ENERGY STATEMENT

WATKINS PAYNE PARTNERSHIP

247 TOTTENHAM COURT ROAD

JULY 2020

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247 Tottenham Court Road
London

Energy Strategy

Planning Submission

Client Name:	Prudential UK Real Estate Nominee 1 Limited and Prudential UK Real Estate Nominee 2 Limited.
Client Address:	10 Fenchurch Avenue London EC3H 5AG 10 Fenchurch Avenue
Property:	247 Tottenham Court Road, London, W1T 7HH; 3 Bayley Street, London, WC1B 3HA; 1 Morwell Street, London, WC1B 3AR; 2-3 Morwell Street, London, WC1B 3AR; and 4 Morwell Street, London, W1T 7QT.
Project Reference:	4650
Issue:	Planning Submission
Date:	July 2020
Prepared by:	JH/MW
Checked by:	MDC
Validated by:	MDC

C O N T E N T S

EXECUTIVE SUMMARY

The energy strategy has been prepared on behalf of Prudential UK Real Estate Nominee 1 Limited and Prudential UK Real Estate Nominee 2 Limited in support of an application at 247 Tottenham Court Road, London for full planning permission for demolition of 247 Tottenham Court Road, 3 Bayley Street, 1 Morwell Street, 2-3 Morwell Street and 4 Morwell Street and the erection of a mixed use office led development comprising ground plus five storey building for office (Class B1) use, flexible uses at ground and basement (Class A1/A2/A3/B1/D1/D2), residential (Class C3) use, basement excavation, provision of roof terraces, roof level plant equipment and enclosures, cycle parking, public realm and other associated works.

The energy strategy adopts a hierarchical approach using passive and low energy design technologies to reduce baseline energy demand and CO_2 emissions followed by the application of low and zero carbon technologies. The target of the energy strategy is to demonstrate a minimum overall 35% reduction in carbon dioxide emissions in line with the current London Plan however consideration is also given to the emerging London Plan whereby the target will be a 100% reduction in carbon dioxide emissions with a 15% reduction for non-domestic and 10% for domestic is met by energy efficiency measures alone.

The energy strategy has been produced using the updated SAP 10 carbon emission factors and supporting documentation from the GLA.

The focus of this energy strategy is on CO_2 reduction by using a highly efficient building envelope with high efficiency mechanical and electrical services, along with air source heat pumps and photovoltaic (PV) cell renewable technology.

The carbon dioxide emission and saving values for the proposed development are as follows:

Commercial – Office

The carbon dioxide emissions and associated savings for the commercial elements of the Proposed Development are as follows:

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Building Regulations 2013 Part L Compliant Development	90.17	182.60
After energy demand reduction (Be Lean)	68.18	160.61
After potential heat network (Be Clean)	68.18	160.61
After renewable energy (Be Green)	37.37	129.80

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be Lean: Saving from energy demand reduction	21.99	24.4%
Be clean: Saving from heat network	0.00	0.0%
Be Green: Saving from heat renewable energy	30.81	45.2%
Total cumulative on-site savings	**52.80**	**58.06%**
Carbon shortfall	37.37	-

	Tonnes CO_2
Cumulative savings for offset payment	1,121.07
Cash-in-lieu contribution	£106,501.51

Commercial – Retail

The carbon dioxide emissions and associated savings for the retail elements of the Proposed Development are as follows:

	CO_2 Emissions (Tonnes per annum)	
	Regulated	Unregulated
Baseline Building Regulations 2013 Part L Compliant Development	23.00	37.50
After energy demand reduction (Be Lean)	26.19	40.60
After potential heat network (Be Clean)	26.19	40.60
After renewable energy (Be Green)	20.67	35.17

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	% Improvement
Be Lean: Saving from energy demand reduction	-3.19	-13.86%
Be clean: Saving from heat network	0.00	0.00%
Be Green: Saving from heat renewable energy	5.52	21.07%
Total cumulative on-site savings	2.33	10.13%
Carbon shortfall	20.67	-

	Tonnes CO_2
Cumulative savings for offset payment	620.04
Cash-in-lieu contribution	£58,903.33

Residential

The carbon dioxide emissions and associated savings for the residential elements of the Proposed Development are as follows:

	CO_2 Emissions (Tonnes per annum)	
	Regulated	Unregulated
Baseline Building Regulations 2013 Part L Compliant Development	11.77	18.13
After energy demand reduction (Be Lean)	10.23	16.59
After potential heat network (Be Clean)	10.23	16.59
After renewable energy (Be Green)	4.19	10.54

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be Lean: Saving from energy demand reduction	1.54	13.1%
Be clean: Saving from heat network	0.00	0.0%
Be Green: Saving from heat renewable energy	6.04	59.1%
Total cumulative on-site savings	7.58	64.4%
Carbon shortfall	4.19	-

	Tonnes CO_2
Cumulative savings for offset payment	125.56
Cash-in-lieu contribution	£11,928.45

Overall Development

The carbon dioxide emissions and associated savings for the Proposed Development as a whole is as follows:

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Building Regulations 2013 Part L Compliant Development	124.94	238.23
After energy demand reduction (Be Lean)	104.60	217.89
After potential heat network (Be Clean)	104.60	217.89
After renewable energy (Be Green)	62.25	175.54

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be Lean: Saving from energy demand reduction	20.34	16.3%
Be clean: Saving from heat network	0.00	0.0%
Be Green: Saving from heat renewable energy	42.34	40.5%
Total cumulative on-site savings	**62.69**	**50.2%**
Carbon shortfall	62.25	

	Tonnes CO_2
Cumulative savings for offset payment	1,867.5
Cash-in-lieu contribution	£177,414.74

As shown within the tables above, the total cumulative savings exceed the minimum 35% on-site carbon reduction target for both commercial and residential but cannot fully achieve the zero-carbon overall target. Therefore, a payment in lieu contribution of £177,414.74 to the Council to offset to zero carbon would be

secured by S106 legal agreement. For clarity the contribution payment is based on a rate of £95/tonne CO_2.

1.00 INTRODUCTION

1.01 Purpose

This report has been prepared on behalf of Prudential UK Real Estate Nominee 1 Limited and Prudential UK Real Estate Nominee 2 Limited for the demolition of 247 Tottenham Court Road, 3 Bayley Street, 1 Morwell Street, 2-3 Morwell Street and 4 Morwell Street and the erection of a mixed use office led development comprising ground plus five storey building for office (Class B1) use, flexible uses at ground and basement (Class A1/A2/A3/B1/D1/D2), residential (Class C3) use, basement excavation, provision of roof terraces, roof level plant equipment and enclosures, cycle parking, public realm works including new hard and soft landscaping and works to the public highway, relocation of the existing Santander cycles from Bayley Street to create pocket park and other associated works (Proposed Development). This document assesses the proposed energy strategy in line with the energy hierarchy set out in the new London Plan (intent to publish) revision, December 2019.

The report contains the predicted energy and carbon emission assessment results for the development and identifies savings from the proposed low and zero carbon technologies which will be incorporated into the scheme.

The energy and carbon dioxide emission assessment has been undertaken using dynamic simulation modelling software EDSL TAS Version 9.5 and Elmhurst Design SAP 2012 version 4.12 for the residential. Based on the building design submitted with the planning application the modelling will identify the energy and carbon dioxide savings related to the building envelope design and efficient mechanical and electrical services systems followed by the improvement using the proposed low and zero carbon (renewable) technologies for the scheme.

1.02 Servicing Strategy

The servicing strategy for the office accommodation, of the Proposed Development, which will be fitted out to a Category A standard is as follows:

Office area heating and cooling	Underfloor heating and cooling system coupled with variable refrigerant flow air source heat pumps to provide the heating and cooling requirements to the underfloor zone units
Reception & lift lobby heating and cooling	Refrigerant based fan coil units served by local air source heat pump (ASHP) installation
Core area heating	Electric panel heaters
Ventilation	Mechanical supply and extract ventilation systems with heat recovery thermal wheel to serve the office areas and basement areas. Dedicated extract systems serving the toilet accommodation, refuse area, cycle storage etc. The scheme is being future proofed with ventilation apertures adjacent to the windows to allow the commercial areas of the development to operate in mixed mode in the future when the air quality and noise along Tottenham Court Road allow.

Domestic hot water	Air source heat pump with electric immersion top-up to the commuter shower and toilets facilities
Lighting	LED lamp sources with daylight dimming and occupancy detection control

The servicing strategy for the residential accommodation which will be fitted out as follows:

Residential heating and cooling	4 pipe fan coil units served by an air to water heat pump installation per apartment
Core area heating	Electric heat panels
Ventilation	Whole house mechanical ventilation unit with heat recovery which will extract air from the wet room and kitchen. Supply air will be to the living room and bedrooms
Domestic hot water	Air to water heat pump shall provide domestic hot water as well as the heating/cooling to the apartment.
Lighting	LED lamp sources

The fitting out of the shell unit for a specific process will require bespoke systems to suit the tenant's individual needs arising at the time of letting and this fit out will require assessment under ADL2A.

