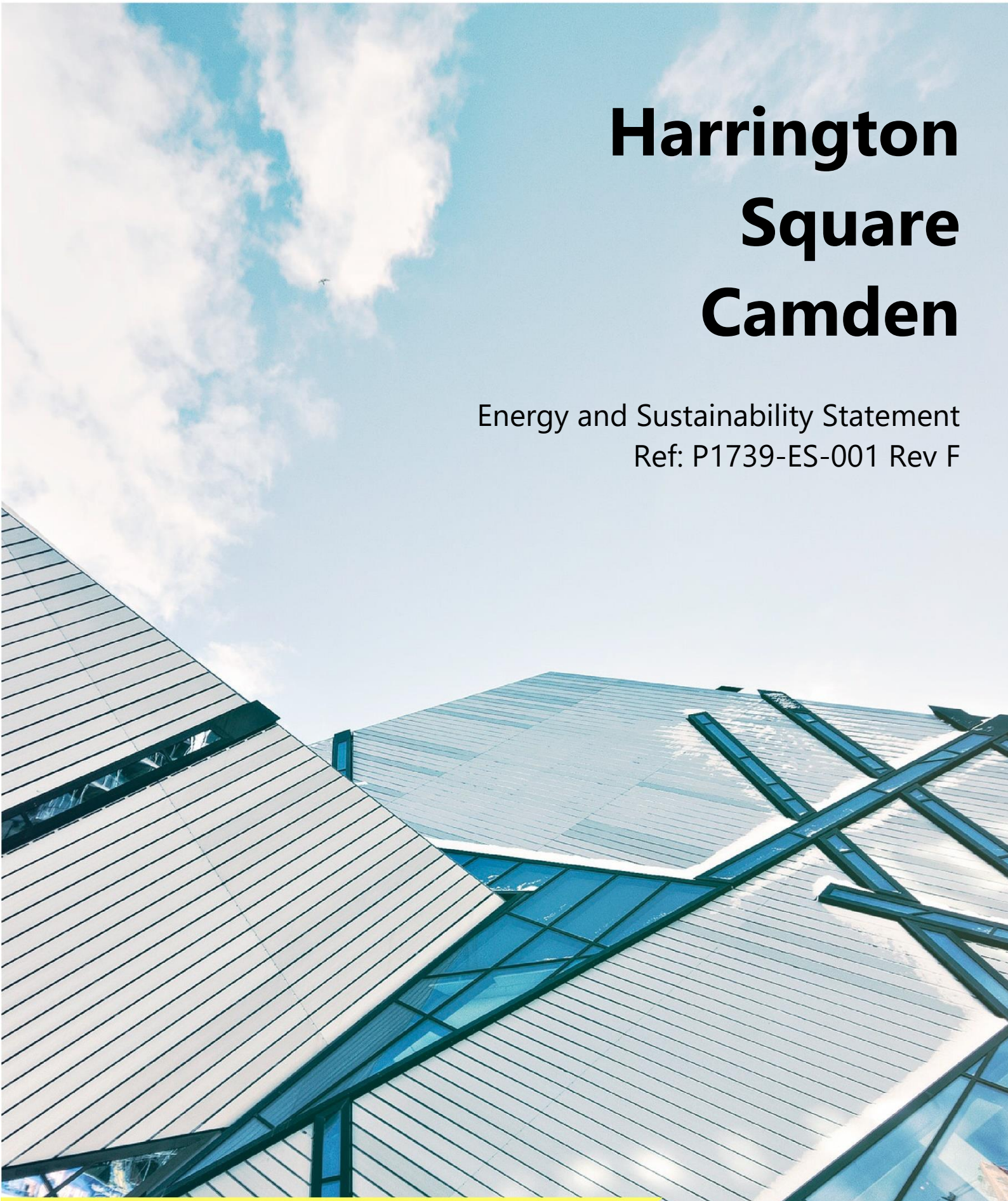
Harrington Square Camden

Energy and Sustainability Statement
Ref: P1739-ES-001 Rev F



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AMENDMENT HISTORY

REVISION	DESCRIPTION	DATE	AUTHOR	CHECKED
A	Planning Issue	Mar 2023	J. Pearson	C. Pearson
B	Updated Design	July 2023	C. Pearson	B. Duckworth
C	Section 1.1 Amended	Sept 2023	C. Pearson	B. Duckworth
D	Updated Design	Nov 2023	C. Pearson	B. Duckworth
E	Comments Addressed	Nov 2023	C. Pearson	B. Duckworth
F	Data updated	Dec 2023	C. Pearson	B. Duckworth

CONTENTS

1 EXECUTIVE SUMMARY

1.1 Summary

The design of the proposed development of the Land adjacent to Hurdwick House, Harrington Square, Camden, has incorporated building fabric enhancement (above current Building Regulation 2021 requirements) to increase the energy efficiency of the development. This concludes that the development uses less energy, by adopting sustainable design and construction measures and by supplying energy efficiently.

Given the development site's location, policies detailed in both the London Local Development Plan and the London Borough of Camden Local Plan must be adhered to. The policies addressed in this Energy Statement include SI2 and SI3 of the LDP and policy CC1 of the CLP; both documents require developments to achieve minimum carbon reduction targets through sustainable design. Current criteria set out within the London Plan March 2021, states that a minimum 35% CO_2 reduction over current Part L Volume 1 2021 Building Regulations is required. As the LDP 2021 is still under development, an Energy Assessment Guidance update document has been produced which advises a further benchmark CO_2 reduction of 50% over Part L 2021 Building Regulations.

The Camden Local Plan is also being developed; the existing Camden Local Plan 2017 stipulates a 19% CO_2 reduction over Part L 2013 Building Regulations is required. However, as the London Plan CO_2 reduction requirement is the more onerous, compliance with the London Plan Policy will automatically result in compliance with the current Camden Local Plan in respect to CO_2 reduction. Policy CC1 of the CLP also stipulates however, that an additional 20% reduction is required between the Be Green and Be Lean stages of the Energy Hierarchy. This report will demonstrate compliance with all energy related policies of the LDP and CLP respectively.

The recommendation for the proposed development is that an all-electric strategy is used, including air source heat pumps to service the heating and hot water demand. This strategy is designed to take advantage of the low fuel carbon factor for grid electricity which is currently circa 48% supplied by renewable technology such as offshore wind, solar PV and Biomass generators. Furthermore, mechanical ventilation with heat recovery will service the ventilation requirements of each dwelling; the heat recovery of this system will be finalised as the design develops, however the anticipated heat recovery efficiency is around 80%. The M&E strategy will be supplemented by a highly efficient building fabric in addition to renewable photovoltaic technology, the former will be prioritised in accordance with the Energy Hierarchy.

The proposed fabric specification is described in Table 1 below. SAP 10.2 Appendix R reference values for thermal junction PSI-values have been used at this stage. Final junction PSI-Values will either be independently calculated where bespoke details are used OR confirmed using pre-existing PSI-Value calculations for common detail build ups listed in an approved database such as the Recognised Constructions Database. Final proposed PSI-Values are to be provided to the Energy Assessor to confirm compliance with the Part L Fabric Efficiency metric is maintained.

Table 1 Domestic Building Fabric Specification

Building Fabric			
Element	**L1A: 2022 Limiting U-values (W/m².k)**	**L1A: 2022 Notional U-values (W/m².k)**	**Proposed U-values (W/m².k)**
Floors	0.18	0.13	0.11
External Walls (inc Walls to Unheated Areas)	0.26	0.18	0.15
Party walls between dwelling	0.20	0.00	0.00
Roof	0.16	0.11	0.11
Windows	1.60	1.20	1.30 (G-Value 0.58)
Doors	1.6	1.0	N/A (communal areas heated)
Air permeability (m²/h.m² @ 50 pa)			
All dwellings	8.0	5.0	3.0
Thermal Bridging Details			
External Junction Type	**Linear Thermal Transmittance Used (Ψ)**	**Note**	
E1 Lintel	0.05	Independently calculated or chosen from a database	
E3 Sill	0.05	Independently calculated or chosen from a database	
E4 Jamb	0.05	Independently calculated or chosen from a database	
E5 Ground Floor	0.16	Independently calculated or chosen from a database	
E6 Intermediate Floor Within Dwelling (Duplex's)	0.07	Independently calculated or chosen from a database	
E7 Party Floor Between Dwellings (flats)	0.07	Independently calculated or chosen from a database	
E14 Flat Roof	0.08	Independently calculated or chosen from a database	
E16 Corner (normal)	0.09	Independently calculated or chosen from a database	
E17 Inverted Corner	-0.09	Independently calculated or chosen from a database	
E18 Party Wall Between Dwellings	0.06	Independently calculated or chosen from a database	
Party Wall Junction Type	**Linear Thermal Transmittance Used (Ψ)**	**Note**	

P2 Intermediate Floor Within a Dwelling	0	Default Detail
P3 Intermediate Floor Between Dwellings	0	Default Detail
P4 Roof (Insulation at Ceiling Level)	0.12	Independently calculated or chosen from a database
Thermal Mass Parameter (TMP)		
Calculated based on detail construction drawings, final thermal mass to achieve a medium density of around 250 kJ/m^{2}K. Preliminary construction types entered as follows:		
Construction Type	**General Description**	
Party Floors (between Dwellings and Non-Domestic areas	Concrete Floor, Slab Carpeted	
Party Walls (to dwellings and heated communal)	Plaster Board on dabs mounted on cement render on both sides, AAC blocks, cavity	
External Floors	Concrete Floor, Slab Carpeted	
External Wall	Cavity Wall: Plasterboard on dabs or battens, AAC block, filled cavity, any outside structure	
Roofs	Plasterboard, insulated flat roof	
Internal Partitions	Plasterboard on timber frame	
Floor/Ceiling within Dwellings (Duplexes)	Carpeted chipboard floor/plasterboard ceiling	

In addition to efficient systems, consideration has been given to the reduction of mains potable water usage through efficient water fixtures. This is further detailed in section 4.5 however potable water demand is to be reduced to <16 litres/person/day as per the requirement within Building Regulations.

EUI has also been considered, the results of which can be found below.

Table 2 EUI (See GLA Carbon Emissions Reporting Spreadsheet)

Results		Table 4 of the guidance comparison	
EUI (kWh/m^2/year) (excluding renewable energy)	Space heating demand (kWh/m^2/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)
26.18604848	12.88733004	35	15

For this project the following results have been obtained, based on an area weighted average block compliance calculation method to adhere to the site wide requirements set out within the Local Authority Policies and the London Plan March 2021.

