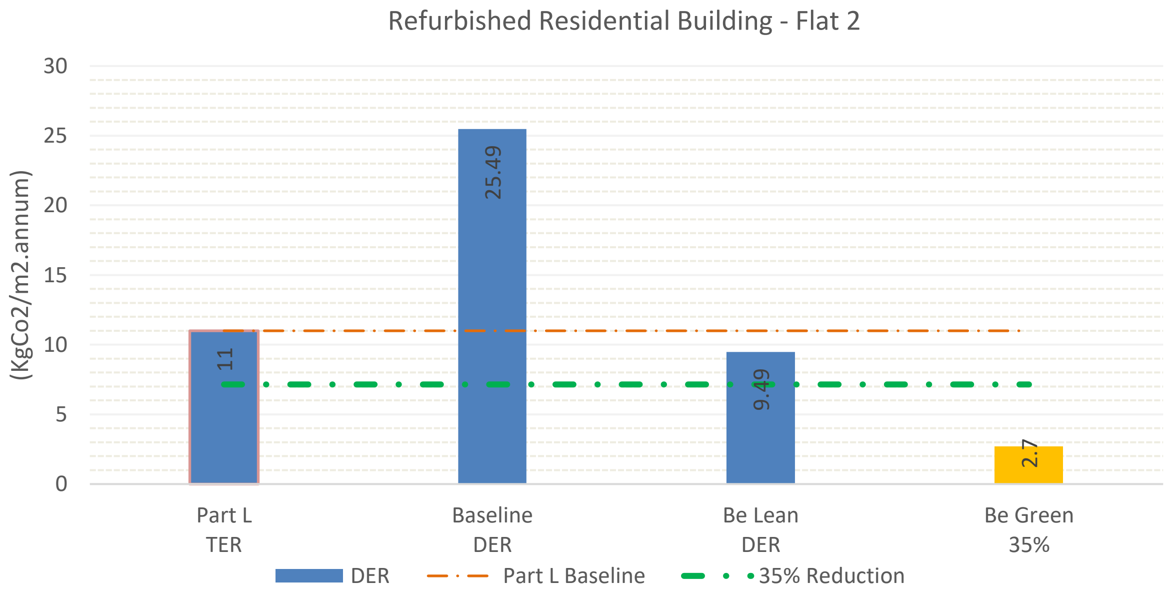


Figure 14: Carbon Emissions Reductions after each stage of the Energy Hierarchy-Flat 2

Table 14: Overall Regulated Carbon Reduction

Analysis stage	Flat 1		Flat 2	
	DER *($kgCO_2/m^2$.annum)*	% Reductions from TER	DER *($kgCO_2/m^2$.annum)*	% Reductions from TER
Notional	11.57	-	11.00	-
Baseline	22.39	-	25.49	-
Be Lean	7.03	39.50	9.49	14.08
Be Clean	7.03	39.50	9.49	14.08
Be Green	**4.67**	**59.22**	**2.7**	**76.05**

10. Appendix – SAP Reports

Block Compliance

Block Reference	Baseline	Issued on Date	14/06/2024
Block Name			
Calculation Type	New Build (As Designed)		

Assessor Details	Ms. Ishita Bhatnagar	Assessor ID	BD58-0001
Client			

Block Compliance Report - DER

Block Reference: Baseline	Block Name:			
Property-Assessment Reference	**Floor area (m^2)**	**DER ($kgCO_2/m^2$)**	**TER ($kgCO_2/m^2$)**	**% DER/TER**
Flat 1 - 00001	70.77	22.39	12.00	-86.58 %
Flat 2 - Baseline	65.28	25.49	11.42	-123.20 %
Totals:	136.05	47.88	23.42	
Average DER = 23.88 $kgCO_2/m^2$	**% DER/TER**	FAIL		
Average TER = 11.72 $kgCO_2/m^2$	-103.70 %			

Block Compliance Report - DFEE

Block Reference: Baseline	Block Name:			
Property-Assessment Reference	**Floor area (m^2)**	**DFEE ($kWh/m^2/yr$)**	**TFEE ($kWh/m^2/yr$)**	**% DFEE/TFEE**
Flat 1 - 00001	70.77	58.60	30.02	-95.19 %
Flat 2 - Baseline	65.28	74.98	44.93	-66.89 %
Totals:	136.05	133.57	74.95	
Average DFEE = 66.46 $kgCO_2/m^2$	**% DFEE/TFEE**	FAIL		
Average TFEE = 37.17 $kgCO_2/m^2$	-78.78 %			