The assumed servicing strategy included in the modelling for the shell flexible use unit will be as follows:

Heating and Comfort Cooling	Air source heat pumps serving refrigerant based variable refrigerant flow (VRF) comfort cooling and heating systems.
Ventilation	Mechanical supply and extract ventilation with heat recovery
Domestic Hot Water	Electric hot water heaters
Lighting	LED lamp sources

1.03 Reservation

This report has been prepared solely for the use of the applicant and Watkins Payne Partnership accept no responsibility for its use by any third parties.

2.00 POLICY REVIEW

2.01 National Policy

The National Planning Policy Framework sets out the planning policies for England that are to be taken into account within local planning policies. The framework itself does not have specific policies but identifies the purpose of achieving sustainable development.

2.02 London Plan (Consolidated with Alterations since 2011) 2016

The London Plan 2016 identifies key policies associated with building design and energy strategy as noted below:

Policy 5.2 Minimising Carbon Dioxide Emissions

Planning Decisions

A Development proposal should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

1 Be lean: use less energy

2 Be clean: supply energy efficiently

3 Be green: use renewable energy

B The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outline in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Non-Domestic Buildings:

Year	***Improvement on 2010 Building Regulations***
2010 – 2013	*25 per cent*
2013 – 2016	*40 per cent*
2016 - 2019	*As per Building Regulations requirements*
2019 – 2031	*Zero carbon*

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

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

a) Calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy

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

c) *Proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as decentralised heating and cooling and combined heat and power (CHP)*

d) *Proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies*

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

Policy 5.5 Decentralised Energy Networks

Strategic

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

Policy 5.6 Decentralised Energy in Development Proposals

Planning Decisions

A *Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.*

B *Major development proposals should select energy systems in accordance with the following hierarchy:*

1. *Connection to existing heating or cooling networks.*
2. *Site wide CHP network.*
3. *Communal heating and cooling.*

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

Policy 5.7 Renewable Energy

Strategic

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

Policy 5.9 Overheating and Cooling

Strategic

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

Planning Decisions

B Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1. *Minimise internal heat generation through energy efficient design*
2. *Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls*
3. *Manage the heat within the building through exposed internal thermal mass and high ceilings*
4. *Passive ventilation*
5. *Mechanical ventilation*
6. *Active cooling systems (ensuring they are the lowest carbon options)*

C Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible.

2.03 GLA Supplementary Planning Guidance

The London Plan (Consolidated with Alterations since 2011) 2016 is supported by various supplementary planning guidance (SPG) that includes "Sustainable Design and Construction" dated April 2014 that relates specifically to sustainability issues.

The Sustainable Design and Construction SPG sets out the Mayor's priorities and the Mayor's best practice for new developments encompassing a wide range of sustainability topics.

The major change to the carbon emission savings targets for the April 2014 edition of the SPG is that the overall saving target is benchmarked against a Building Regulations Part L2A:2013 Baseline and not Part L2A:2010. This change gives a revised carbon emission reduction target of 35% less than Part L2A:2013.

The relevant sections from the Sustainable Design and Construction SPG are as follows:

Energy and Carbon Dioxide Emissions	
Mayor's Priority	**London Plan Policy**
The overall carbon dioxide emissions from a development should be minimized through the implementation of the energy hierarchy set out in the FALP 2016 Policy 5.2.	5.2, 5.3
Developments should be designed to meet the following Regulated carbon dioxide standards, in line with MALP 2016 Policy 5.2.	5.2

Non-Domestic Buildings • Year - Improvements beyond 2010 Building Regulations. • 1st October 2013 – 2016 – 40 per cent • 2016 – 2019 – As per Building Regulation requirements • 2019 – 2031 – Zero carbon	5.2
Mayor's Best Practice	**London Plan Policy**
Developments should contribute to ensuring resilient energy infrastructure and a reliable energy supply, including from local low and zero carbon sources.	5.1, 5.5, 5.6, 5.7, 5.8, 5.17
Developers are encouraged to include innovative low and zero carbon technologies to minimize carbon dioxide emissions within developments and keep up to date with rapidly improving technologies.	5.2, 5.17
Energy Demand Assessment	
Mayor's Priority	**London Plan Policy**
Development applications are to be accompanied by an energy demand assessment.	5.2
Use Less Energy	
Mayor's Priority	**London Plan Policy**
The design of developments should prioritise passive measures.	5.2, 5.3, 5.9
Mayor's Best Practice	**London Plan Policy**
Developers should aim to achieve Part L 2013 Building Regulations requirements through design and energy efficiency alone, as far as is practical.	5.2, 5.3
Efficient Energy Supply	
Mayor's Priority	**London Plan Policy**
Where borough heat maps have identified district heating opportunities, boroughs should prepare more detailed Energy Master Plans (EMPs) to establish the extent of market competitive district heating networks.	5.5, 5.6
Mayor's Priority	**London Plan Policy**
Developers should assess the potential for their development to: • connect to an existing district heating or cooling network; • expand an existing district heating or cooling network, and connect to it; or • establish a site wide network and enable the connection of existing buildings in the vicinity of the development.	5.5, 5.6
Mayor's Priority	**London Plan Policy**
Where opportunities arise, developers generating energy or waste heat should maximize long term carbon dioxide savings by feeding the decentralized energy network with low or zero carbon hot, and where required, cold water.	5.5, 5.6

Renewable Energy	
Mayor's Priority	**London Plan Policy**
Boroughs and neighbourhoods should identify opportunities for the installation of renewable energy technologies in their boroughs and neighbourhoods.	5.4, 5.7
Major development should incorporate renewable energy technologies to minimize overall carbon dioxide emissions, where feasible.	5.7
Carbon Dioxide Off-setting	
Mayor's Priority	**London Plan Policy**
Boroughs should establish a carbon off-set fund and identify suitable projects to be funded.	5.2, 5.4
Where developments do not achieve the Mayor's carbon dioxide reduction targets set out in MALP 2016 Policy 5.2, the developer should make a contribution to the local borough's carbon dioxide off-setting fund.	5.2, 5.4
Retrofitting	
Mayor's Priority	**London Plan Policy**
Boroughs should set out policies to encourage the retrofitting of carbon dioxide and water saving measures in their borough.	5.4, 5.15
Where works to existing developments are proposed developers should retrofit carbon dioxide and water saving measures.	5.4, 5.15
Monitoring Energy Use	
Mayor's Best Practice	**London Plan Policy**
Developers are encouraged to incorporate monitoring equipment and systems where appropriate to enable occupiers to monitor and reduce their energy use.	5.2, 5.3
Supporting a Resilient Energy Supply	
Mayor's Best Practice	**London Plan Policy**
Developers are encouraged to incorporate equipment that would enable their schemes to participate in demand side response opportunities.	5.2, 5.3
Climate Change Adaptation	
Tackling Increased Temperature and Drought	
Overheating	
Mayor's Priority	**London Plan Policy**
Developers should include measures, in the design of their schemes, in line with the cooling hierarchy set out in MALP 2016 Policy 5.9 to prevent overheating over the schemes life-time.	5.3, 5.9

2.04 Emerging London Plan

The new London Plan (intent to publish) version, dated December 2019 with a draft supplementary energy strategy guidance update issued in April 2020. Adoption is expected in 2020. The key change relating to energy usage is detailed below in Policy SI2:

Policy SI2 Minimising greenhouse gas emissions

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 Regulations 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 life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

2.05 Camden Council Local Plan

The London Borough of Camden Local Plan adopted June 2017 identify key policies associated with climate change adaption and mitigation as noted below.

Policy CC1 Climate change mitigation

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.
We will:

a) promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
b) require all major development to demonstrate how London Plan targets for carbon dioxide 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:

a) working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
b) 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
c) requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

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

Policy CC2 Adapting to climate change

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

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

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

Sustainable design and construction measures

The Council will promote and measure sustainable design and construction by:

a) ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;
b) encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;
c) encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and
d) expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.

3.00 OUTLINE METHODOLOGY

3.01 Energy Strategy

The fundamental approach for the energy strategy is as set out below for the residential element:

- Establish the baseline energy demand in line with statutory requirements in terms of Building Regulations Part L1A:2013 compliance using SAP calculations for a sample of apartment types across the development of different sizes and orientations.
- Establish the baseline energy demand in line with statutory requirements in terms of Building Regulations Part L2A: 2013 compliance using accredited thermal modelling software for the landlords' common areas.

For the commercial element:

- Establish the baseline energy demand in line with statutory requirements in terms of Building Regulations Part L2A 2013 compliance using accredited thermal modelling software for the commercial and retail areas of the development.