Table 3 As-Designed Building Regulations Part L 2021 Results

Target Emission Rate vs Dwelling Emission Rate	
Combined Target Carbon Dioxide Emission Rate (TER)	12.54 $kgCO_2/m^2.yr$
Combined Dwelling Carbon Dioxide Emission Rate (DER)	3.97 $kgCO_2/m^2.yr$
% Reduction	**68.36%**
Target Fabric Energy Efficiency vs Dwelling Fabric Energy Efficiency	
Combined Target Fabric Energy Efficiency (TFEE)	36.28 $kWh/m^2.yr$
Combined Dwelling Fabric Energy Efficiency (DFEE)	34.36 $kWh/m^2.yr$
% Reduction	**5.28%**
Target Primary Energy Rate vs Dwelling Primary Energy Rate	
Combined Target Primary Energy Rate (TPER)	66.64 $kWh/m^2.yr$
Combined Dwelling Primary Energy Rate (DPER)	44.98 $kWh/m^2.yr$
% Reduction	**32.51%**

As all 3nr compliance metrics in Table 2 have been passed it is deemed that the development complies with Part L Volume 1 2021. The total site wide CO_2 emission reduction exceeds the required 50% reduction stipulated in policy SI2 (energy assessment update document).

To satisfy the requirement to reduce CO_2 by 20% via renewable sources, the benefit of the PV must be isolated by achieving the 20% reduction between the Be Lean stage DER (dwelling emission rate) and the Be Green Stage DER. Please note that the 11.3% reduction at Be Green referred to in figure 1 and throughout does not isolate the reduction from PV as it is the reduction over the notional building TER (target emission rate) which, counter to the definition of the Be Lean Stage, also incorporates PV. Therefore the 11.3% referred to throughout should not be used as evidence the requirement is met, instead the reduction between Be Lean and Be Green DER's should be used as below:

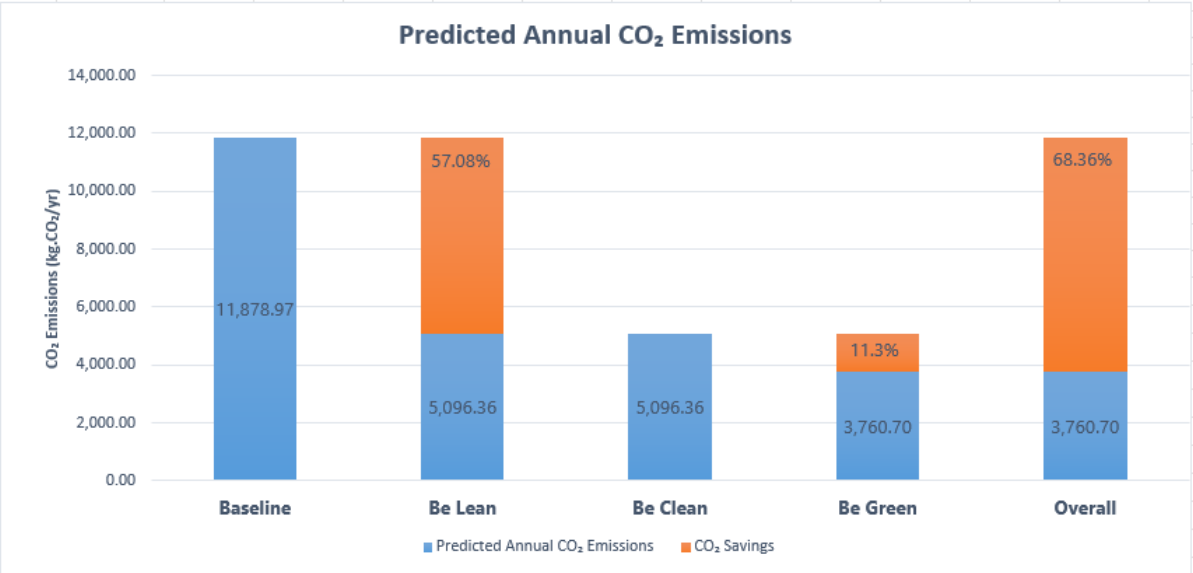
Be Lean DER (excluding renewable benefit) – 5.38 kgCO2/m2
Be Green DER (including renewable benefit) – 3.97 kgCO2/m2
Reduction achieved by renewable technology = 26.21%

The calculated block compliance Be Lean and Be Green DER's used above are evidenced in the block compliance calculations available in Appendix A.

Furthermore, the suitability of decentralised energy and CHP has been reviewed in accordance with policy SI3. It is therefore deemed that the proposed design of Harrington Square complies with all appropriate London Plan 2021 and Camden Local Plan energy policies.

The below graph displays the performance of this development within the Energy Hierarchy.

Figure 1 Energy Hierarchy overall results



2 INTRODUCTION

2.1 PURPOSE

NOVO Integration Ltd has been appointed as Energy Consultants to produce an Energy Strategy for the development at Harrington Square, Camden. This is to support the scheme design process, demonstrate Building Regulations Part L1A compliance and to achieve the applicable planning polices set out in the Local Authority of Camden Adopted Local Plan and the London Plan March 2021.

This report has been prepared solely for the use of Salboy and NOVO Integration Ltd accept no responsibility for its use by any third parties.

Figure 2 Harrington Square

This report will outline the following:

1. Assess the proposed development site's estimated CO_2 emissions, it will look into the feasibility of Low Zero Carbon technologies, examining the following aspects relative to LZC/renewable technologies:

    - Energy generated by Renewable/Low Zero Carbon Technologies (LZC)
    - Feasibility assessment for each Renewable/Low Zero Carbon Technologies (LZC)
    - Local Planning Requirements

2. The proposed building fabric and Low Zero Carbon (LZC) design strategy and analyse calculations, with respect to the Standard Assessment energy assessment Procedure (SAP). Demonstration of how the design is compliant against the current 2021 Part L1A Buildings Regulations.

3. The report will follow the steps related to the Energy Hierarchy and prioritise the 'Fabric First' approach defined therein.

2.2 BACKGROUND POLICY DOCUMENTS

The following statements and regulatory guidelines form the policy background to this Energy Strategy:

- The Kyoto Protocol at the United Nations.
- Framework Convention on Climate Change as negotiated in December 1997 has come into effect on 16 February 2005 following the ratification of the agreement by Russia on 18 November 2004. The Burden Sharing Agreement of the EU mandates a 12.5% reduction in greenhouse gas emissions for the UK by 2008 - 12.
- The Department of Transport and Industry White Paper, titled "Our Energy Future - Creating a Low Carbon Economy", spells out a target for 10% of electricity to be from renewable sources nationally by 2010 and twice this by 2020.
- National Policy Objectives in regard to renewable energy Planning Policy Statement 22: Renewable energy guidance for local governing bodies concerning implementation of renewable energy technologies through appropriate planning.
- The United Kingdom has made commitments that extend beyond this requirement. National Targets are for a reduction to 20% below 1990 CO_2 levels by 2010 and a 60% reduction by 2050.
- Integrating renewable energy into new developments: Toolkit for planners, developers and consultants, September 2004.
- National Planning Policy Framework (July 2021)
  The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. In particular point A of paragraph 16 which states the following:

  Plans should:

  a) be prepared with the objective of contributing to the achievement of sustainable development.

  b) be prepared positively, in a way that is aspirational but deliverable

  c) be shaped by early, proportionate, and effective engagement between plan makers and communities, local organisations, businesses, infrastructure providers and operators and statutory consultees

  d) contain policies that are clearly written and unambiguous, so it is evident how a decision maker should react to development proposals

  e) be accessible through the use of digital tools to assist public involvement and policy presentation; and

  f) serve a clear purpose, avoiding unnecessary duplication of policies that apply to a particular area (including policies in this Framework, where relevant).

Another key point of the NPPF is paragraph 8, point C which states the following:

Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

a) an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth,

innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

b) a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and

c) an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

- Adopted Camden Local Plan (2017).
- Adopted London Plan 2021.
- Approved Document Part L Volume 1: Dwellings 2021

2.3 SITE DESCRIPTION

The development site is located at Harrington Square, London adjacent to Harrington Square Gardens. The former car park development consists of 11 new build flats and falls within the curtilage of Camden.

The site is situated in a very accessible location south of Camden Town and adjacent to Mornington Crescent Underground Station. Central London is located 2 miles to the south of the Property. The site is also a short distance from a variety of amenities including Camden Market and The Roundhouse.

Figure 3: Ariel View

2.4 PLANNING POLICY

2.4.1 Local Policy

The locality of the development site means it falls under the jurisdiction of Camden Local Authority. As such the policies adopted by Camden Local Authority must be adhered to.

The Local Plan March 2017 sets out the spatial vision for Camden and includes policy applicable to this Energy Strategy.

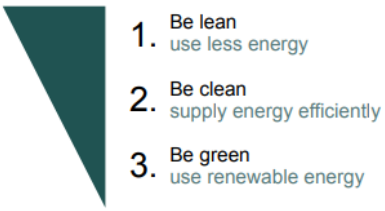
As Part L1A 2021 Building Regulations apply in this instance, some interpretation of this documentation must be considered and will be highlighted throughout this Energy Strategy.

The main policy relating to sustainability with the Local Plan is Policy CC1. The policy states the following:

The energy hierarchy

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 CO2 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.

8.7 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.



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 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.

Be lean

8.9 Proposals should demonstrate how passive design measures including the development orientation, form, mass, and window sizes and positions have been taken into consideration to reduce energy demand, demonstrating that the minimum energy efficiency requirements required under building regulations will be met and where possible exceeded. This is in line with stage one of the energy hierarchy 'Be lean'.

Be clean

8.10 The second stage of the energy hierarchy 'Be clean' should demonstrate how the development will supply energy efficiently through decentralised energy. Please refer to the section below on decentralised energy generation.

Be green

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 CO2 emissions of the development after all proposed energy efficiency measures and any CO2 reduction from non-renewable decentralised energy (e.g. CHP) have been incorporated.

8.12 All major developments will also be expected to demonstrate how relevant London Plan targets for CO2 reduction, including targets for renewable energy, have been met. Where it is demonstrated that the required London Plan reductions in carbon dioxide emissions cannot be met on site, the Council will require a financial contribution to an agreed borough wide programme to provide for local low carbon projects. The borough wide programme will be connected to key projects identified in the Council's Green Action for Change.

8.13 In cases where standards change or are superseded, the Council will use the equivalent replacement standards.

The above extract from the Camden Local Plan stipulates a 19% reduction in CO_2 emmisions over Building Regulations 2013. This has now however, been superceaded by Building Regulations 2021 of which the London Plan now follows. The London Plan CO_2 emmisions target are therefore the primary forcus of this report. The Camden Local Plan does however require a specific 20% CO_2 reduction between the Be Green and Be Lean Energy Hierachy stages, this will be adheared to throughout this report.

As above this reduction must come from on-site renewable generation, therefore to prove the benefit of the proposed on-site renewable generation a Be Lean DER (Dwelling Emission rate) with no PV benefit will be compared with the Be Green DER which does include proposed PV as per the excutive summary of this report. Appendix A contains the block compliance calculations for the Be Lean and Green DERs for verification.

2.4.2 The London Plan 2021

Policy SI2 Minimising Greenhouse Gas Emissions states:

A) Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy: 1) be lean: use less energy and manage demand during operation 2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly 3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site 4) be seen: monitor, verify and report on energy performance.

B) Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

C) A minimum on-site reduction of at least 35 per cent beyond Building Regulations152 is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either: 1) through a cash in lieu contribution to the borough's carbon offset fund, or 2) off-site provided that an alternative proposal is identified, and delivery is certain.

D) Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.

E) Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.

F) Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

All of the above points have been considered throughout this strategy and results have been provided at each stage of the Energy Hierarchy as dictated.

The below extract from the Energy Assessment Guidance Note stipulates a further benchmark result of 50% over Part L 2021, this aspect of the London Plan policy will be adhered to in this report.

Applying London Plan policy

- **Achieving on-site carbon reductions:** the on-site carbon reductions that can normally be achieved over Part L 2021 will vary for different development types:
    - Residential developments are expected to be able to achieve on-site savings beyond the minimum 35 per cent improvement, so we have introduced an additional percentage improvement benchmark of 50 per cent plus which these developments should be aiming to achieve. Meeting the energy efficiency target may now be more challenging initially, but it is essential that planning applicants reduce energy demand as far as possible to avoid high energy bills for occupants.

London Plan Policy SI3 details consideration of decentralised energy and CHP, the viability and suitability of connection to such a system is assessed later in this report.

Policy SI 3 Energy infrastructure

A Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

B Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities) which establish the most effective energy supply options. Energy masterplans should identify:

1) major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
2) heat loads from existing buildings that can be connected to future phases of a heat network
3) major heat supply plant including opportunities to utilise heat from energy from waste plants
4) secondary heat sources, including both environmental and waste heat
5) opportunities for low and ambient temperature heat networks
6) possible land for energy centres and/or energy storage
7) possible heating and cooling network routes
8) opportunities for futureproofing utility infrastructure networks to minimise the impact from road works
9) infrastructure and land requirements for electricity and gas supplies
10) implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector
11) opportunities to maximise renewable electricity generation and incorporate demand-side response measures.

C Development Plans should:

1) identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure

2) identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.

D Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:

1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
   a) connect to local existing or planned heat networks
   b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
   c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
   d) use ultra-low NOx gas boilers
2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality
3) where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.

E Heat networks should achieve good practice design and specification standards for primary, secondary and tertiary systems comparable to those set out in the CIBSE/ADE Code of Practice CP1 or equivalent.

2.4.3 Code for Sustainable Homes

Following the outcome of the Housing Standards review released March 2015, Code for Sustainable Homes is now no longer applicable for newly proposed residential developments. As this is a new development being proposed after March 2015 the Local Authority is prohibited from requesting a Code for Sustainable Homes assessment and therefore this requirement will be omitted from this Energy Strategy.

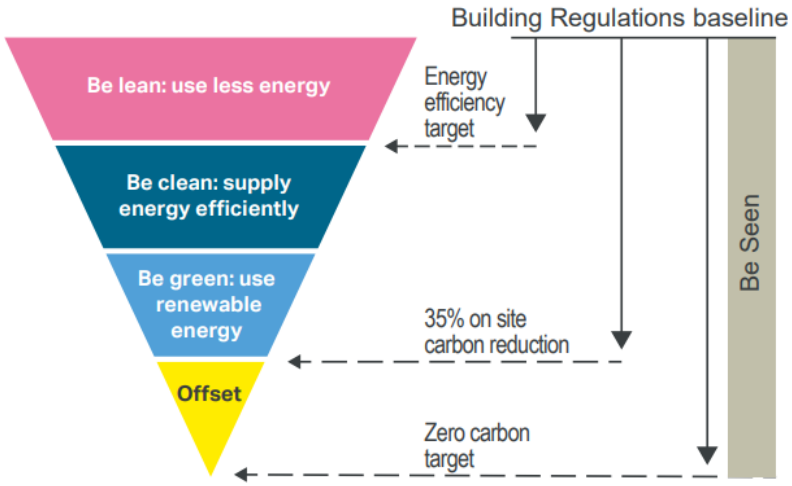
As the development provides a 56.95% reduction in CO_2 emissions compared with current Building Regulations, if the Code for Sustainable Homes were still a requirement, this reduction would give the equivalent of Level 4 in the Energy section of the Code. Code level 4 requires a 19% reduction for 2013 Building regulations, as such this strategy shows betterment than the minimum requirements for Code level 4.

2.4.4 Energy Hierarchy

The Mayor's 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. These

guiding principles have been reordered since the publication of the Mayor's Energy Strategy in Feb 2004 and the adopted replacement London Plan March 2021 states that 'The following hierarchy should be used to assess applications':

Figure 3: Energy Hierarchy Diagram



- Using less energy, in particular by adopting sustainable design and construction measures.
- Supplying energy efficiency, in particular by prioritising decentralised energy generation; and
- Using renewable energy.

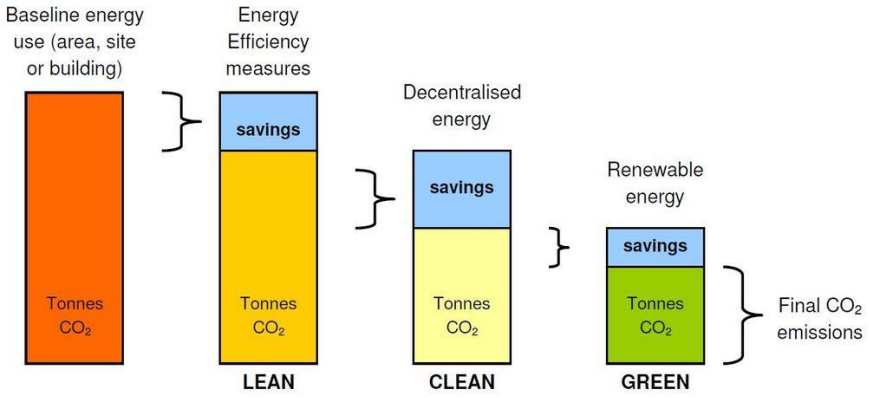
The development Energy strategy has adopted the following design ethos:

- **BE LEAN** – By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.

- **BE CLEAN** – By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.

- **BE GREEN** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.

Figure 4: Energy Hierarchy Example Graph



2.4.5 Overheating and Cooling Hierarchy

Stated within Policy SI 4 "Managing Heat Risk" of the London Plan, major development proposals should reduce potential overheating and reliance of air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1) Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
2) Minimise internal heat generation through energy efficient design
3) Manage the heat within the building through exposed internal thermal mass and high ceilings
4) Provide passive ventilation
5) Provide mechanical ventilation
6) Provide active cooling systems.

The dwellings will take all of the above into consideration and refer to the overheating risk analysis presented by the SAP calculations. A TM59 Assessment will be carried out to satisfy Part O Building Regulations once the design has developed and full detail build up thermal mass can be accounted for in accordance with the methodology.

2.5 BUILDING REGULATIONS

Compliance with the Approved Document Part L Volume 1 2021 should be demonstrated at detailed design stage, prior to construction in the detail design phase of the project.

The requirements for Part L 2021 Building Regulations are summarised below however. In this case a Part L 2021 calculation has been used to demonstrate compliance with the London Plan 2021 CO2 requirements.

1) The Dwelling Emission Rate must be lower than the Target Emission Rate
2) The Dwelling Fabric Energy Efficiency must be lower that the Target Fabric Energy Efficiency
3) The Dwelling Primary Energy Rate must be lower than the Target Primary Energy Rate

The following are some key extracts from ADL1 detailing the requirements of the regulations, for full details please refer to Part L1 Volume 1 2021.

Regulations

Methodology of calculation of the energy performance

24. (1) The Secretary of State shall approve—

(a) a methodology of calculation of the energy performance of buildings, including methods for calculating asset ratings and operational ratings of buildings; and

(b) ways in which the energy performance of buildings, as calculated in accordance with the methodology, shall be expressed.

(2) In this regulation—

"asset rating" means an energy performance indicator determined from the amount of energy estimated to meet the different needs associated with a standardised use of the building; and

"operational rating" means an energy performance indicator determined from the amount of energy consumed during the occupation of a building over a period of time and the energy demand associated with a typical use of the building over that period.

Minimum energy performance requirements for new buildings

25. Minimum energy performance requirements shall be approved by the Secretary of State, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, for—

(a) new buildings (which shall include new dwellings), in the form of target CO_2 emission rates;

(b) new dwellings, in the form of target fabric efficiency rates; and

(c) new buildings in the form of target primary energy rates.

Nearly zero-energy requirements for new buildings

25B. Where a building is erected, it must be a nearly zero-energy building.

CO_2 emission rates for new buildings

26. Where a building is erected, it shall not exceed the target CO_2 emission rate for the building that has been approved pursuant to regulation 25, applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24.

Fabric energy efficiency rates for new dwellings

26A. Where a dwelling is erected, it shall not exceed the target fabric energy efficiency rate for the dwelling that has been approved pursuant to regulation 25, applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24.

Target primary energy rates for new buildings

26C. Where a building is erected it must not exceed the target primary energy rate for the building which has been approved pursuant to regulation 25(c), applying the methodology of calculation and expression of the energy performance of buildings approved pursuant to regulation 24.

Regulation *continued*

CO_2 emission rate calculations

27. (1) This regulation applies where a building is erected and regulation 26 applies.

(2) Not later than the day before the work starts, the person carrying out the work shall give the local authority a notice which specifies—

(a) the target CO_2 emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24,

(b) the CO_2 emission rate for the building as designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

(c) a list of specifications to which the building is to be constructed.

(3) Not later than five days after the work has been completed, the person carrying out the work shall give the local authority—

(a) a notice which specifies—

(i) the target CO_2 emission rate for the building, calculated and expressed in accordance with the methodology approved pursuant to regulation 24,

(ii) the CO_2 emission rate for the building as constructed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24, and

(iii) whether the building has been constructed in accordance with the list of specifications referred to in paragraph (2)(c), and if not a list of any changes to those specifications; or

(b) a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in sub-paragraph (a).

(4) A local authority are authorised to accept, as evidence that the requirements of regulation 26 have been satisfied, a certificate to that effect by an energy assessor who is accredited to produce energy performance certificates for that category of building.

(5) In this regulation, "specifications" means specifications used for the calculation of the CO_2 emission rate.

Fabric energy efficiency rate calculations

27A. (1) This regulation applies where a dwelling is erected and regulation 26A applies.

(2) Not later than the day before the work starts, the person carrying out the work shall give the local authority a notice which specifies—

(a) the target fabric energy efficiency rate for the dwelling, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;

(b) the fabric energy efficiency rate for the dwelling as designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24; and

(c) a list of specifications to which the dwelling is to be constructed.

(3) Not later than five days after the work has been completed, the person carrying out the work shall give the local authority—

(a) a notice which specifies—

(i) the target fabric energy efficiency rate for the dwelling, calculated and expressed in accordance with the methodology approved pursuant to regulation 24;

(ii) the fabric energy efficiency rate for the dwelling as constructed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24; and

(iii) whether the dwelling has been constructed in accordance with the list of specifications referred to in paragraph (2)(c), and if not a list of any changes to those specifications; or

(b) a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in sub-paragraph (a).

