156 West End Lane

FHP Energy Strategy

March 2022

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Rev – P7

Inspiring Built Environments

MEP
Sustainability & Building Physics
Digital Engineering

Revision	Date of Issue	Details of Change	Written By	Checked By
P1	19.08.20	First Issue – Draft For Comment	SM	RM
P2	18.12.20	Second Issue- East Block Updated	SM	LT
P3	13.05.21	Draft Watermark removed.	SM	RM
P4	05.10.21	Incorporated Tetra Tech comments.	SM	SM
P5	19.11.21	Updated to reflect the latest PV proposals	SM	SM
P6	07.12.21	Updated to comments from Tetra Tech	SM	SM
P07	04.03.22	Updated to comments from Tetra Tech	SM	SM

Contents

Executive Summary

This Energy Strategy has been prepared on behalf of the applicant, Astir Living Ltd to support the discharge of Conditions 21 and 22 of planning permission dated 14th July 2021 (ref: 2019/4140/P); and to discharge Clause 4.7.1 of the associated S106 Agreement at 156 West End Lane, West Hampstead, London.

Details to discharge Conditions 21 and 22 (Combined Heat and Power (CHP) plant, emissions standards, and air inlet locations) of the original planning permission dated 23rd June 2017 (2015/6455/P) were approved on 20th March 2020 (ref: 2019/6364/P).

The introduction of SAP10 carbon factors however has resulted in CHP no longer providing a signification reduction in emissions and therefore it is not considered to be feasible. The only technology considered feasible, which will reduce emissions in accordance with required targets is Air Source Heat Pumps (ASHP). These will be integrated into both building-level heating systems, providing 70% of the annual heat demand.

In addition, PV arrays will be installed on the roof space to both the East and West blocks and will maximise on-site renewable energy generation in accordance with the Greater London Authority's requirements. The total on-site PV is estimated to be 128 kWp.

When compared to the regulatory baseline scenario as set out in the GLA Guidance and Part L 2013, the above measures reduce carbon emissions by 59% in the case of residential dwellings, and 43% in the case of non-residential areas.

Predicted Carbon Dioxide (CO2) emissions have been calculated in accordance with Building Regulations Approved Document Part L1A (2013) and determined using the government approved Stroma FSAP 2012 software. The energy strategy for the scheme seeks to achieve the London Plan energy target requirement for a 35% reduction in regulated carbon dioxide emissions (beyond Part L 2013) onsite. This will be achieved by following the GLA energy hierarchy of Be Lean (consume less energy), Be Clean (use of heating and cooling networks) and Be Green (include renewable energy systems).

The Energy Strategy has been written in accordance with the "Energy Assessment Guidance" (October 2018), prepared by the Greater London Authority (GLA), with a "fabric-first approach" to energy efficiency specified in order to minimise demand.

This scheme complies with The London Plan 2016 and follows the energy hierarchy as follows:

Be Lean - Reduce energy and Carbon Dioxide (CO_2) emissions using passive design and energy efficient measures.

Be Clean – Reduce energy and Carbon Dioxide (CO_2) emissions by investigating the possibility of installing a site wide Combined Heat and Power (CHP) system or connecting to an existing decentralised heat network.

Be Green – Reduce energy and Carbon Dioxide (CO_2) emissions by installing Low or Zero Carbon Technologies such as Air Source Heat Pumps (ASHP), Solar Panels, Photovoltaics (PV), Wind Turbines, etc.

Summary of Results

The following tables and graphs detail the site energy hierarchy results, formatted to the requirements of the GLA.