Block Compliance Report - DPER

Block Reference: Baseline	Block Name:			
Property-Assessment Reference	**Floor area (m^2)**	**DPER ($kWh/m^2/yr$)**	**TPER ($kWh/m^2/yr$)**	**% DPER/TPER**
Flat 1 - 00001	70.77	123.72	63.05	-96.23 %
Flat 2 - Baseline	65.28	140.51	61.04	-130.19 %
Totals:	136.05	264.23	124.09	
Average DPER = 131.78 $kgCO_2/m^2$	**% DPER/TPER**	FAIL		
Average TPER = 62.09 $kgCO_2/m^2$	-112.25 %			

Block Compliance

Block Reference	Be Lean	Issued on Date	14/06/2024
Block Name			
Calculation Type	New Build (As Designed)		

Assessor Details	Ms. Ishita Bhatnagar	Assessor ID	BD58-0001
Client			

Block Compliance Report - DER

Block Reference: Be Lean	Block Name:			
Property-Assessment Reference	Floor area (m^2)	DER ($kgCO_2/m^2$)	TER ($kgCO_2/m^2$)	% DER/TER
Flat 1 - 00001	70.77	7.03	11.57	39.24 %
Flat 2 - Be Lean	65.28	9.49	11.00	13.73 %
Totals:	136.05	16.52	22.57	
Average DER = 8.21 $kgCO_2/m^2$	% DER/TER	PASS		
Average TER = 11.30 $kgCO_2/m^2$	27.32 %			

Block Compliance Report - DFEE

Block Reference: Be Lean	Block Name:			
Property-Assessment Reference	Floor area (m^2)	DFEE ($kWh/m^2/yr$)	TFEE ($kWh/m^2/yr$)	% DFEE/TFEE
Flat 1 - 00001	70.77	27.88	30.02	7.13 %
Flat 2 - Be Lean	65.28	42.76	45.13	5.26 %
Totals:	136.05	70.64	75.15	
Average DFEE = 35.02 $kgCO_2/m^2$	% DFEE/TFEE	PASS		
Average TFEE = 37.27 $kgCO_2/m^2$	6.04 %			

Block Compliance Report - DPER

Block Reference: Be Lean	Block Name:			
Property-Assessment Reference	Floor area (m^2)	DPER ($kWh/m^2/yr$)	TPER ($kWh/m^2/yr$)	% DPER/TPER
Flat 1 - 00001	70.77	73.37	60.69	-20.89 %
Flat 2 - Be Lean	65.28	98.52	58.79	-67.58 %
Totals:	136.05	171.89	119.48	
Average DPER = 85.44 $kgCO_2/m^2$	% DPER/TPER	FAIL		
Average TPER = 59.78 $kgCO_2/m^2$	-42.92 %			

Block Compliance

Block Reference	Be Green	Issued on Date	14/06/2024
Block Name			
Calculation Type	New Build (As Designed)		

Assessor Details	Ms. Ishita Bhatnagar	Assessor ID	BD58-0001
Client			

Block Compliance Report - DER

Block Reference: Be Green	Block Name:			
Property-Assessment Reference	**Floor area (m^2)**	**DER ($kgCO_2/m^2$)**	**TER ($kgCO_2/m^2$)**	**% DER/TER**
Flat 1 - 00001	70.77	4.67	11.57	59.64 %
Flat 2 - Be Green	65.28	2.70	11.00	75.45 %
Totals:	136.05	7.37	22.57	
Average DER = 3.72 $kgCO_2/m^2$	**% DER/TER**	PASS		
Average TER = 11.30 $kgCO_2/m^2$	67.03 %			

Block Compliance Report - DFEE

Block Reference: Be Green	Block Name:			
Property-Assessment Reference	**Floor area (m^2)**	**DFEE ($kWh/m^2/yr$)**	**TFEE ($kWh/m^2/yr$)**	**% DFEE/TFEE**
Flat 1 - 00001	70.77	27.88	30.02	7.13 %
Flat 2 - Be Green	65.28	42.76	45.13	5.26 %
Totals:	136.05	70.64	75.15	
Average DFEE = 35.02 $kgCO_2/m^2$	**% DFEE/TFEE**	PASS		
Average TFEE = 37.27 $kgCO_2/m^2$	6.04 %			

Block Compliance Report - DPER

Block Reference: Be Green	Block Name:			
Property-Assessment Reference	**Floor area (m^2)**	**DPER ($kWh/m^2/yr$)**	**TPER ($kWh/m^2/yr$)**	**% DPER/TPER**
Flat 1 - 00001	70.77	54.47	60.69	10.25 %
Flat 2 - Be Green	65.28	52.73	58.79	10.31 %
Totals:	136.05	107.20	119.48	
Average DPER = 53.64 $kgCO_2/m^2$	**% DPER/TPER**	PASS		
Average TPER = 59.78 $kgCO_2/m^2$	10.28 %			