All elements of the development then follow the approach set out below:

- Adopt passive and low energy design techniques in order to reduce the energy demand for the development beyond the baseline energy demand requirements (lean scheme).
- Assess the potential decentralised heating, cooling and power measures available to suit this development, adopt the measures that are suitable and establish potential energy/carbon dioxide reduction for viable solutions (clean scheme).
- Assess the potential low and zero carbon (renewable) technologies to suit the development, adopt the measures that are suitable and establish potential energy/carbon dioxide reduction for viable solutions (green scheme).
- Establish the anticipated energy and carbon dioxide emission reductions for the development using Building Regulations 2013 calculation methodologies.

In line with the Draft Energy Assessment Guidance issued by the GLA (April 2020) the results have been calculated using the current carbon factors and then back calculated using the updated SAP 10 carbon factors to obtain the results found within this energy strategy.

This approach is in line with the principles detailed within the relevant policy statements and regulatory guidelines listed in section 2.00.

3.02 Energy Strategy Target

In accordance with the emerging London Plan planning policies the target regulated carbon emission savings for this project when compared to a Building Regulations Part L1A: 2013 and Part L2A:2013 compliant baseline are:

- A minimum 35% carbon reduction on site
- An overall target of net zero carbon i.e. a 100% carbon reduction
- A minimum carbon reduction requirement 15% for commercial and 10% for residential due to energy efficiency measures alone.

3.03 Overheating

The approach adopted for the office accommodation overheating analysis is in line with CIBSE TM52.
The approach adopted for the residential apartment overheating analysis is in line with CIBSE TM59. A selected sample of apartments across the development have been assessed against the CIBSE TM59 overheating criteria.

The TM52 and TM59 overheating analysis form separate reports that should be read in conjunction with this energy strategy. These can be found in the Appendix.

4.00 ENERGY DEMAND ASSESSMENT

4.01.01 General

The energy demand work associated with the apartments has been undertaken using Elmhurst Energy Design SAP software version 4.12 which incorporates calculations set out in the SAP 2012 document in order to establish a carbon dioxide emission rate in line with Part L1A: 2013.

The energy demand assessment work associated with office, retail and landlord areas has been undertaken using EDSL TAS dynamic simulation software Version 9.5.0 that incorporates the SBEM calculation methodology in line with Building Regulations Part L2A: 2013 requirements in order to generate a predicted annual CO_2 emission rate.

Within the energy demand assessment, the following updated SAP 10 fuel carbon dioxide emission intensity factors have been used in line with Part L2A: 2013.

Fuel	kg CO_2 / kWhr
Natural gas	0.210
Grid supplied electricity	0.233
Grid displaced electricity	0.233

4.01.02 Regulated and Un-Regulated Energy

The planning application energy strategy will be provided in a format that reflects the recommendations of the adopted GLA document “Energy Assessment Guidance – Great London Authority guidance on preparing energy assessments as part of planning applications (April 2020)”.

Therefore, this framework energy strategy shows how policy compliance for the “regulated” energy can be achieved at the Proposed Development and makes reference to the estimated “un-regulated” energy usage by means of energy benchmarks.

For clarity “regulated” and “un-regulated” energies are summarised as follows:

- Regulated Energy — This is the energy covered by Approved Document L2A of the Building Regulations i.e. the energy used in heating, cooling, fans and pumps plus domestic hot water
- Un-regulated Energy — This is energy used within a building that is not covered by the Building Regulations i.e. the energy used for general small power loads, lifts, external lighting, catering electricity etc.

The planning policy CO_2 reduction targets are based in “regulated” energy only. Hence the percentage CO_2 emission savings target is not adversely affected by the estimated “un-regulated” energy in a building.

The unregulated energy use assessment for the apartments is based upon the principles defined within the SAP software calculation procedure that principally accounts for energy usage from appliances and cooking equipment.

The assessed un-regulated energy uses for the office, retail and landlord areas at the site are as follows:

General small power
Lifts
External lighting
Catering electricity (if used)
Computer room power

4.01.03 Energy Benchmarks

4.01.03.01 Office and Retail Units

The "un-regulated" energy use and benchmarks for this energy strategy have been derived from data and guidance taken from the following Chartered Institute of Building Services Engineers (CIBSE) documents:

1. CIBSE Guide F – Energy Efficiency in Buildings: 2012
2. CIBSE Technical Memorandum – Energy Benchmarks TM46: 2008

The un-regulated energy use values have been derived from the CIBSE Guide F Benchmark Section. The most appropriate specific benchmarks used, and resultant estimated un-regulated energy values are as follows:

Office	Office benchmarks good practise type 3 ('Standard' Air-Conditioned Office) of 49.0 kWh/m^2/year that equates to 25.33 kgCO_2/m^2. Applying SAP10 carbon emission figures the un-regulated figures equate to 11.42 kgCO_2/m^2.
Mixed use	Standard mixed-use buildings of 57 kWh/m^2/year that equates to 29.58 kgCO_2/m^2. Applying SAP10 carbon emission figures the un-regulated figures equate to 13.28 kgCO_2/m^2.

4.01.03.02 Residential Apartments

The value from the SAP software which takes into account energy usage from appliances and cooking equipment has been converted into an area weighted value that for all the apartments equates to 6.84 kg CO_2/m^2/year.

4.02 Baseline Scheme

4.02.01 Residential Areas

For the purpose of the baseline scheme the SAP assessment has been undertaken on an individual apartment basis and then combined on an area weighted basis to give an estimated overall residential development CO_2 emission rate. These apartments are assessed in line with Part L1A: 2013 where the notional apartment (TER) form the baseline scheme.

For clarity as set out in the design and access statement (DAS) the apartment internal layouts are not fixed. The SAP calculations have been based on the typical apartment layouts shown in the DAS.

The baseline scheme carbon emissions for the target emission rate (TER) from the SAP assessment are as follows:

Apartment Type	CO_2 Emissions (kg CO_2/m^2/year)
	Residential
A1-F1	15.5
A2-F2	13.1
A3-F2	13.7
A4-F3	13.5
A5-F3	11.6
A6-F4&5	12.9
A7-F4&5	12.7
Area Weighted Part L1A: 2013 TER	**13.33**
Unregulated Uses	7.20
Total	20.53

The annual CO_2 emissions resulting from the baseline demand equates to the following:

	CO_2 Emissions (tonnes CO_2/year)
	Residential
Without un-regulated uses	11.77
With un-regulated uses	18.13

For a full list of the emissions from each selected apartment type please refer to Appendix 2 of this document.

4.02.02 Commercial Areas

The baseline demand is the Building Regulations Part L2A: 2013 target emission rate (TER) and is applied in this case to all areas of the building excluding the residential areas.

The Part L2A: 2013 TER is derived from the thermal model based on the National Calculation Methodology (NCM). The review has been carried out utilising the TAS dynamic thermal modelling software version 9.5 that has achieved accreditation from the Department of Communities and Local Government (DCLG).

The baseline CO_2 emissions for the new build and change of use elements of the building are modelled as follows:

Office Area

	CO_2 Emissions (kg CO_2/m^2/year)
	Office (B1)
Heating	0.28
Cooling	2.57
Fans and Pumps	2.21
Lighting	4.39

	CO_2 Emissions (kg CO_2/m^2/year)
	Office (B1)
Domestic Hot Water	1.69
Part L2A: 2013 TER	11.14
Unregulated Uses	11.42
Total	22.55

The annual CO_2 emissions resulting from the baseline demand equates to the following:

	CO_2 Emissions (tonnes CO_2/year)
	Office (B1)
Without un-regulated uses	90.17
With un-regulated uses	182.60

A1 Retail Area

	CO_2 Emissions (kg CO_2/m^2/year)
	Retail (A1)
Heating	0.13
Cooling	4.29
Fans and Pumps	3.59
Lighting	12.62
Domestic Hot Water	0.43
Part L2A: 2013 TER	**21.06**
Unregulated Uses	13.28
Total	**34.34**

The annual CO_2 emissions resulting from the baseline demand equates to the following:

	CO_2 Emissions (tonnes CO_2/year)
	Retail (A1)
Without un-regulated uses	23.00
With un-regulated uses	37.50

4.02.03 Development Wide Baseline CO_2 Emissions

The existing building change of use and new build baseline scheme CO_2 emissions have been combined using an area weighted calculation to show the total emissions for the development as a whole and are as follows:

	CO_2 Emissions (kg CO_2/m^2/year)
	Whole Development
Heating	0.89
Cooling	2.53

	CO_2 Emissions (kg CO_2/m^2/year)
	Whole Development
Fans and Pumps	2.18
Lighting	4.97
Domestic Hot Water	1.83
Whole Site TER	12.41
Unregulated Uses	11.25
Total	23.66

The annual CO_2 emission resulting from the baseline demand for the development equates to the following:

	CO_2 Emissions (tonnes CO_2/year)
	Whole Development
Without un-regulated uses	124.94
With un-regulated uses	238.23

4.03 Demand Reduction (Be Lean)

4.03.01 General

The energy strategy prioritises the reduction in energy consumption and hence CO_2 emissions through the building envelope design together with the use of efficient mechanical and electrical services.