Residential CO2 Emissions at Each Stage of the Hierarchy

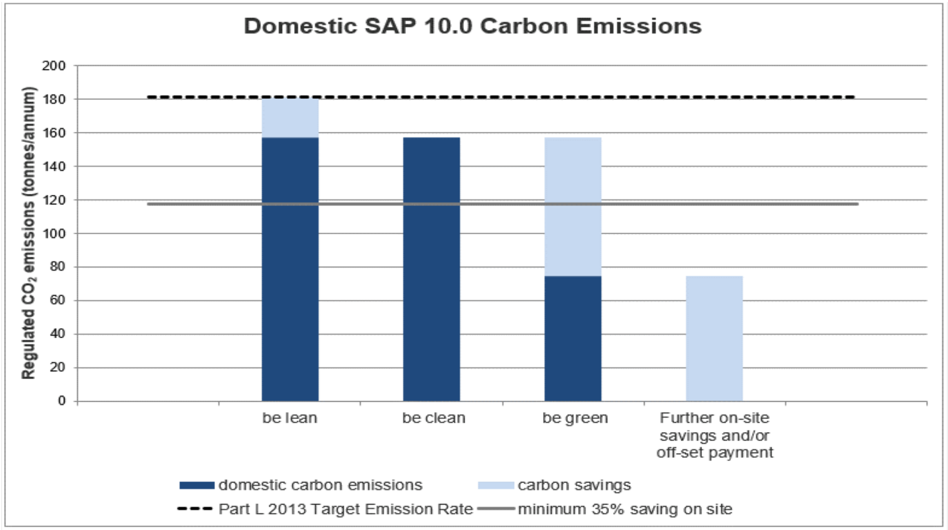
Scenario - Residential Scheme	Regulated CO_2 emissions (Tonnes CO_2/annum)	Unregulated CO_2 emissions (Tonnes CO_2/annum)
Baseline	181.1	92.6
Be Lean	157.1	92.6
Be Clean	157.1	92.6
Be Green	74.6	92.6

Non-Residential CO2 Emissions at Each Stage of the Hierarchy

Scenario - Residential Scheme	Regulated CO_2 emissions (Tonnes CO_2/annum)	Unregulated CO_2 emissions (Tonnes CO_2/annum)
Baseline	21.84	7.9
Be Lean	18.21	7.9
Be Clean	18.21	7.9
Be Green	12.52	7.9

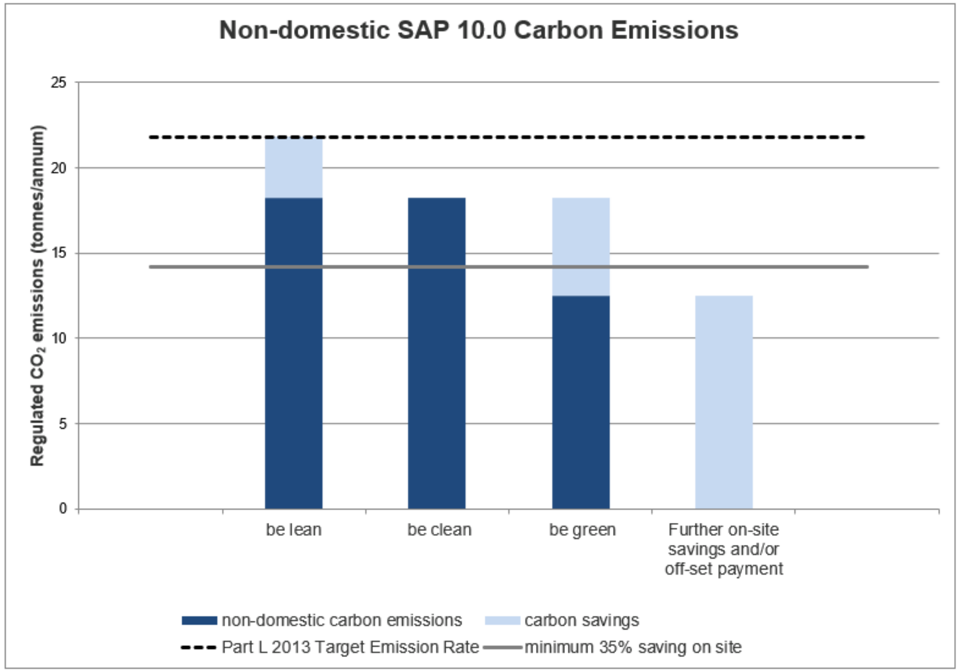
Residential regulated CO2 savings at each stage of the energy hierarchy

Scenario - Residential Scheme	Regulated CO_2 Savings (Tonnes CO_2/annum)	CO_2 Reduction (%)
Savings from 'Be Lean'	24	13%
Savings from 'Be Clean'	0	0%
Savings from 'Be Green'	82.6	46%
Cumulative on-site savings	106.6	59%
Carbon Shortfall	74.6	-