(4) A local authority is authorised to accept, as evidence that the requirements of regulation 26A have been satisfied, a certificate to that effect by an energy assessor who is accredited to produce energy performance certificates for that category of building.

(5) In this regulation, "specifications" means specifications used for the calculation of the fabric energy efficiency rate.

Regulation *continued*

Target primary energy rate calculations for new buildings

27C. (1) This regulation applies where a building is erected.

(2) Not later than the day before the work starts, the person carrying out the work must give the local authority a notice which specifies—

(a) the target primary energy rate for the building calculated and expressed in accordance with the methodology approved pursuant to regulation 24;

(b) the calculated target primary energy rate for the building as designed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24; and

(c) the list of specifications to which the building is to be constructed.

(3) Not later than five days after the work has been completed, the person carrying out the work must give the local authority—

(a) a notice which specifies—

(i) the target primary energy rate for the building calculated and expressed in accordance with the methodology approved pursuant to regulation 24;

(ii) the calculated target primary energy rate for the building as constructed, calculated and expressed in accordance with the methodology approved pursuant to regulation 24; and

(iii) whether the building has been constructed in accordance with the list of specifications referred to in paragraph (2)(c), and if not a list of any changes to those specifications; or

(b) a certificate of the sort referred to in paragraph (4) accompanied by the information referred to in sub-paragraph (a).

(4) A local authority is authorised to accept, as evidence that the requirements of regulation 26C have been satisfied, a certificate to that effect by an energy assessor who is accredited to produce energy performance certificates for that category of building.

(5) In this regulation, "specifications" means specifications used for the calculation of the target primary energy rate.

3 DESIGN PARAMETERS

3.1 METHODOLOGY

The Standard Assessment Procedure (SAP) is the Government's approved methodology for assessing the predicted energy consumption and carbon dioxide emissions for new dwellings. Results are derived in respect of floor area and consider energy use (kWh/m^2/yr.) and associated CO_2 emissions (kg.CO_2/m^2/yr.) from the following:

- Space heating
- Domestic hot water
- Ventilation
- Lighting
- Ancillary pumps and fans
- Energy generation technology

SAP is compliant with the EU Energy Performance of Buildings Directive and is carried out using approved software. For the purpose of this report, data has been produced by an accredited domestic energy assessor using Design SAP 10.

To enable a review of each level of the Energy Hierarchy, firstly the Baseline CO_2 emission figures must be established. These figures are based on Part L volume 1 2021 'Notional Dwelling', a specific set of specification criteria referenced in section 3.4 of this report.

All additional measures included to reduce the overall CO_2 emissions to the appropriate target of 50%, such as improved building fabric and renewable technology will be compared against the Baseline figures. These figures are the Target Emission Rate derived from SAP 10.2 for each of the specific dwellings within the development.

A 'fabric first' approach will be undertaken throughout this report, looking at improvements to the thermal envelope initially to understand the improvements that can be gained prior to the feasibility any renewable / low carbon technologies.

Renewable / low carbon technologies will then be considered with regards to special constraints, feasibility and appropriateness in relation to the site.

All additional measures included to reduce the overall CO_2 emissions to the appropriate target of 50%, such as improved fabric measures, will be compared against the Baseline figures. These figures are the Target Emission Rate (TER) derived from SAP 10.2 for each of the specific dwellings within the development.

Renewable / low carbon technologies will then be considered with regards to special constraints, feasibility and appropriateness in relation to the site.

An overall area weighted average figure will then be assessed to comply with the policies set out by the London Plan.

NOVO Integration Ltd have used the following information to formulate the Energy Strategy.

3.2 ARCHITECTURAL DRAWINGS BY STUDIO POWER ARCHITECTS

Table 4 Architects Drawing Schedule

Drawing Number	Drawing Contents
0010_SP-XX-XX-M3-A-0001 [R23] - Sheet - 0300	Basement Floor Plan
0010_SP-XX-XX-M3-A-0001 [R23] - Sheet - 0301	Ground Floor Plan
0010_SP-XX-XX-M3-A-0001 [R23] - Sheet - 0302	First Floor Plan
0010_SP-XX-XX-M3-A-0001 [R23] - Sheet - 0303	Second Floor Plan
0010_SP-XX-XX-M3-A-0001 [R23] - Sheet - 0304	Third Floor Plan
0010_SP-XX-XX-M3-A-0001 [R23] - Sheet - 0305	Fourth Floor Plan
0010_SP-XX-XX-M3-A-0001 [R23] - Sheet - 0306	Roof Plan
0010_SP-XX-XX-M3-A-0001 [R23]	Revit Model

3.3 FUEL

Table 5 Fuel Factors SAP 2012 and SAP 10 Applied Within Part L Calculation

kgCO_2/kWh	SAP 2012	SAP 10.1
Gas:		
mains gas	0.216	0.210
bulk LPG	0.241	0.241
bottled LPG	0.241	0.241
bottled LPG (no contract)	0.241	0.241
LPG subject to Special Condition 18	0.241	0.241
biogas (including anaerobic digestion)	0.098	0.024
Liquid fuel:		
heating oil	0.298	0.298
biodiesel from any biomass source	0.123	0.038
biodiesel from vegetable oil only	0.083	0.018
appliances able to use mineral oil or biodiesel	0.298	0.298
B30K	0.245	0.220
bioethanol from any biomass source	0.140	0.105
Solid fuel:		
house coal	0.394	0.395
anthracite	0.394	0.395
manufactured smokeless fuel	0.433	0.366
wood logs	0.019	0.028
wood pellets (in bags for secondary heating)	0.039	0.053
wood pellets (bulk supply for main heating)	0.039	0.053
wood chips	0.016	0.023
dual fuel appliance (mineral and wood)	0.226	0.087
Electricity:		
standard tariff	0.519	0.136
7-hour tariff (high rate)	0.519	0.136
7-hour tariff (low rate)	0.519	0.136
10-hour (high rate)	0.519	0.136
10-hour (low rate)	0.519	0.136
18-hour (high rate)	0.519	0.136
18-hour (low rate)	0.519	0.136
24-hour heating tariff	0.519	0.136
electricity exported to grid	0.519	0.136
electricity, any tariff	0.519	0.136
Community heating schemes:		
heat from boilers - mains gas	0.216	0.210
heat from boilers - LPG	0.241	0.241
heat from boilers - oil	0.331	0.335
heat from boilers that can use mineral oil or biodiesel	0.331	0.335
heat from boilers using biodiesel from any biomass source	0.123	0.038
heat from boilers using biodiesel from vegetable oil only	0.083	0.018
heat from boilers - B30D	0.269	0.269
heat from boilers - coal	0.380	0.375
heat from electric heat pump	0.519	0.136
heat from boilers - waste combustion	0.047	0.074
heat from boilers - biomass	0.031	0.029
heat from boilers - biogas (landfill or sewage gas)	0.098	0.024
waste heat from power station	0.058	0.015
geothermal heat source	0.041	0.011
heat from CHP	as above	0.011
electricity generated by CHP	0.519	0.136
electricity for pumping in distribution network	0.519	0.136

3.4 BASELINE CO_2 EMISSIONS

For the purpose of this report the baseline energy use and CO2 emissions are calculated based on the 'Notional Dwelling' requirements specified in the Building Regulations L Volume 1 2021 (Table 1.1). Please note that the notional/baseline dwelling in SAP 10 always includes PV, this is produced by the calculation software and cannot be removed for a fair fabric only comparison between the baseline calculation and the Be Lean stage calculation of the Energy Hierarchy.

Table 6 Residential Baseline Building Fabric

Building Fabric			
Element	**L1A: 2022 Limiting U-values ($W/m^2.k$)**	**L1A: 2022 Notional U-values ($W/m^2.k$)**	**Proposed U-values ($W/m^2.k$)**
Floors	0.18	0.13	-
External Walls	0.26	0.18	-
Party walls between dwelling	0.20	0.00	-
Roof	0.16	0.11	-
Windows	1.60	1.20	-
Doors	1.6	1.0	-
Air permeability ($m^2/h.m^2$ @ 50 pa)			
All dwellings	8.0	5.0	-

The following table details the notional baseline area weighted CO_2 regulated emissions for the development. The target emission rates (TER's) in the above figures combined with the total floor area was used to produce the baseline CO_2 emissions below.

Table 7 Estimated Baseline Carbon Emissions SAP 10 Building Regulations

Building Services	**Baseline CO2 Emissions (kg CO_2/m2)**
Total regulated emissions (heating, hot water, lighting, fans & pumps)	12.54

An area weighted block compliance baseline carbon emission result is presented above, produced by the SAP 10 software.

By using low u-values and high-performance materials to reduce greenhouse emissions and improve energy efficiency; the Be Lean stage of this report addresses policy SI2 and policy CC1 of the London Local Plan and Camden Local Plan respectively. This is also in accordance with Paragraph 8 of the National Planning Policy Framework (NPPF) by reducing CO_2 emissions and supporting a low carbon economy.

Section 4 below will now detail how the reduction between the dwelling emission rate (DER) and the target emission rate (TER) has been achieved.

4 ENERGY STRATEGY

4.1 ENERGY EFFICIENT DESIGN

This section outlines the design energy efficient measures taken in order to minimise the building's energy demand and therefore reduce energy use and CO_2 emissions further than the Baseline (Building Regulations 2021 Part L Volume 1 compliance). Often referred to as the 'Fabric First' approach.

The energy efficient measures include:

a) Inclusion of better U-values than the minimum U-values set in the ADL1A
b) Designing for a buildings air permeability exceeding ADL1A target values
c) Utilising Mechanical Ventilation Heat Recovery Systems to all dwellings
d) Utilising low energy efficient lighting such as LED lighting

The table below outlines the improvements made to the building fabric elements compared against both the Building Regulations limiting U-values and the 'Notional Dwelling' U-values which the baseline is derived from.

Table 8 Proposed Fabric Specification

Building Fabric			
Element	**L1A: 2022 Limiting U-values (W/m².k)**	**L1A: 2022 Notional U-values (W/m².k)**	**Proposed U-values (W/m².k)**
Floors	0.18	0.13	0.11
External Walls (inc Walls to Unheated Areas)	0.26	0.18	0.15
Party walls between dwelling	0.20	0.00	0.00
Roof	0.16	0.11	0.11
Windows	1.60	1.20	1.30 (G-Value 0.58)
Doors	1.6	1.0	N/A (communal areas heated)
Air permeability (m²/h.m² @ 50 pa)			
All dwellings	8.0	5.0	3.0

As can be seen in the tables above several elements of the building fabric has been improved significantly over the standard notional values, this results in a strong CO_2 reduction at the Be Lean Stage as detailed in section 4.2. The proposed U-Values detailed above are highly efficient primarily to ensure compliance with the fabric efficiency target as displayed in Figure 5 above.