The passive and low energy design principles that have been adopted in the current design include:

- High performance glazing
- Improved building fabric thermal insulation.
- Low building air leakage rate ($3m^3/hr/m^2$ at 50 Pa which represents a 70 % improvement over the minimum 2013 Building Regulations requirements).
- High efficiency heating/cooling systems.
- Whole house mechanical supply and extract ventilation systems in each apartment with integral heat recovery.
- Thermal wheel heat recovery to the office mechanical fresh air supply and extract ventilation systems.
- Variable speed fans and pumps.
- Low energy lighting (LED lamp sources) with PIR occupancy control.

The retail units within the Proposed Development are being provided on a shell basis with the fit out by the future tenant. This energy strategy therefore has to include an assumed retail tenant fit out. The servicing strategy for this assumed fit out is summarised in section 1.02 of this report, this heating and cooling strategy is included in this lean scheme analysis.

The detail of the passive and low energy design principles used within the commercial and residential can be found within the appendix. The appendix will include enhanced U-values, air tightness improvement, efficient services, lighting and glazing percentage of the building utilised for the proposed development.

4.03.02 Residential (Lean Scheme)

The Building Regulations thermal model analysis identifies the following CO_2 emissions for the residential element of the development:

	Baseline Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/m^2/year)**
A1-F1	15.45	14.11
A2-F2	13.13	10.75
A3-F2	13.68	12.08
A4-F3	13.47	11.19
A5-F3	11.55	10.05
A6-F4&5	12.92	11.26
A7-F4&5	12.70	11.18
Area Weighted Part L1A: 2013 Total	**13.33**	**11.59**
Unregulated Uses	7.20	7.20
Total	**20.53**	**18.79**

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Scheme	11.77	18.13
Lean Scheme	10.23	16.59

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be lean: savings from energy demand reduction	1.54	13.1%

4.03.03 Commercial (Lean Scheme)

The Building Regulations thermal model analysis identified CO_2 emissions for the total emissions for the commercial build elements of the development and are as follows:

Office Area

	Baseline Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/m^2/year)**
Heating	0.28	0.39

	Baseline Scheme (kg CO_2/m^2/year)	Lean Scheme (kg CO_2/m^2/year)
Cooling	2.57	2.08
Fans and pumps	2.21	2.31
Lighting	4.39	1.96
Domestic Hot Water	1.69	1.69
Part L2A: 2013 Total	**11.14**	**8.42**
Unregulated Power	11.42	11.42
Total	**22.55**	**19.84**

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Scheme	90.17	182.60
Lean Scheme	68.18	160.61

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be lean: savings from energy demand reduction	21.99	24.4%

A1 Retail Area

	Baseline Scheme (kg CO_2/m^2/year)	Lean Scheme (kg CO_2/m^2/year)
Heating	0.13	0.86
Cooling	4.29	3.77
Fans and pumps	3.59	5.61
Lighting	12.62	13.30
Domestic Hot Water	0.43	0.43
Part L2A: 2013 Total	**21.06**	**23.98**
Unregulated Power	13.28	13.28
Total	**34.34**	**37.26**

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Scheme	23.00	37.50
Lean Scheme	26.19	40.69

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be lean: savings from energy demand reduction	-3.19	-13.9%

4.03.04 Whole Development (Lean Scheme)

The Building Regulations thermal model analysis identified CO_2 emissions have been combined using area weighted calculations to show the total emissions for the development as a whole and are as follows:

	Baseline Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/m^2/year)**
Heating	0.89	0.81
Cooling	2.53	2.09
Fans and pumps	2.18	2.54
Lighting	4.97	3.09
Domestic Hot Water	1.83	1.85
Part L Total	**12.41**	**10.39**
Unregulated Power	11.25	11.25
Total	**23.66**	**21.64**

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Scheme	124.94	238.23
Lean Scheme	104.60	217.89

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be lean: savings from energy demand reduction	20.34	16.3%

4.03.05 Energy Demand Reporting

The Building Regulations thermal model analysis identifies the following annual energy demand for the commercial and residential development as a whole:

Energy Demand Following Energy Efficiency Measures (MWh/year)							
Elements	**Space Heating**	**Hot Water**	**Lighting**	**Auxiliary**	**Cooling**	**Unregulated Electricity**	**Unregulated Gas**
Residential Development	17.42	17.93	1.57	10.57	1.97	27.30	0.00
Commercial Development	17.35	61.16	130.32	106.55	296.36	381.24	0.00

4.03.06 Fabric Energy Efficiency (FEE) Reporting

The Building Regulations Part L1A: 2013 requires all residential dwellings to achieve fabric energy efficiency target with improvement to the building fabric. The FEE for the residential development is stated below:

	Target Fabric Energy Efficiency (MWh/year)	**Design Fabric Energy Efficiency (MWh/year)**	**Improvement (%)**
Development Total	43.96	38.81	11.70%

5.00 HEATING INFRASTRUCTURE (BE CLEAN)

5.01 General

The potential use of site-wide heat networks for the development have been assessed in relation to the following:

- Connection to an area wide heat network
- Communal heating system
- Individual heating system

5.02 Connection to an area wide heat network

Investigations into site-wide heat networks has established that there is no existing or proposed infrastructure arrangement within a reasonable distance from the development site. This has been confirmed in correspondence with the Camden Council, contained within Appendix 5.

Due to decarbonisation of the national grid using electricity for heating via the proposed air source heat pumps (ASHPs) in section 6.00 will be less carbon intensive than the burning of gas in a typical energy centre CHP plant.

A further study produced by the department for Business, Energy and Industrial Strategy (BEIS) suggests that by 2025 the carbon emissions factor of electricity will be as low as 0.12kg CO_2/kWh which is nearly half of that of the current carbon emission factor of gas. Therefore, taking the mentioned points into consideration the heating demand of the development is better met with electrically powered ASHPs rather than by any existing heat network.

5.03 Communal Heating System

A major consideration of the RIBA Stage 2 design process has been to minimise the massing of the building when viewed from Bedford Square. As part of this process the proposed floor to floor heights have been minimised along with the amount and the height of the plant to be located on the roof.

These constraints have led to the proposed heating and comfort cooling solution to the commercial office areas of an underfloor heating and cooling systems served by on-floor zone units as this solution works well in low floor to floor heights. Each on-floor underfloor zone unit needs to be provided with a heating medium and a cooling medium. The smallest roof plant area foot print and height is to couple each on-floor zone unit with a variable refrigerant flow air source heat pump. This has the added benefit of omitting the combustion of natural gas to provide the heat source to the building.

The design constraints described above, i.e. the smallest roof plant foot print area and height, apply equally to the residential units so a similar solution of individual air source heat pumps described in section 5.04 below, has been applied to the residential units.

For the reasons described above a communal heating system is not proposed to the development.

5.04 Individual Heating System

Based on the development constraints noted above individual heating systems are proposed to the Proposed Development.

The commercial development's heating and cooling systems proposed are as noted above.

The residential apartments will have a standalone heating and cooling system served by an external air to water air source heat pump. The circuit from the external heat pump to the internal control module will be refrigeration based with a water circuit then distributing to the 4-pipe fan coils within the apartment.

6.00 RENEWABLE ENERGY ASSESSMENT (BE GREEN)

6.01 General

The following renewable energy technologies have been considered for the development:

- Biomass
- Solar water heating
- Ground source heating and cooling
- Wind turbines
- Fuel cell
- Photovoltaic cells
- Air source heating and cooling
- Water source heating and cooling

Of the above systems those which have been deemed not feasible are contained with their reasoning within the LZC assessment document in appendix 8.

6.02 Solar Water Heating

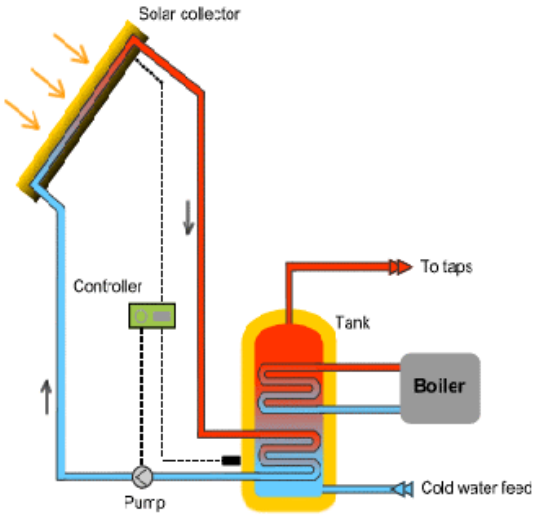
Solar thermal panels utilise the sun's energy to generate hot water for use within the building. The panels are commonly provided in either flat plate or evacuated tube arrangements. The panels are ideally located facing south at an approximate 30° inclination angle in areas where they are not subjected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

Commercial Area

The proposed development has the potential to use solar water heating to pre-heat the domestic hot water service, however the hot water service load is relatively small due to the primarily office use of the development. Additionally, the available roof space is very limited for the positioning of these panels and the available space is being utilised by the proposed photovoltaic panels. Therefore, solar water heating is not being proposed for the commercial elements of the development.