4.1.1 Heating Demand

The heating energy demand will be reduced by providing good insulation of the building envelope in order to minimise heat losses.

At the Be Lean stage, air source heat pumps have been specified for the heating and hot water demand, this is to take advantage of their low fuel carbon factor and their delivery efficiencies which stand at 100%. Further reductions in heating demand will occur via the installation of mechanical ventilation with heat recovery (MVHR) which can pre-heat incoming supply air using recovered heat from exhaust air.

4.1.2 Ventilation

The full building will utilise a Heat Recovery Mechanical Ventilation system. This is to ensure acceptable indoor air quality levels can be maintained and satisfy conditions relating to pollutants. Occupants will also have a natural ventilation option via the openable balcony doors and windows in the living areas. Extract fans will be included to all wet areas and in the kitchens.

4.1.3 Lighting

The proposed light fittings will be low energy efficient fittings, in this instance LED fittings only throughout. For Part L compliance the lighting efficacy for each fitting type will stand at 100lm/w or higher.

The following table demonstrates the reduction in CO2 emissions based on an area weighted average calculation utilising "BE LEAN" energy efficiency measures mentioned above for the whole building.

4.2 CO_2 REDUCTIONS AFTER FABRIC FIRST APPROACH 'BE LEAN'

The following table demonstrates the reduction in CO2 emissions based on an area weighted average calculation utilising a fabric first approach with no reduction incorporated from the inclusion of any renewable technology:

Table 9 2021 Building Regulations Fabric First Results

Regulated Emissions	Baseline CO_2 Emissions	Fabric First Building CO_2 Emissions	CO_2 Emission Savings	% Reduction in CO_2 Emissions
kg of CO2/m2/yr.	12.54	5.38	7.16	57.08%
kg of CO2/yr.	11,878.97	5,096.36	6,782.6	

From the table above it can be seen that the overall CO_2 reduction due to the fabric first 'Be Lean' approach is 57.08%for the development's total emissions. This saves approximately 7.16 tonnes of Carbon Dioxide annually and demonstrates compliance with policy SI2 from the London Local Plan which requires a minimum of 10% CO_2 reduction at the Be Lean stage.

Table 10: Be Lean Stage Fabric Energy Efficiency Results

Baseline Fabric Energy Efficiency vs Fabric First Stage Fabric Energy Efficiency	
Combined Target Fabric Energy Efficiency (TFEE)	36.28 kWh/m^2
Combined Dwelling Fabric Energy Efficiency (DFEE)	34.36 kWh/m^2
% Reduction	5.28%

Figure 5: Be Lean Carbon Emissions Current 2021 Building Regulations

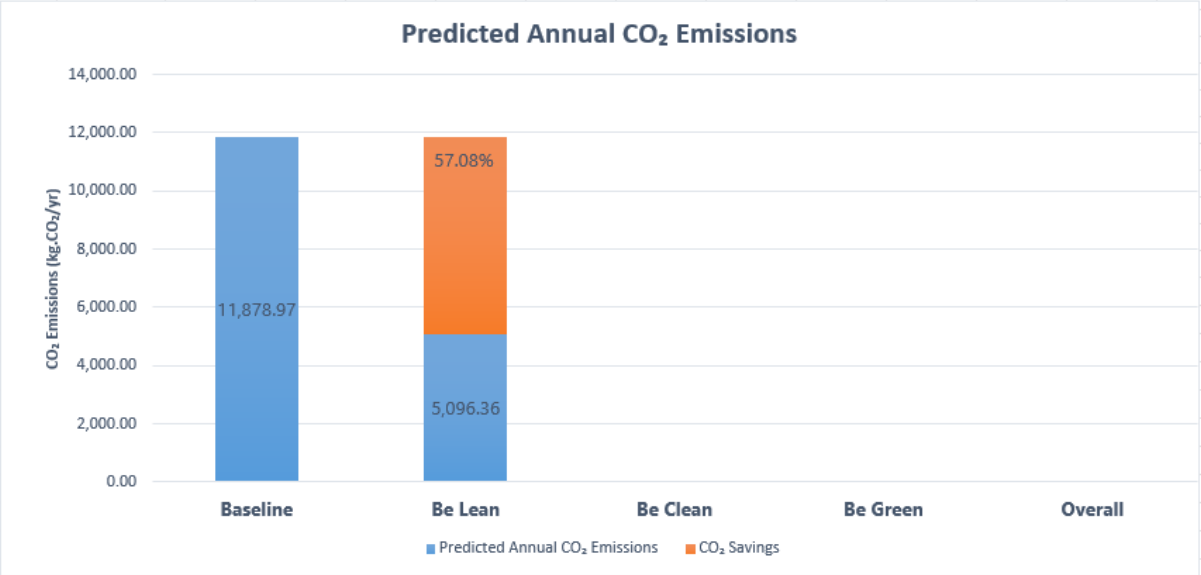


Figure 6 above shows the Be Lean CO_2 reduction under SAP 10.2 2021 Building Regulations, as can be seen a 57.08%reduction CO_2 is achieved through fabric performance and an all-electric strategy that takes advantage of the SAP 10 fuel carbon factor for grid electricity. The improvement displayed here does not include any renewable technology and is purely the result of the Fabric First approach.

4.2.1 Overheating Risk

Following the cooling hierarchy, overheating risk has been considered. Highly insulated fabric, and high-performance glazing elements lower transference of external heat to the internal surfaces, as well as glazing reducing the effects of solar gains form part of the strategy to mitigate overheating.

The orientation of the block means that many of the Living Kitchen windows are in a position to add solar gains to the dwellings, this is mitigated passively however by the G-Value performance of the glazing in addition to local shading devices.

Considering factors outside of the cooling hierarchy such as NOx fume air pollutants and noise impact from the main road, mechanical ventilation and cooling have been included to ensure occupant thermal comfort without total reliance on openable windows and avoid any air quality and noise pollution issues.

At detailed design stage, independently from this energy strategy report, Building Regulations Part O (Overheating) will be complied with via a TM59 over heating assessment.

4.3 CLEANER ENERGY - CHP & DECENTRALISED ENERGY NETWORKS

The Energy Hierarchy encourages the use of a CHP system and/or the connection to District Heating system to reduce CO_2 emissions further.

4.3.1 CHP

The Energy Hierarchy identifies 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 the majority 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.

A CHP system will not be considered for this development due to the following reasons:

- The heating load of the building is not enough for the CHP system to run efficiently.
- Economic viability is heavily dependent on the demand for heat and power, as well as the price of electricity and gas. The heat and power demand of the proposed development is not sufficient for a CHP system to run efficiently.

Hence, the implementation of a CHP strategy is not recommended for this development.

4.3.2 Micro - CHP

Micro CHP has not been considered further for this project for the following reasons:

Micro-CHP is a relatively new concept (Baxi Ecogen was made available in 2009) and issues are raised in relation to unproven technology, inefficiency for shorter run cycles and lack of technical knowledge that can limit the practical application of micro-CHP at present.

In addition, other issues surrounding the fact that around 50% of electricity generated in domestic properties is surplus, high installation costs and estimated low life expectancy has also been taken into consideration. Micro-CHP also has lower FIT tariff rate and period duration and is only applicable for systems under 2kW.

4.3.3 Communal Heating

A communal heating scheme could consist of for example CHP unit, or a centralised gas boiler system supply heat and / or hot water to all individual units, alone with other varying systems.

As CHP has been ruled out previously in this report, and the effectiveness and appropriateness of Air Source heat pumps discussed later in this report, deem that the only reasonable communal heating scheme would be a centralised communal boiler.

The current design however is the preferred option as this system is purely electric, the fuel carbon factor for grid electricity is brought in line with natural gas under the SAP 10 changes and will eventually become zero carbon as the portion of renewable energy supplied to the grid increases. This therefore provides the development with some future proofing and better addresses the current climate emergency by removing another potential source of emissions.

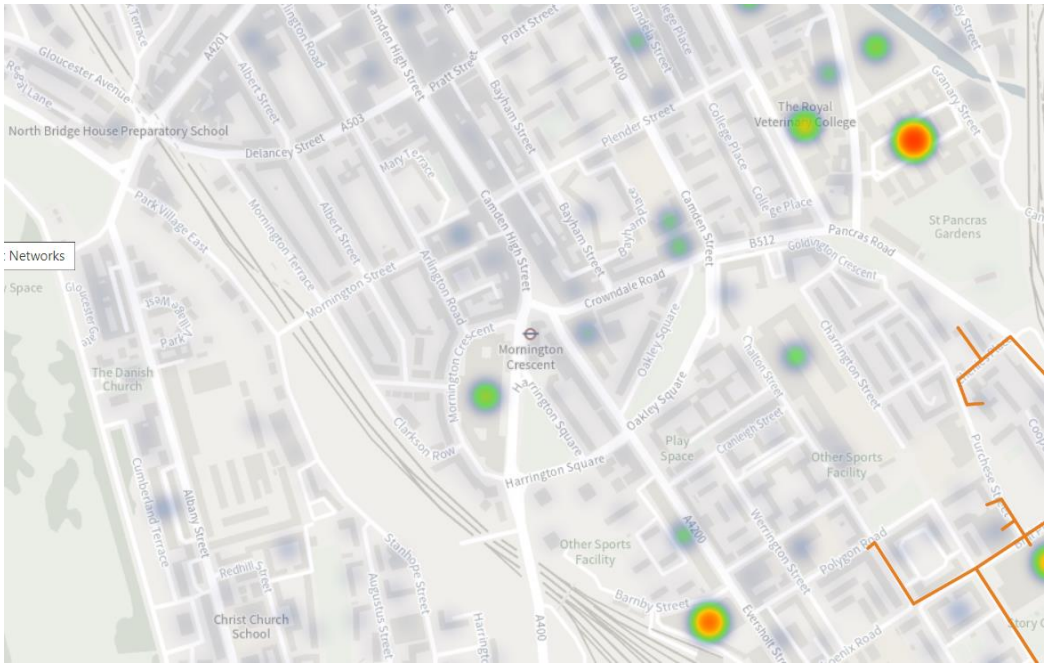
Utilising a community heating system would result in reduced efficiency from the boilers and increase NOX emissions to an extent. This would ultimately result in the CO_2 reduction being less than currently described. As such this option has been discounted.

4.3.4 Decentralised Energy Network

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 Study and the UK CHP Development Map for London Borough of Camden.

The development is not in close proximity to an existing District Heating transmission line and generally the heat density in the area is low. As such there are no connections available to this site.

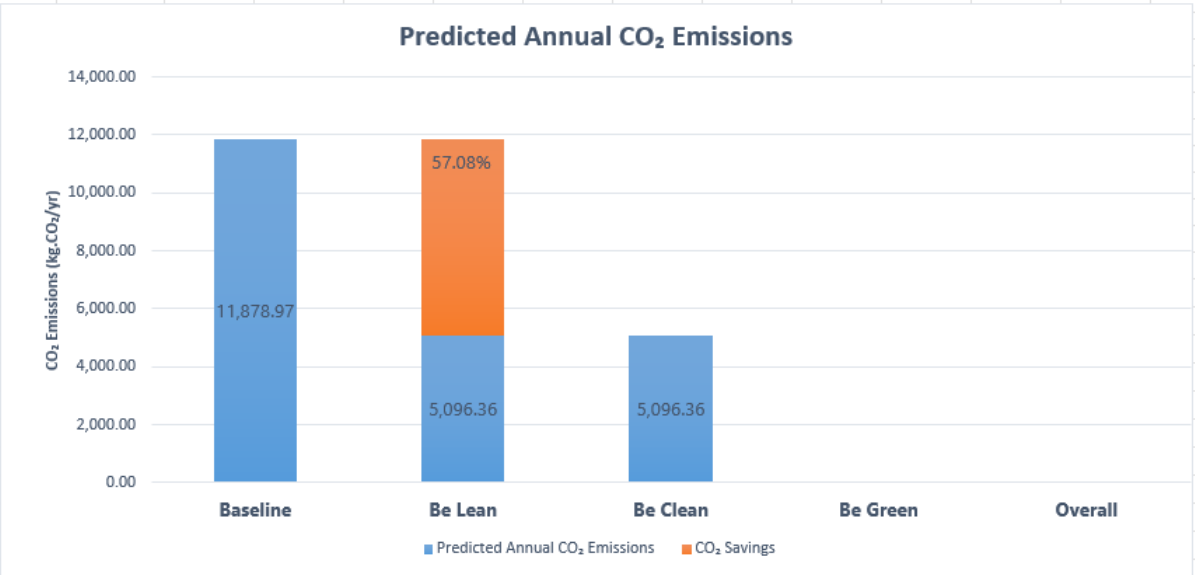
Figure 6: London Heat Map



Indicated in figure 8 above is a proposed heat network extending in proximity to St Pancras, however as stated previously, an all-electric strategy has been pursued on this project to take advantage of the upcoming SAP 10 changes that will drastically improve the carbon fuel factor for grid electricity and therefore the overall carbon reduction potential.

As a result, no CO_2 reduction can be achieved as part of the section of the Energy Hierarchy as described by the graph below.

Figure 7: Be Clean Carbon Emissions Current 2021 Building Regulations

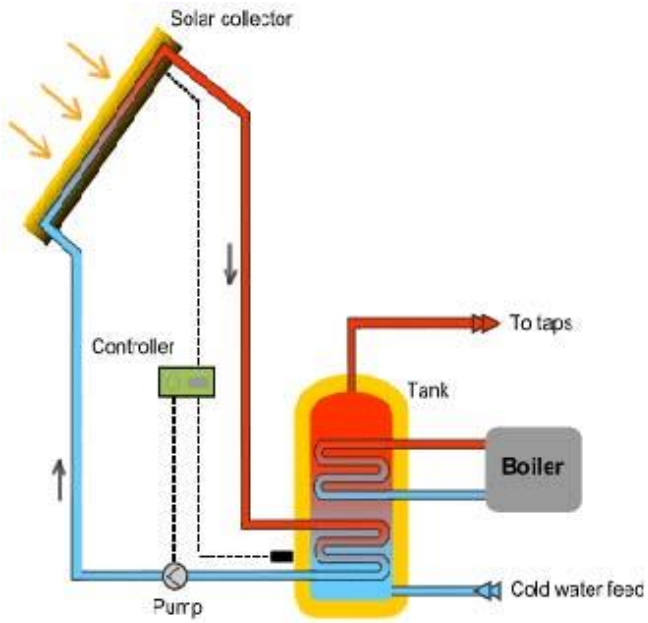


4.4 LOW & ZERO CARBON TECHNOLOGIES

4.4.1 General

Low and zero carbon (LZC) technologies are systems that generate energy with either zero or reduced CO2 emissions when compared against traditional energy generation methods.

Figure 8: Solar Thermal Diagram



The alternative LZC technologies have been assessed in relation to the development and their viability assessed. Some of the LZCs are intrinsically unsuitable due to the development type and location whereas others are potentially viable.

4.4.2 Solar Water Heating

Solar thermal panels utilise the suns energy to generate hot water for use within the building. The panels are commonly provided in either flat plate or evacuated tube arrangements. The panels are ideally located facing south at an approximate 30° inclination angle in areas where they are not subjected to shade.

Solar thermal water heating will introduce further piping into the dwellings which will emit heat and increase the mechanical ventilation and cooling load therefore increasing the energy demand. Roof space priority has also been given to Photovoltaics which will be providing the development with renewable energy and directly address the requirements of the London Plan. As such roof space for Solar water heating is limited.

This system alone would not generate a large enough CO_2 reduction in proportion to other comparable technologies. This technology has also been discounted due to the inflated cost of installation with regards additional pipe runs, maintenance requirements and the significant roof area that would be required. For these reasons, this technology has been discounted.

4.4.3 Wind Turbines

Wind turbines generate electrical energy derived from kinetic energy provided by the local wind resource. The performance of wind turbines depends greatly on the wind speed and turbulence that in turn is influenced by the terrain and installation height.

Figure 9: Typical Small Scale 6kW Wind Turbine

The use of wind turbines on the development will also have a significant visual impact on the city centre location and neighbouring buildings, as well as low frequency noise source and hence it is likely to meet opposition within the local area.

For the reasons detailed above wind turbines are not considered viable for the development.

4.4.4 Photovoltaic Cells (PV)

Photovoltaic (PV) panels utilise the sun's energy to generate electricity. The optimum location for PV panels is south facing at an approximate 30° inclination angle in areas where they are not subjected to shade.

Figure 10: PV Examples

Photovoltaic panels have been included in the design in order to achieve compliance with the Target Primary Energy Rate metric now mandatory within Part L Volume 1 2021. The current design incorporates this technology to also comply with policy CC1 of the Camden Local Plan and achieve at least 20% CO_2 reduction between the Be Lean and Be Green stages, isolating the benefit of the PV. The size of the installation may vary, and the number of panels requirement may change as the design progresses and a final panel specification has been chosen.

The final installed kWp distribution will be assigned based on an area weighted calculation in accordance with the SAP methodology with all dwellings receiving connection to the PV. The final SAP ratings, DER and DPER values per dwelling may therefore change as the design progresses.

At this stage 12kWp total which translates to approximately 55.28m^2 total assuming the use of 560W panels is included in SAP Calculations. The final installed amount may change as the design progresses.

4.4.5 Source Heating and Cooling

The Air Source Heat Pumps can be linked with indoor units to heat and cool spaces. These could be either ceiling mounted cassette units, wall mounted units or floor mounted units. This option therefore has good flexibility in terms of installation. The outdoor units can be located anywhere and are not dependant on orientation. They need to be externally mounted and in a local compound to be safe.

ASHP technology is included in the current design and will provide both heating via wet underfloor emitters and hot water to all dwellings to support the low carbon all electric strategy. Comfort cooling is not included in the current design.

The final chosen ASHP product will be determined as the design develops however the SCOP performance will be 3.4 or above.

4.4.6 Biomass Boiler

Biomass is considered to be a renewable fuel source as the CO2 absorbed during the growth period is assessed as being approximately equal to the CO2 emitted during combustion and hence deemed "carbon neutral". Biomass for boilers is typically wood either in chip or pellet form. Biomass boilers require fuel storage together with associated transportation and delivery to the store location.

Figure 11: Biomass Example

With the minimal plant areas, logistics of deliveries etc and the domestic nature of the development it is not considered viable to transport wood pellets or similar to the building. For the above reasons, the use of a biomass boiler plant is not considered viable for the development.

4.4.7 Fuel Cell

The fuel cell technology essentially converts chemical energy into both electrical and heat energy. The cell needs to be continually supplied with hydrogen (derived from either a piped or storage source) and oxygen (derived from air) that are combined and the chemical reaction produce electrical energy, heat energy and water vapour.

The fuel cell requires a hydrogen fuel source that can either be from a piped source (not currently available) or from stored gas. However, the more usual approach currently in the UK is to use natural gas in order to generate the hydrogen required to operate the fuel cell.

Fuel cells have various commercial and technical limitations. There is a high initial capital cost together with there being few established suppliers and a very limited specialist design, installation and maintenance capabilities. Certain fuel cell elements require regular replacement imposing a significant on-going cost implication. The fuel cells themselves are generally large, heavy and require fresh air ventilation.

Due to the initial capital cost, space requirements and on-going maintenance costs fuel cells are not considered viable for this development.

4.5 WATER

The dwellings will be designed to reduce mains/potable water and include water efficient devices and equipment. This will comprise of efficient water fixtures (low flow taps and showers, dual flush WCs and low volume baths) to reduce potable water demand to <105litres/person/day as per the requirement within Building Regulations and adhering to Camden Local policy CC3 and the London Plan requirements.

This will be done through the use of low flow rate sanitaryware, low-capacity baths and the use of flow restrictors throughout the dwelling.

An example of the flow rates and capacities that could potentially be used are as follows. Please note these are a guide at this stage and actual figures may differ at the time of construction. However, they will fall within the required level:

- WC – Dual Flush – 6/3 Litre Flush capacity
- Bath – 130 Litre capacity
- Wash hand basin taps – 5 L/min
- Kitchen sink taps – 7L/min
- Shower – 7L/min

The estimated usage per person per days shall be 100 l/person/day which is lower than the required standard.

4.5.1 Rainwater Reclamation

The use of rainwater reclamation has become increasingly common and recognised as an effective means of dramatically reducing water consumption in a wide range of applications. In their simplest form rainwater systems comprise of a rainwater collection tank (water butt) which collects rainwater from the building for irrigation of the garden areas, to further reduce potable water consumption and promote the recycling of rainwater.

4.5.2 Surface Water Run Off

The development will comprise a combination of soft landscaping and permeable paving to mitigate surface water discharge from the development.

4.6 CHOSEN RENEWABLE SOLUTION

Following the above review of various LZC technology the chosen solution for this strategy is to supplement the current mechanical and electrical design with photovoltaic (PV) technology. This will supply renewable energy to each dwelling based on area weighted average, ensure compliance with Part L 2021 and support policies SI2 and CC1 of the London Local Plan and the Camden Local Plan which promote the use of low/zero carbon technology.