Residential Area

The proposed residential development has the potential to use solar water heating to pre-heat the domestic hot water service, however the hot water service load is met by air to water heat pump. Additionally, the available roof space is very limited for the positioning of these panels. Therefore, solar water heating is not being proposed for the residential elements of the development.



6.03 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.

Commercial Areas

In urban areas non-laminar wind flow occurs as a result of turbulence due primarily to adjacent buildings. There is growing evidence of urban wind turbines failing to perform in line with manufacturer's estimated outputs and as a result, wind turbines are likely to produce only modest power outputs with corresponding low carbon dioxide emission reduction within urban sites. Also, the introduction of wind turbines on the building roof will be unacceptable visually due to the building's location.

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

Residential Areas

The reasoning stated for the commercial areas applies to the residential area.

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

6.04 Photovoltaic Cells

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.

Commercial Area

The proposed development has limited unshaded roof area that could be utilised for PV panels. A typical array of transparent PV panels is pictured above. It is proposed that to meet the energy reduction targets a total of 180m^2 PV panel is used on the available flat roof using a minimal pitch

The following quantity of PV is proposed based on the unshaded space available on the core roofs:

PV panel area	180 m^2
Predicted annual carbon emission reduction	0.84 kgCO_2/m^2
	6.81 Tonnes CO_2/year.

Residential Area

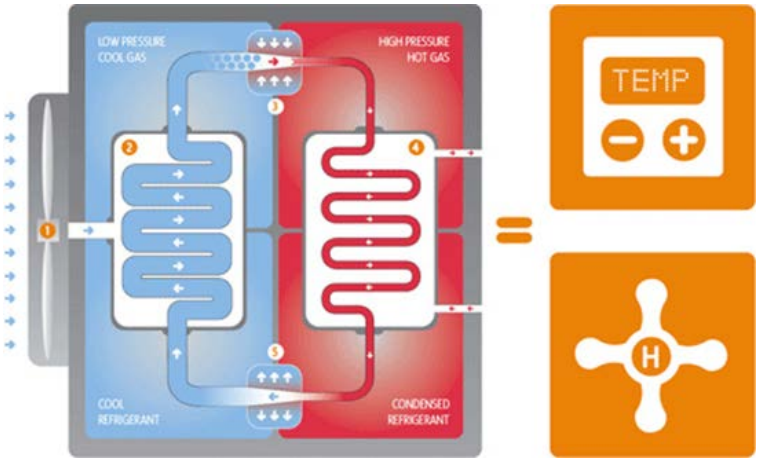
The residential and commercial area share a single roof. It is proposed that to meet the energy reduction targets a total of 24m^2 PV panel is used on the available flat roof using a minimal pitch

The following quantity of PV is proposed based on the unshaded space available on the core roofs:

PV panel area	24 m^2 (2no. panel per apartment)
Predicted annual carbon emission reduction	0.76 kgCO_2/m^2
	0.66 Tonnes CO_2/year.

6.05 Air Source Heat Pump Heating and Cooling

Air source heat pumps (ASHP) utilise the principle of vapor compression refrigeration to transfer heat from outside to inside a building or vice versa. In heating mode, the ASHP absorbs heat from outside air and releases it inside the building via a temperature medium, mainly a refrigerant or water with the use of a heat exchanger. In cooling mode, it is a similar process but reversed where heat is rejected from the building to the outside air via the same temperature medium.



Commercial Area

Air source heat pumps are considered suitable for use in the proposed commercial development. They will provide the heating and comfort cooling to all areas of the whole building.

The SCOPs and SEERs incorporated into the thermal model exceed the minimum standards set out in the Enhanced Capital Allowances (ECA) product criteria and are as follows:

SCOP	SEER
4.00	5.80

The thermal modelling has indicated that the annual electricity input to the ASHPs and the predicted carbon emission reductions are:

ASHP electricity input	50,037 kWh/year
Predicted annual carbon emission reduction	2.55 kg CO_2/m^2/year
	23.43 Tonnes CO_2/year
Offset of the lean scheme CO_2 emissions.	22.4%

Associated pipework will be sufficiently insulated and where routed externally trace heated in order to ensure that the system runs efficiently and that losses are minimised.

In order to ensure that the systems are operated as efficiently as possible end-users will be provided with information relating to the control and operation of the system. The performance of the system will be monitored post-construction to see that the required level of efficiency is achieved.

Residential Area

For the proposed residential development an air to water package system will be provided. This system will provide heating, cooling via 4-pipe fan coil unit to the apartment as well as domestic hot water.

6.06 Water Source Heating and Cooling

Water source heat pumps (WSHP) work on the same principles as ASHPs however the medium in which heat is extracted is water rather than the external air. The seasonal coefficient of performance of the WSHP depends on the temperature difference of the water source.

Commercial Area

Water source heat pumps are technically suitable for use in the commercial element of the Proposed Development. Air source heat pumps and the water source heat pumps would both be used to serve the same building heating and cooling loads and are therefore not suitable for the use together in the Proposed Development. Hence, a strategic view needs to be taken on the most suitable heat pump technology to be applied to the Proposed Development. As previously noted in clause 5.03, specifically for the Proposed Development the internal and external plant space needs to be minimised. The air source heat pump solution provides the minimum internal and external plant area. For the reasoning set out below water source heat pumps are not proposed to be used in the Proposed Development:

- Water source heat pumps are connected to a low temperature water circuit that they either draw heat from or reject heat to dependant on whether they are heating or cooling mode. So that the operating temperature of the low temperature water circuit remains within its maximum and minimum operating temperatures a means of adding heat into the low temperature circuit and a means of rejecting heat from the low temperature circuit is required. This is additional plant could consist of conventional gas fired boilers and cooling towers or adiabatic coolers or it could be an air source heat pump.
- The above therefore creates additional plant space not required for the proposed refrigerant based air source heat pumps.

Residential Area

The comments above equally apply to residential element of the Proposed Development so a similar solution of air source eat pumps has been applied to this residential scheme.

6.07 Renewable Energy Analysis

6.07.01 Viable LZC's

Commercial Area

The proposed renewable energy sources for the proposed commercial development are:

Photovoltaic panels	-	180 m^2
Air source heat pumps	-	ASHPs will provide the heating and cooling of the office areas.
Water source heat pumps	-	WSHPs will provide domestic hot water by utilising the heating circuit from the air source heat pump installation

Residential Area

The proposed renewable energy sources for the proposed commercial development are:

Photovoltaic panels	-	24 m^2 (2no. panel per apartment)
Air source heat pumps	-	ASHPs will provide the heating, cooling and hot water for the residential apartments.

6.07.02 Residential (Green Scheme)

The thermal model has been repeated incorporating the renewable energy technologies and the results for the refurbished existing areas are:

	Base Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/ m^2/year)**	**LZC Scheme (CO_2/m^2/ year)**
A1-F1	15.45	14.11	5.47
A2-F2	13.13	10.75	4.21
A3-F2	13.68	12.08	4.59
A4-F3	13.47	11.19	4.37
A5-F3	11.55	10.05	3.71
A6-F4&5	12.92	11.26	5.12
A7-F4&5	12.70	11.18	4.76
Area Weighted Part L1A: 2013 Total	**13.33**	**11.59**	**4.74**
Unregulated Uses	7.20	7.20	7.20
Total	**20.53**	**18.79**	**11.94**

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Lean Scheme	10.23	16.59
Clean Scheme	10.23	16.59
Green Scheme	4.19	10.54

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Lean Scheme savings	1.54	13.1%
Clean Scheme savings	0.00	0.0%
Green Scheme savings	6.04	59.1%
Total cumulative savings	**7.58**	**64.4%**

6.07.03 Commercial Office (Green Scheme)

The thermal model has been repeated incorporating the renewable energy technologies and the results for the new office areas are:

	Baseline Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/ m^2/year)**	**LZC Scheme (CO_2/m^2/ year)**
Heating	0.28	0.39	0.10
Cooling	2.57	2.08	0.77
Fans and pumps	2.21	2.31	1.30
Lighting	4.39	1.96	1.66
Domestic Hot Water	1.69	1.69	0.79
Displaced Electricity	0.00	0.00	-0.84
Part L2A: 2013 Total	**11.14**	**8.42**	**4.62**
Unregulated Power	11.42	11.42	11.42
Total	**22.55**	**19.84**	**16.03**

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Scheme	90.17	182.60
Lean Scheme	68.18	160.61
Clean Scheme	68.18	160.61
Green Scheme	37.37	129.80

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Lean Scheme savings	21.99	24.4%
Clean Scheme savings	0.00	0.0%
Green Scheme savings	30.81	45.2%
Total cumulative savings	52.80	58.6%