The following tables demonstrates the reduction in CO2 emissions calculated on an area weighted average, via the "BE GREEN" energy efficiency measures mentioned above for the building:

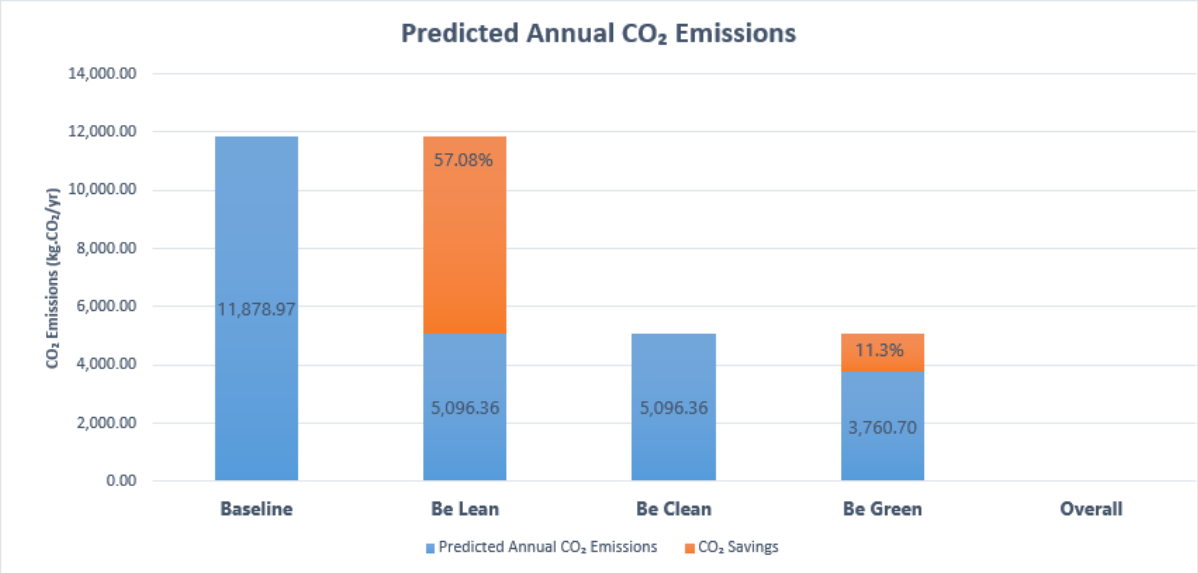
Table 11: 2021 Building Regulations Be Green Emissions

Regulated Emissions	**Baseline CO_2 Emissions**	**BE LEAN Building CO_2 Emissions**	**BE CLEAN Building CO_2 Emissions**	**BE GREEN Building CO_2 Emissions**	**Total Cumulative CO_2 Emission Savings**	**% Reduction in CO_2 Emissions**
Kg of CO2/m2/yr.	12.54	5.38	5.38	3.97	8.57	**68.36%**
Kg of CO2/yr.	11,878.97	5,096.36	5,096.36	3,760.7	8,118.25	**68.36%**

Through the provision of low carbon technology, regulated on-site annual CO2 emissions have been significantly reduced beyond the Part L defined baseline target emission rates. The strategy therefore supports the low carbon/renewable technology objectives of the Camden Local Plan and the London Local Plan.

As per the above table the $kgCO_2$ /m2/yr reduction difference between the Be Lean stage (5.38) and the Be Green stage (3.97) equals 26.21% which exceeds the required 20% reduction from renewable sources in accordance with policy CC1. Appendix A contains the true Be Lean stage block compliance DER which does not include any PV benefit in line with the Energy Hierarchy. A Be Green stage block compliance DER is also available in Appendix A which includes proposed PV. As both block compliance calculations are produced via an approved calculation tool (Design SAP 10 in this instance), these block compliance calculations should take precedence in the verification of achieved DERs and by extension, the calculated CO2 reduction achieved through the inclusion of proposed PV renewable technology.

Figure 12: Be Green Carbon Emissions Current 2021 Building Regulations



4.7 CARBON OFFSET

It is stated within the London Plan 2021 that all new developments in London must achieve Zero Carbon target. A minimum 35% reduction in CO_2 emissions must be made on site (with a further benchmark of 50% as stated earlier) through the Energy Hierarchy and then the remainder of the regulated residential CO_2 emissions that have not been reduced through onsite measures, are to be off set through a cash in lieu of contribution scheme to the relevant borough.

This contribution is to be used for the delivery of CO_2 savings through communal schemes. The contribution figure used to calculate the overall contribution of a site is outlined within the Mayor's Housing Standards Viability Assessment and is described as:

The remaining CO_2 in tonnes multiplied by £95 per tonne for 30 years.

The results for this site are shown in the calculation table below. Please note this is based on As Designed figures and may change at the point of completion.

Table 12: Carbon Offset Figure 2021 Building Regulations

Carbon Contribution Viability Assessment			
Pounds Per Tonne Per Annum £/T/yr	**Residual CO2 Emissions not dealt with on-site in tonnes**	**Residual CO2 Emissions 30 Years**	**Estimated Contribution**
£95	3.97	30 x 3.97 = 119.1 tonnes	£11,314.5

5 CONCLUSION

The Energy Strategy for the proposed development at Harrington Square has adopted a hierarchical approach of using passive and low energy design technologies to reduce the baseline energy demand and hence CO_2 emissions followed by the application of low and zero carbon technologies as appropriate.

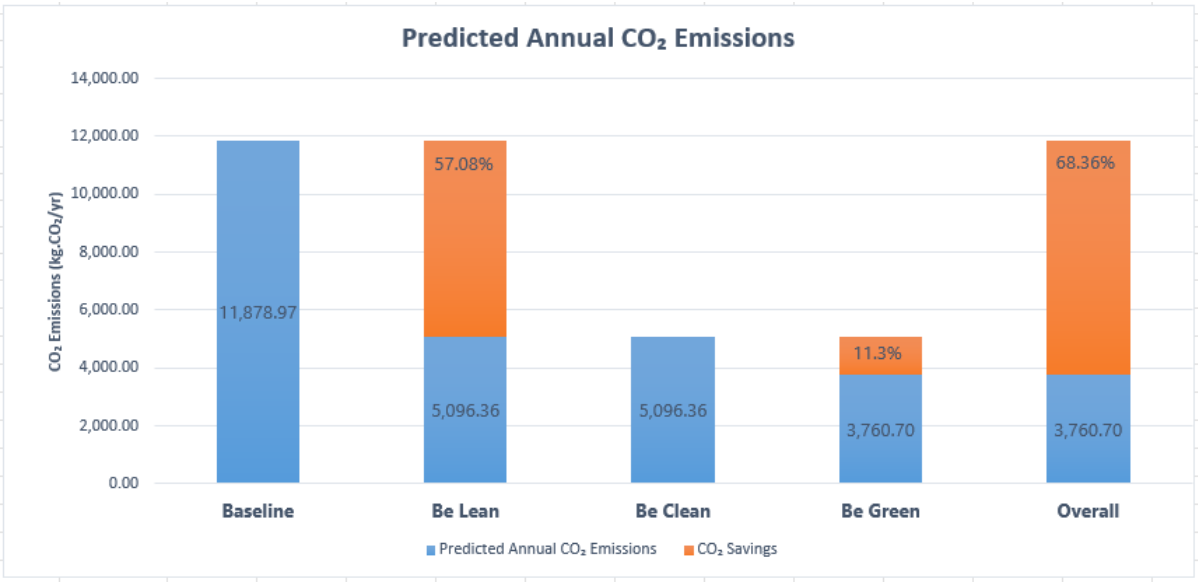
This is supported by the SAP reports to provide compliance in England with the Building Regulations Part L 2021, issued with this report.

The analysis has shown that by incorporating passive and low energy design measures, there is a reduction of 68.36% for the developments annual corrected CO_2 baseline emissions under the 2021 Building Regulations. This is achieved by incorporation of the following elements:

- Improved thermal transmittance U-valued as depicted.
- MVHR ventilation
- All-electric heating and hot water via low carbon air source heat pump technology
- PV array supplying circa 12 kWp total
- Low building air leakage rate (3.0 m^3/h/m2 at a pressure differential of 50 Pa)
- Low energy lighting to achieve efficacies of 100+lm/w for each fitting type
- Low flow aerated showerheads and basin tap inserts to reduce water consumption
- Reducing mains/potable water via water efficient devices and equipment to be at 100l/person/day

A 'Fabric First' approach has been used in this strategy then, following the stages of the Energy Hierarchy, CHP and district heating has been assessed followed by a study of various low and zero carbon technologies. The graph below demonstrates the results for each stage of the Energy Hierarchy.

Figure 13: Overall Carbon Emission 2021 Building Regulations



5 CONCLUSION

To summarise, the present 68.36% reduction in CO_2 has been achieved through the use of high-performance materials to improve the building fabric u-values, by incorporating air source heat pumps for heating and hot water, and the use of MVHR for ventilation. Photovoltaic Panels will supply renewable energy and efficient low energy lighting will be used throughout; low flow rate fixtures and fittings will be used to reduce water consumption. It is therefore the conclusion of this report that the requirements of Part L 2021 have been met; and policies SI2, SI3 and CC1 of the London Local Plan 2021/Camden Local Plan 2017 have been complied with.

6 APPENDICES

Appendix A - Block Compliance Calculations for Be Lean and Be Green Stages

Appendix B - Individual SAP Reports and Predicted EPCs (Issued Separately)

Appendix A

Block Compliance Calculations for Be Lean and Be Green Stages

Block Compliance

Block Reference	PRIMARY As-D Rev D ASHP LEAN	**Issued on Date**	19/12/2023
Block Name			
Calculation Type	New Build (As Designed)		
Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client	Domis, Domis, Unit 2, Block C , 14 Hulme Street , Salford, M5 4ZG		

Block Compliance Report - DER

Block Reference: PRIMARY As-D Rev D ASHP LEAN | **Block Name:**

Property-Assessment Reference	Floor area (m^2)	DER ($kgCO_2/m^2$)	TER ($kgCO_2/m^2$)	% DER/TER
Unit 1 GF_Copy_Copy_Copy - Unit 1 GF_Copy_Copy_Copy	97.24	5.72	14.35	60.14 %
Unit 10 3F_Copy_Copy_Copy - Unit 10 3F_Copy_Copy_Copy	112.46	4.46	10.78	58.63 %
Unit 11 4F_Copy_Copy_Copy - Unit 11 4F_Copy_Copy_Copy	135.35	5.25	12.55	58.17 %
Unit 2 GF_Copy_Copy_Copy - Unit 2 GF_Copy_Copy_Copy	96.63	6.55	16.81	61.04 %
Unit 3 FF_Copy_Copy_Copy - Unit 3 FF_Copy_Copy_Copy	87.88	6.22	11.03	43.61 %
Unit 4 FF_Copy_Copy_Copy - Unit 4 FF_Copy_Copy_Copy	65.60	5.26	11.68	54.97 %
Unit 5 FF_Copy_Copy_Copy - Unit 5 FF_Copy_Copy_Copy	49.69	6.05	14.11	57.12 %
Unit 6 2F_Copy_Copy_Copy - Unit 6 2F_Copy_Copy_Copy	87.88	4.65	11.00	57.73 %
Unit 7 2F_Copy_Copy_Copy - Unit 7 2F_Copy_Copy_Copy	65.60	5.16	11.65	55.71 %
Unit 8 2F_Copy_Copy_Copy - Unit 8 2F_Copy_Copy_Copy	49.69	5.97	13.99	57.33 %
Unit 9 3F_Copy_Copy_Copy - Unit 9 3F_Copy_Copy_Copy	99.26	4.66	10.96	57.48 %
Totals:	947.28	59.95	138.91	
Average DER = 5.38 $kgCO_2/m^2$	**% DER/TER**	PASS		
Average TER = 12.54 $kgCO_2/m^2$	57.08 %			

Block Compliance Report - DFEE

Block Reference: PRIMARY As-D Rev D ASHP LEAN | **Block Name:**

Property-Assessment Reference	Floor area (m^2)	DFEE ($kWh/m^2/yr$)	TFEE ($kWh/m^2/yr$)	% DFEE/TFEE
Unit 1 GF_Copy_Copy_Copy - Unit 1 GF_Copy_Copy_Copy	97.24	44.31	45.82	3.30 %
Unit 10 3F_Copy_Copy_Copy - Unit 10 3F_Copy_Copy_Copy	112.46	30.96	33.28	6.97 %
Unit 11 4F_Copy_Copy_Copy - Unit 11 4F_Copy_Copy_Copy	135.35	41.97	45.07	6.88 %
Unit 2 GF_Copy_Copy_Copy - Unit 2 GF_Copy_Copy_Copy	96.63	52.80	56.73	6.93 %
Unit 3 FF_Copy_Copy_Copy - Unit 3 FF_Copy_Copy_Copy	87.88	28.94	29.35	1.41 %

Block Compliance

Unit 4 FF_Copy_Copy_Copy - Unit 4 FF_Copy_Copy_Copy	65.60	26.21	25.84	-1.45 %
Unit 5 FF_Copy_Copy_Copy - Unit 5 FF_Copy_Copy_Copy	49.69	28.89	30.41	5.00 %
Unit 6 2F_Copy_Copy_Copy - Unit 6 2F_Copy_Copy_Copy	87.88	27.18	28.90	5.95 %
Unit 7 2F_Copy_Copy_Copy - Unit 7 2F_Copy_Copy_Copy	65.60	24.39	25.74	5.23 %
Unit 8 2F_Copy_Copy_Copy - Unit 8 2F_Copy_Copy_Copy	49.69	27.61	29.47	6.34 %
Unit 9 3F_Copy_Copy_Copy - Unit 9 3F_Copy_Copy_Copy	99.26	29.41	31.28	5.99 %
Totals:	947.28	362.67	381.90	
Average DFEE = 34.36 $kgCO_2/m^2$	**% DFEE/TFEE**	PASS		
Average TFEE = 36.28 $kgCO_2/m^2$	5.28 %			

Block Compliance Report - DPER

Block Reference: PRIMARY As-D Rev D ASHP LEAN	**Block Name:**			
Property-Assessment Reference	**Floor area (m^2)**	**DPER ($kWh/m^2/yr$)**	**TPER ($kWh/m^2/yr$)**	**% DPER/TPER**
Unit 1 GF_Copy_Copy_Copy - Unit 1 GF_Copy_Copy_Copy	97.24	60.20	76.30	21.10 %
Unit 10 3F_Copy_Copy_Copy - Unit 10 3F_Copy_Copy_Copy	112.46	47.12	57.01	17.35 %
Unit 11 4F_Copy_Copy_Copy - Unit 11 4F_Copy_Copy_Copy	135.35	55.11	66.43	17.04 %
Unit 2 GF_Copy_Copy_Copy - Unit 2 GF_Copy_Copy_Copy	96.63	68.59	89.53	23.39 %
Unit 3 FF_Copy_Copy_Copy - Unit 3 FF_Copy_Copy_Copy	87.88	66.28	58.47	-13.36 %
Unit 4 FF_Copy_Copy_Copy - Unit 4 FF_Copy_Copy_Copy	65.60	56.15	62.20	9.73 %
Unit 5 FF_Copy_Copy_Copy - Unit 5 FF_Copy_Copy_Copy	49.69	64.68	75.59	14.43 %
Unit 6 2F_Copy_Copy_Copy - Unit 6 2F_Copy_Copy_Copy	87.88	49.51	58.31	15.09 %
Unit 7 2F_Copy_Copy_Copy - Unit 7 2F_Copy_Copy_Copy	65.60	55.15	62.07	11.15 %
Unit 8 2F_Copy_Copy_Copy - Unit 8 2F_Copy_Copy_Copy	49.69	63.87	74.93	14.76 %
Unit 9 3F_Copy_Copy_Copy - Unit 9 3F_Copy_Copy_Copy	99.26	49.42	58.04	14.85 %
Totals:	947.28	636.08	738.88	
Average DPER = 57.02 $kgCO_2/m^2$	**% DPER/TPER**	PASS		
Average TPER = 66.64 $kgCO_2/m^2$	14.44 %			

Block Compliance

Block Reference	PRIMARY As-D Rev D ASHP GREEN	**Issued on Date**	19/12/2023
Block Name			
Calculation Type	New Build (As Designed)		
Assessor Details	Mr. Cairn Pearson	**Assessor ID**	AW08-0001
Client	Domis, Domis, Unit 2, Block C , 14 Hulme Street , Salford, M5 4ZG		

Block Compliance Report - DER

Block Reference: PRIMARY As-D Rev D ASHP GREEN | **Block Name:**

Property-Assessment Reference	Floor area (m^2)	DER ($kgCO_2/m^2$)	TER ($kgCO_2/m^2$)	% DER/TER
Unit 1 GF_Copy_Copy - Unit 1 GF_Copy_Copy	97.24	4.31	14.35	69.97 %
Unit 10 3F_Copy_Copy - Unit 10 3F_Copy_Copy	112.46	3.04	10.78	71.80 %
Unit 11 4F_Copy_Copy - Unit 11 4F_Copy_Copy	135.35	3.84	12.55	69.40 %
Unit 2 GF_Copy_Copy - Unit 2 GF_Copy_Copy	96.63	5.14	16.81	69.42 %
Unit 3 FF_Copy_Copy - Unit 3 FF_Copy_Copy	87.88	4.81	11.03	56.39 %
Unit 4 FF_Copy_Copy - Unit 4 FF_Copy_Copy	65.60	3.84	11.68	67.12 %
Unit 5 FF_Copy_Copy - Unit 5 FF_Copy_Copy	49.69	4.63	14.11	67.19 %
Unit 6 2F_Copy_Copy - Unit 6 2F_Copy_Copy	87.88	3.24	11.00	70.55 %
Unit 7 2F_Copy_Copy - Unit 7 2F_Copy_Copy	65.60	3.74	11.65	67.90 %
Unit 8 2F_Copy_Copy - Unit 8 2F_Copy_Copy	49.69	4.55	13.99	67.48 %
Unit 9 3F_Copy_Copy - Unit 9 3F_Copy_Copy	99.26	3.24	10.96	70.44 %
Totals:	947.28	44.38	138.91	
Average DER = 3.97 $kgCO_2/m^2$	**% DER/TER**	PASS		
Average TER = 12.54 $kgCO_2/m^2$	68.36 %			

Block Compliance Report - DFEE

Block Reference: PRIMARY As-D Rev D ASHP GREEN | **Block Name:**

Property-Assessment Reference	Floor area (m^2)	DFEE ($kWh/m^2/yr$)	TFEE ($kWh/m^2/yr$)	% DFEE/TFEE
Unit 1 GF_Copy_Copy - Unit 1 GF_Copy_Copy	97.24	44.31	45.82	3.30 %
Unit 10 3F_Copy_Copy - Unit 10 3F_Copy_Copy	112.46	30.96	33.28	6.97 %
Unit 11 4F_Copy_Copy - Unit 11 4F_Copy_Copy	135.35	41.97	45.07	6.88 %
Unit 2 GF_Copy_Copy - Unit 2 GF_Copy_Copy	96.63	52.80	56.73	6.93 %
Unit 3 FF_Copy_Copy - Unit 3 FF_Copy_Copy	87.88	28.94	29.35	1.41 %

Block Compliance

Unit 4 FF_Copy_Copy - Unit 4 FF_Copy_Copy	65.60	26.21	25.84	-1.45 %
Unit 5 FF_Copy_Copy - Unit 5 FF_Copy_Copy	49.69	28.89	30.41	5.00 %
Unit 6 2F_Copy_Copy - Unit 6 2F_Copy_Copy	87.88	27.18	28.90	5.95 %
Unit 7 2F_Copy_Copy - Unit 7 2F_Copy_Copy	65.60	24.39	25.74	5.23 %
Unit 8 2F_Copy_Copy - Unit 8 2F_Copy_Copy	49.69	27.61	29.47	6.34 %
Unit 9 3F_Copy_Copy - Unit 9 3F_Copy_Copy	99.26	29.41	31.28	5.99 %
Totals:	947.28	362.67	381.90	
Average DFEE = 34.36 $kgCO_2/m^2$	**% DFEE/TFEE**	PASS		
Average TFEE = 36.28 $kgCO_2/m^2$	5.28 %			

Block Compliance Report - DPER

Block Reference: PRIMARY As-D Rev D ASHP GREEN	**Block Name:**			
Property-Assessment Reference	**Floor area (m^2)**	**DPER ($kWh/m^2/yr$)**	**TPER ($kWh/m^2/yr$)**	**% DPER/TPER**
Unit 1 GF_Copy_Copy - Unit 1 GF_Copy_Copy	97.24	48.17	76.30	36.87 %
Unit 10 3F_Copy_Copy - Unit 10 3F_Copy_Copy	112.46	35.31	57.01	38.06 %
Unit 11 4F_Copy_Copy - Unit 11 4F_Copy_Copy	135.35	43.38	66.43	34.70 %
Unit 2 GF_Copy_Copy - Unit 2 GF_Copy_Copy	96.63	56.54	89.53	36.85 %
Unit 3 FF_Copy_Copy - Unit 3 FF_Copy_Copy	87.88	54.04	58.47	7.58 %
Unit 4 FF_Copy_Copy - Unit 4 FF_Copy_Copy	65.60	43.94	62.20	29.36 %
Unit 5 FF_Copy_Copy - Unit 5 FF_Copy_Copy	49.69	52.29	75.59	30.82 %
Unit 6 2F_Copy_Copy - Unit 6 2F_Copy_Copy	87.88	37.50	58.31	35.69 %
Unit 7 2F_Copy_Copy - Unit 7 2F_Copy_Copy	65.60	42.95	62.07	30.80 %
Unit 8 2F_Copy_Copy - Unit 8 2F_Copy_Copy	49.69	51.48	74.93	31.30 %
Unit 9 3F_Copy_Copy - Unit 9 3F_Copy_Copy	99.26	37.44	58.04	35.49 %
Totals:	947.28	503.04	738.88	
Average DPER = 44.98 $kgCO_2/m^2$	**% DPER/TPER**	PASS		
Average TPER = 66.64 $kgCO_2/m^2$	32.51 %			