6.07.04 Commercial Retail (Green Scheme)

The thermal model has been repeated incorporating the renewable energy technologies and the results for the new office areas are:

	Baseline Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/m^2/year)**	**LZC Scheme (CO_2/m^2/ year)**
Heating	0.13	0.86	0.24
Cooling	4.29	3.77	2.83
Fans and pumps	3.59	5.61	2.08
Lighting	12.62	13.30	13.30
Domestic Hot Water	0.43	0.43	0.48
Displaced Electricity	0.00	0.00	0.00
Part L2A: 2013 Total	**21.06**	**23.98**	**18.93**
Unregulated Power	13.28	13.28	13.28
Total	**34.34**	**37.26**	**32.21**

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Scheme	23.00	37.50
Lean Scheme	26.19	40.69
Clean Scheme	26.19	40.69
Green Scheme	20.67	35.17

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Lean Scheme savings	-3.19	-13.9%
Clean Scheme savings	0.00	0.0%

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Green Scheme savings	5.52	21.1%
Total cumulative savings	**2.33**	**10.1%**

6.07.05 Whole Development (Green Scheme)

The thermal model has been repeated incorporating the renewable energy technologies and the area weighted results for the development as a whole are:

	Baseline Scheme (kg CO_2/m^2/year)	**Lean Scheme (kg CO_2/ m^2/year)**	**LZC Scheme (CO_2/m^2/ year)**
Heating	0.89	0.81	0.29
Cooling	2.53	2.09	0.94
Fans and pumps	2.18	2.54	1.36
Lighting	4.97	3.09	2.76
Domestic Hot Water	1.83	1.85	0.84
Displaced Electricity	0.00	0.00	-0.75
Part L Total	**12.41**	**10.39**	**6.18**
Unregulated Power	11.25	11.25	11.25
Total	**23.66**	**21.64**	**17.43**

	CO_2 Emissions (Tonnes per annum)	
	Regulated	**Unregulated**
Baseline Scheme	124.94	238.23
Lean Scheme	104.60	217.89
Clean Scheme	104.60	217.89
Green Scheme	62.25	175.54

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Lean Scheme savings	20.34	16.3%
Clean Scheme savings	0.00	0.0%
Green Scheme savings	42.34	40.5%
Total cumulative savings	**62.69**	**50.2%**

7.00 OVERALL DEVELOPMENT ANALYSIS

7.01 Residential Building Analysis

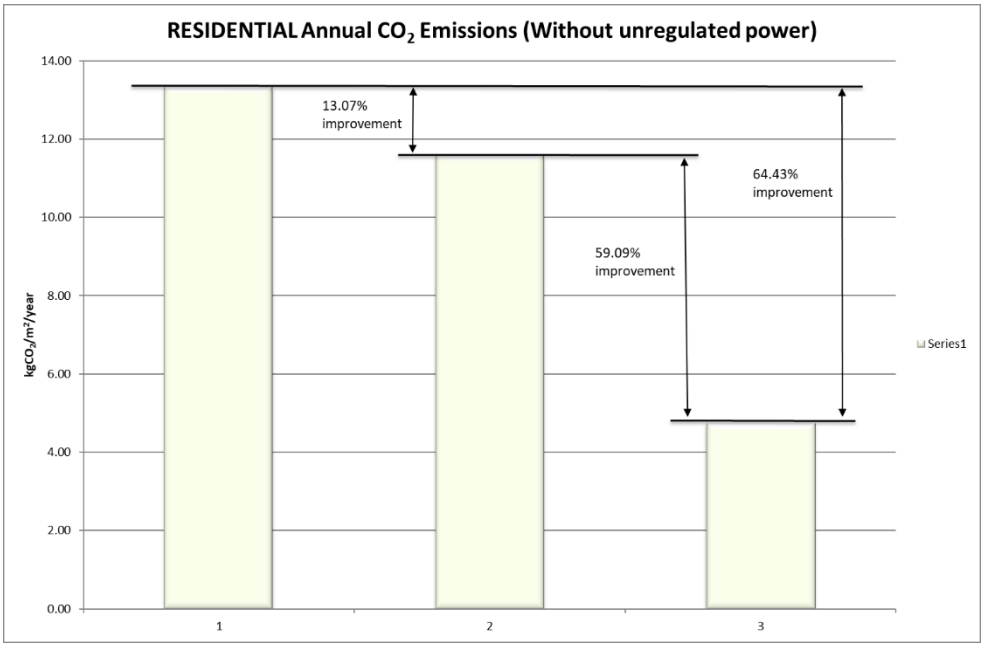
The overall analysis for the residential areas of the development can be summarised as follows:

	kg CO_2/m^2		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Building Regulations Compliant	13.33	11.59	4.74
Allowing for Un-regulated Uses	20.53	18.79	11.94

These values are shown in diagrammatic form below that show the following principles:

	Regulated Energy	
	Lean Scheme (with passive/low energy)	**LZC Scheme**
Improvement over baseline scheme	13.07%	64.43%
Improvement over lean scheme	-	59.09%

	Unregulated Energy	
	Lean Scheme (with passive/low energy)	**LZC Scheme**
Improvement over baseline scheme	8.49%	41.83%
Improvement over lean scheme	-	36.44%



Based on the regulated power results indicated above the proposed scheme incorporating renewable energy technologies provides a carbon emissions reduction of 64.4% when compared to the baseline Building Regulation 2013 (TER) compliant scheme.

The predicted annual CO_2 emissions data is as follows:

	Tonnes CO2 /year		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Regulated Uses	11.77	10.23	4.19
Allowing for Un-regulated Uses	18.13	16.59	10.54

The carbon emission savings as a result of the proposed measures based on the current design are predicted as follows:

	Regulated Uses CO_2 Emission (tonnes CO_2/year)	**With Un-Regulated Uses CO_2 Emission (tonnes CO_2/year)**
Baseline scheme	11.77	18.13
LZC Scheme	4.19	10.54
Saving over baseline scheme	**7.58**	**7.58**

When considered against the current London Plan target of a 100% carbon reduction the shortfall is as follows:

	Regulated CO_2 Savings	
	Tonnes per Annum	**%**
Total Cumulative on-site Savings	7.58	64.43%
Total Target Savings	11.77	100.00%
Annual Shortfall	4.19	35.57%
Cumulative 30 Year Shortfall	125.56	N/A
Cash-in lieu carbon offset payment	£11,928.45	N/A

7.02 Commercial – Office Analysis

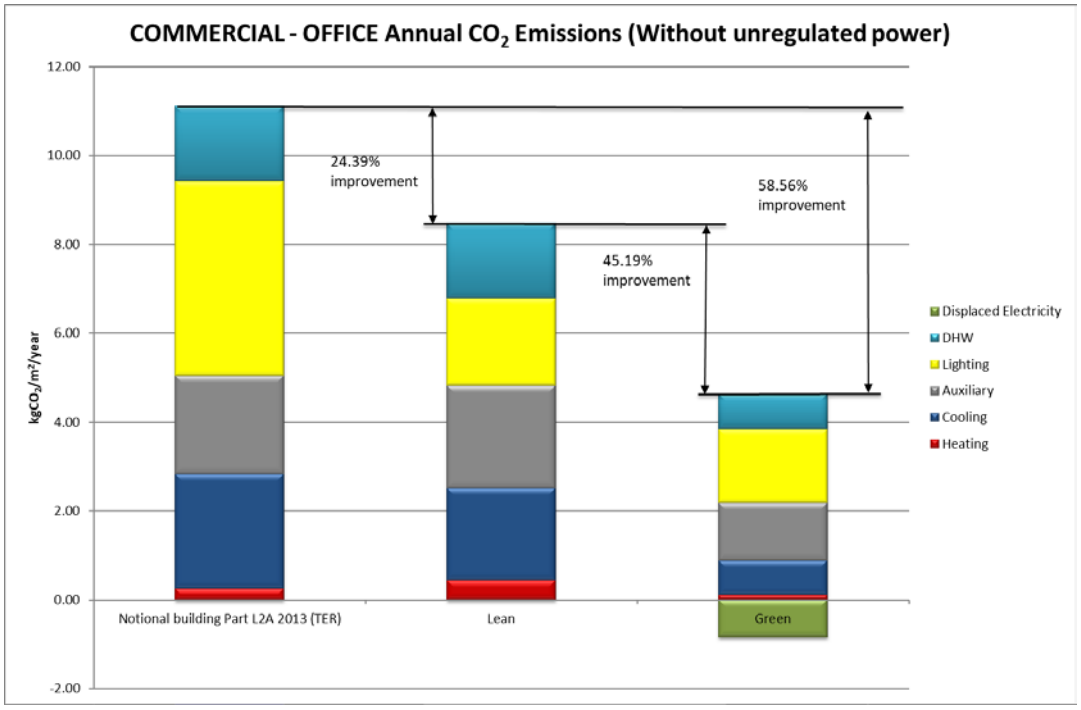
The overall analysis for the commercial office area of the development can be summarised as follows:

	kg CO_2/m^2		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Building Regulations Compliant	90.17	68.18	37.37
Allowing for Un-regulated Uses	182.60	160.61	129.80

These values are shown in diagrammatic form below that show the following principles:

	Regulated Energy	
	Lean Scheme (with passive/low energy)	**LZC Scheme**
Improvement over baseline scheme	24.39%	58.56%
Improvement over lean scheme	-	45.19%

	Unregulated Energy	
	Lean Scheme (with passive/low energy)	**LZC Scheme**
Improvement over baseline scheme	12.04%	28.92%
Improvement over lean scheme	-	19.18%



Based on the regulated power results indicated above the proposed scheme incorporating renewable energy technologies provides a carbon emissions reduction of 54.59% when compared to the baseline Building Regulation 2013 (TER) compliant scheme.

The predicted annual CO_2 emissions data is as follows:

	Tonnes CO_2 /year		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Regulated Uses	90.17	68.18	37.37
Allowing for Un-regulated Uses	182.60	160.61	129.80

The carbon emission savings as a result of the proposed measures based on the current design are predicted as follows:

	Regulated Uses CO_2 Emission (tonnes CO_2/year)	**With Un-Regulated Uses CO_2 Emission (tonnes CO_2/year)**
Baseline scheme	90.17	182.60
LZC Scheme	37.37	129.80
Saving over baseline scheme	**52.80**	**52.80**

When considered against the new (intent to publish) London Plan target of a 100% carbon reduction the shortfall is as follows:

	Regulated CO_2 Savings	
	Tonnes per Annum	**%**
Total Cumulative on-site Savings	52.80	58.56%
Total Target Savings	90.17	100.00%
Annual Shortfall	37.37	41.44%
Cumulative 30 Year Shortfall	1121.07	N/A
Cash-in lieu carbon offset payment	£106,501.51	N/A

7.03 Commercial – Retail Analysis

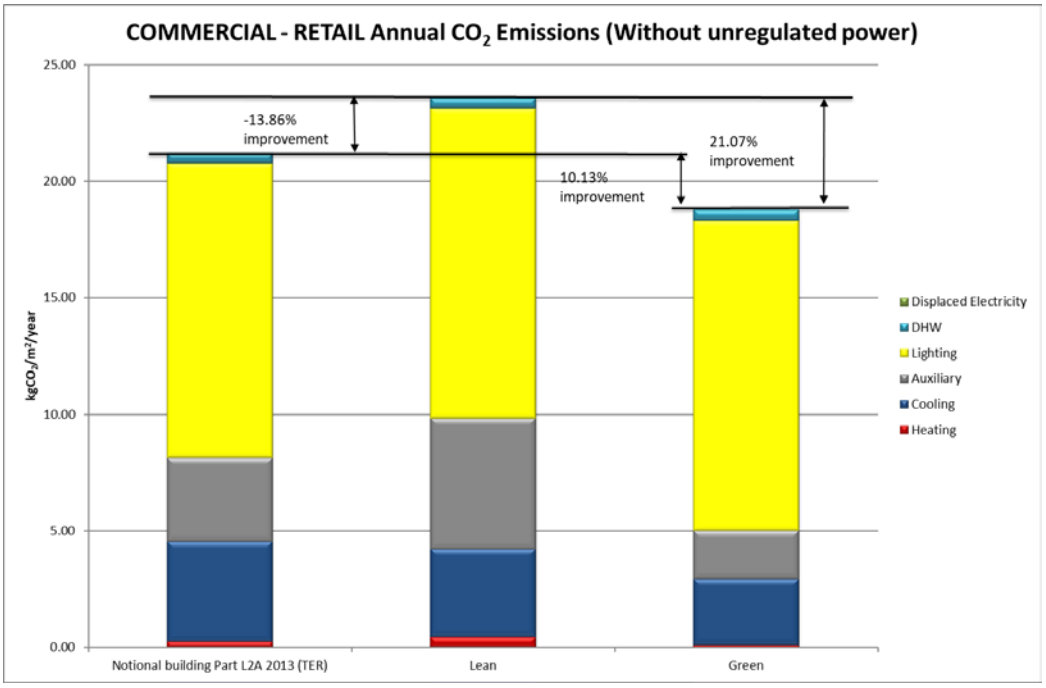
The overall analysis for the commercial area of the development can be summarised as follows:

	kg CO_2/m^2		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Building Regulations Compliant	21.06	23.98	18.93
Allowing for Un-regulated Uses	34.34	37.36	32.21

These values are shown in diagrammatic form below that show the following principles:

	Regulated Energy	
	Lean Scheme (with passive/low energy)	**LZC Scheme**
Improvement over baseline scheme	-13.86%	10.13%
Improvement over lean scheme	-	21.07%

	Unregulated Energy	
	Lean Scheme (with passive/low energy)	**LZC Scheme**
Improvement over baseline scheme	-8.50%	6.21%
Improvement over lean scheme	-	13.56%



Based on the regulated power results indicated above the proposed scheme incorporating renewable energy technologies provides a carbon emissions reduction of 54.59% when compared to the baseline Building Regulation 2013 (TER) compliant scheme.

The predicted annual CO_2 emissions data is as follows:

	Tonnes CO2 /year		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Regulated Uses	23.00	26.19	20.67
Allowing for Un-regulated Uses	37.50	40.69	35.17

The carbon emission savings as a result of the proposed measures based on the current design are predicted as follows:

	Regulated Uses CO_2 Emission (tonnes CO_2/year)	**With Un-Regulated Uses CO_2 Emission (tonnes CO_2/year)**
Baseline scheme	23.00	37.50
LZC Scheme	20.676	35.17
Saving over baseline scheme	**2.33**	**2.33**

When considered against the new (intent to publish) London Plan target of a 100% carbon reduction the shortfall is as follows:

	Regulated CO_2 Savings	
	Tonnes per Annum	**%**
Total Cumulative on-site Savings	2.33	10.13%
Total Target Savings	23.00	100.00%
Annual Shortfall	20.67	46.45%
Cumulative 30 Year Shortfall	620.04	N/A
Cash-in lieu carbon offset payment	£58,903.33	N/A

7.04 Overall Development Analysis

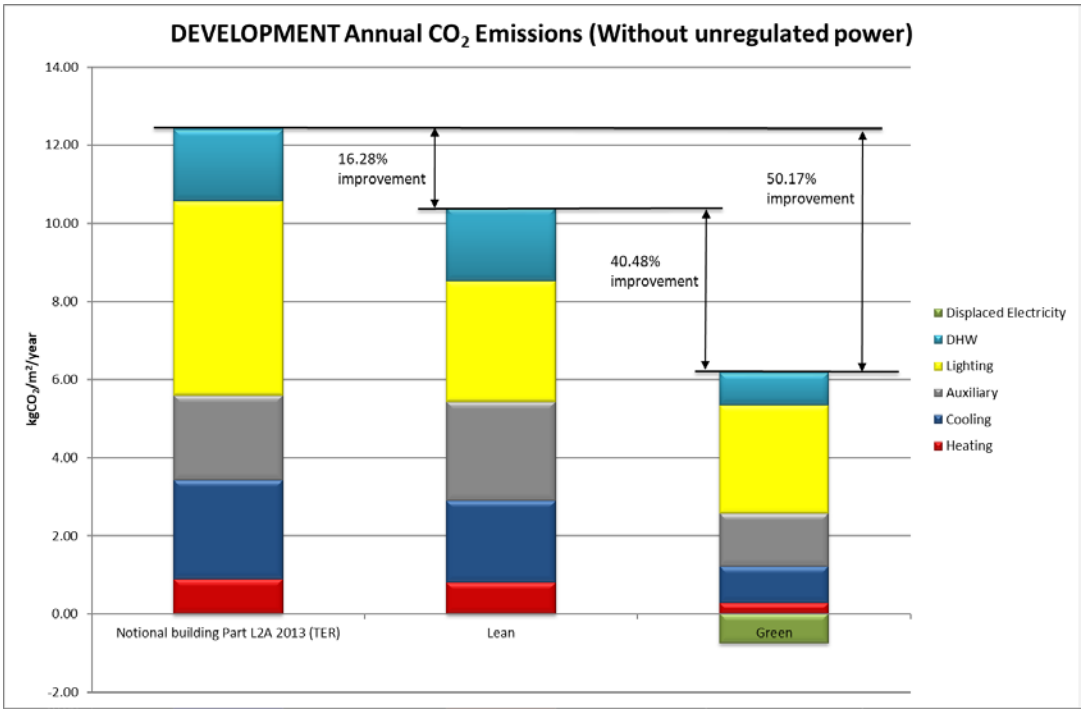
The calculated area weighted analysis for the development as a whole can be summarised as follows:

	kg CO_2/m^2		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Building Regulations Compliant	12.41	10.39	6.18
Allowing for Un-regulated Uses	23.66	21.64	17.43

These values are shown in diagrammatic form below that show the following principles:

	Regulated Energy	
	Lean Scheme (with passive/low energy)	**LZC Scheme**
Improvement over baseline scheme	16.28%	50.17%
Improvement over lean scheme	-	40.48%

	Unregulated Energy %	
	Lean Scheme (with passive/low energy)	**LZC Scheme**
Improvement over baseline scheme	8.54%	26.31%
Improvement over lean scheme	-	19.43%



Based on the regulated power results indicated above the proposed scheme incorporating renewable energy technologies provides a carbon emissions reduction of 50.17% when compared to the baseline Building Regulation 2013 (TER) compliant scheme.

The predicted annual CO_2 emissions data is as follows:

	Tonnes CO2 /year		
	Baseline Scheme	**Lean Scheme (with passive/low energy)**	**LZC Scheme**
Regulated Uses	124.94	104.60	62.25
Allowing for Un-regulated Uses	238.23	217.89	175.54

The carbon emission as a result of the proposed measures based on the current design are predicted as follows:

	Regulated Uses CO_2 Emission (tonnes CO_2/year)	**With Un-Regulated Uses CO_2 Emission (tonnes CO_2/year)**
Baseline scheme	124.94	238.23
LZC Scheme	62.25	175.54
Saving over baseline scheme	**62.69**	**62.69**

When considered against the new (intent to publish) London Plan target of a 100% carbon reduction the shortfall is as follows:

	Regulated CO_2 Savings	
	Tonnes per Annum	**%**
Total Cumulative on-site Savings	62.69	50.17%
Total Target Savings	124.94	100.00%
Annual Shortfall	62.25	49.83%
Cumulative 30 Year Shortfall	1867.50	N/A
Cash-in lieu carbon offset payment	£177,414.74	N/A

8.00 MIXED MODE OPERATION

The commercial office areas of the development are being future proofed with natural ventilation apertures to allow the commercial office to be operated in a future mixed mode ventilation and cooling strategy if improvements to the Tottenham Court Road air quality and noise allow.

Within the commercial office façade design, there are openings incorporated adjacent to windows within each bay of the office areas from 1st floor level and above. These doors behind screened louvres have the potential to be used as part of a mixed mode ventilation and cooling strategy. To ensure the environmental conditions are acceptable, this future passive ventilation strategy would only be operated in the scenario when the adjacent roads are free of pollution and ambient sound levels are substantially reduced. The ability to operate using a passive strategy is anticipated to reduce the demand for cooling and ventilation with an associated drop in CO_2 emissions.

It is proposed that the openings would be operated by building users when external ambient conditions allow cooling without mechanical means. This is expected to be in the range of 13°C to 26°C. Internal temperatures would be acceptable at a slightly higher range than when using the installed HVAC. The mixed mode ventilation aperture doors should be closed by users if internal temperatures exceed 26°C at which time mechanical cooling is then utilised.

The alternative scenario has been simulated using the same 'green' scheme model as for the results reported in the remainder of this energy statement.

The critical performance measures impacted by the change in environmental servicing strategy, which are reported below, are cooling demand and CO_2 emissions.

Cooling demand

The whole building area weighted cooling demand reduces from 115 to 65 MJ/m^2, a 43.5% improvement on the proposed strategy. This is a 60% improvement on the notional building demand.

	Area weighted average building cooling demand (MJ/m^2)
Notional Development	164
Actual Development	115
Mixed mode strategy	65

CO_2 reduction total

Actual CO_2 emissions for the office areas are calculated at 36.57 tonnes/yr. By using the same baseline as the proposed offices, CO_2 emissions are expected to reduce by 11% as a result of this change in servicing strategy.

	Regulated Energy Tonnes CO_2/year	
	Proposed Scheme (with passive/low energy)	**Mixed Mode Scheme**
Baseline	90.17	
Actual emissions	37.37	34.16
Savings over baseline scheme	52.80	56.01

	Regulated Energy Tonnes CO_2/year	
	Proposed Scheme (with passive/low energy)	**Mixed Mode Scheme**
Improvement vs Baseline %	58.56%	62.11%
Improvement vs Proposed scheme %	N/A	3.56%

9.00 CONCLUSIONS

In line with the relevant planning policies and guidelines the energy strategy for the proposed development 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.

The focus of the energy strategy is on CO_2 reduction from the building by adopting a highly efficient building envelope solution together with high efficiency mechanical and electrical services incorporating heat recovery. The renewable energy technologies assessment is based on using solutions that are technically proven with low maintenance implications taking into account the energy efficiency strategies being proposed in the current design.

The analysis has shown that by incorporating passive and low energy design measures there is a predicted reduction in the proposed development's annual CO_2 emissions, as indicated in the table below, from the baseline scheme.

The following passive and low energy design measures have been incorporated into the proposed development:

- High performance glazing
- Improved building fabric
- Low building air leakage rate
- Variable speed fans and pumps.
- Heat recovery.
- Low energy lighting.
- Automatic lighting control with occupancy sensors (auto on, auto off).

The proposed development has been assessed for risk of overheating in line with the requirements of the GLA and CIBSE TM52. The analysis has shown that the proposed development is at risk of overheating during each of the three TM49 design summer years under free running conditions and that as such additional measures are required by way of comfort cooling. The offices have been shown to pass the TM52 mechanically cooled criteria and the active cooling demand within the building has been shown to be lower than the notional demand.

The decentralised heating, cooling and power assessment has indicated that none are viable for the scheme.

The potential renewable energy technologies have been assessed taking into account the particular development constraints. The strategy is to utilise:

- Photovoltaic cells to provide a contribution to the electrical demand.
- Air source heat pumps to provide the heating and cooling requirements.

The above measures result in the following carbon dioxide emission savings:

Residential

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be Lean: Saving from energy demand reduction	1.54	13.1%
Be clean: Saving from heat network	0.00	0.0%
Be Green: Saving from heat renewable energy	6.04	59.1%
Total cumulative on-site savings	7.58	64.4%
Carbon shortfall	4.19	
	Tonnes CO_2	
Cumulative savings for offset payment	125.56	
Cash-in-lieu contribution	£11,928.45	

Commercial – Office

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be Lean: Saving from energy demand reduction	21.99	24.4%
Be clean: Saving from heat network	0.00	0.0%
Be Green: Saving from heat renewable energy	30.81	45.2%
Total cumulative on-site savings	52.80	58.6%
Carbon shortfall	37.37	
	Tonnes CO_2	
Cumulative savings for offset payment	1,121.07	
Cash-in-lieu contribution	£106,501.51	

Commercial - Retail

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	**% Improvement**
Be Lean: Saving from energy demand reduction	-3.19	-13.86%
Be clean: Saving from heat network	0.00	0.00
Be Green: Saving from heat renewable energy	5.52	21.07
Total cumulative on-site savings	2.33	10.13
Carbon shortfall	20.67	-

	Tonnes CO_2
Cumulative savings for offset payment	620.04
Cash-in-lieu contribution	£58,903.33

Overall Development

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 per year	% Improvement
Be Lean: Saving from energy demand reduction	20.34	16.3%
Be clean: Saving from heat network	0.00	0.0%
Be Green: Saving from heat renewable energy	42.34	40.5%
Total cumulative on-site savings	62.69	50.2%
Carbon shortfall	62.25	
	Tonnes CO_2	
Cumulative savings for offset payment	1,867.5	
Cash-in-lieu contribution	£177,414.74	

As shown in the above tables the total cumulative savings for the development exceed the minimum 35% on-site carbon reduction target but cannot fully achieve the zero carbon overall target. Therefore, a payment in lieu contribution of £177,414.74 to the Council to offset to zero carbon would be secured by S106 legal agreement. For clarity the contribution payment is based on a rate of £95/tonne CO_2.

The commercial office areas are provided with natural ventilation openings to allow the commercial office to operate in the future with a mixed mode ventilation and cooling strategy. The predicted reduction in cooling demand for this operating scenario is 43.5%. This predicted additional carbon emission saving is 3.56%.

Appendix 1 – Office BRUKL Reports

BRUKL – Lean Scheme

BRUKL - Green Scheme

Appendix 2 – Retail BRUKL Reports

BRUKL – Lean Scheme

BRUKL - Green Scheme

Appendix 3 – Residential SAP Worksheets

DER-TER Calculations – Lean Scheme

DER-TER Calculations - Green Scheme

Appendix 4 – Residential Input Summary

Summary Information – Lean Scheme

Summary Information - Green Scheme

Appendix 5 – Correspondence with Camden Council for DHN

Appendix 6 – Cooling and Overheating Analysis Document – Commercial

Appendix 7 - Cooling and Overheating Analysis Document – Residential

Appendix 8 – LZC Assessment Document

Appendix 9 – GLA SAP 10 Spreadsheet

Appendix 10 – Energy Strategy Parameters

Appendix 11 – PV Roof Layout