Non-residential regulated CO2 savings at each stage of the energy hierarchy

Scenario – Non-residential Scheme	Regulated CO_2 savings (Tonnes CO_2/annum)	CO_2 reduction (%)
Savings from 'Be Lean'	4	17%
Savings from 'Be Clean'	0	0%
Savings from 'Be Green'	6	26%
Cumulative on-site savings	9	43%



Site Wide regulated CO_2 savings at each stage of the energy hierarchy

Scenario – Site Wide Scheme	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 Savings (Tonnes CO_2/annum)
Baseline	202.9	-
Be Lean	175.4	27.6
Be Clean	175.4	0
Be Green	87.1	88.3

Introduction

This Energy Strategy has been prepared by FHP Partnership Limited on behalf of Astir Living Ltd to support the discharge of Conditions 21 and 22 of planning permission 2019/4140/P (dated 14th July 2021); and the discharge of Clause 4.7.1 of the associated S106 Agreement.

The approved development at 156 West End Lane, West Hampstead in the London Borough of Camden (LBC) comprises 180 mixed tenure residential dwellings (use Class C3), flexible non-residential use (Class A1-A3, D1, D2), employment floorspace (Use Class B1) and community space (Use Class D1) in buildings ranging from 3 to 7 storeys. New vehicular access from West End Lane and the provision of accessible car parking spaces, in addition to new public open space, the widening of Potteries Path and associated cycle parking and landscaping.

The development is split across two blocks, namely “East” and “West”. The East block contains 101 residential dwellings (private and shared ownership), and the West Block contains 79 residential dwellings (affordable rent and intermediate rent). The West block also contains flexible non-residential floorspace at both ground and first floors.

The previous Energy Strategy prepared by Silver EMS (submitted in support of the original planning permission dated 23rd June 2017 (22015/6455/P)) proposed the implementation of a gas-fired Combined Heat and Power (CHP) engine and efficient gas-fired boilers connected to a site-wide district heating network (DHN), which would supply heating and hot water for the entire development. It was anticipated that the use of the CHP engine and DHN would help to reduce the regulated CO2 emissions by approximately 27.3% (Revised Energy Strategy, June 2016). In addition, a dedicated Photovoltaics (PV) system for the non-residential units on the roof of the West Building was proposed in order to achieve the required CO2 reductions for the entire development. It was stated within the Strategy that the renewable electricity could reduce the regulated CO2 emissions of the site by circa 24.8%.

It is now widely recognised that with the introduction of SAP10 carbon factors CHP is no longer providing a signification emission reduction and therefore it is considered not feasible for developments within London and therefore, the Energy Strategy has been updated to reflect the proposed use of Air Source Heat Pumps (ASHP) and a gas (community) boiler system located within the lower ground floor of the East building. In addition, the use of PVs will be taken forward on the roof of the West building.

This Energy Strategy shall set out the applicable national, strategic, and local energy policies for the approved scheme, as well as the methodology for, and results from an Energy Assessment. A CO2 emissions assessment in accordance with local planning authority guidance is included and energy efficiency measures and low carbon technologies are outlined.

In addition to the requirement of an improvement over Building Regulations Approved Document Part L1A (2013) of 35%, the GLA seek to maximise the on-site renewable energy generation, therefore even if the 35% target is achieved before considering renewable sources of energy, PV would still need to be included and should cover all available and practical roof space. The policy documents also stipulate a target of achieving zero carbon. This target is typically met by a payment in lieu contribution based on the total remaining carbon emissions of the development over a 30-year period to the local authority.

In accordance with national, strategic and local planning policy and best practice guidance, the following approach informs the updated energy strategy for the development:

1. Propose improvements to the building fabric from the maximum values set out in Building Regulations Approved Document Part L1A (2013) – **Be Lean**.
2. Propose improvements to reduce energy consumption and carbon dioxide (CO_2) emissions through the use of passive and energy efficiency measures. To investigate the feasibility of connecting to an existing heat network and where this is not available investigate the feasibility of

providing a central Combined Heat and Power system to provide the base heating and hot water requirements to the site – **Be Clean**.

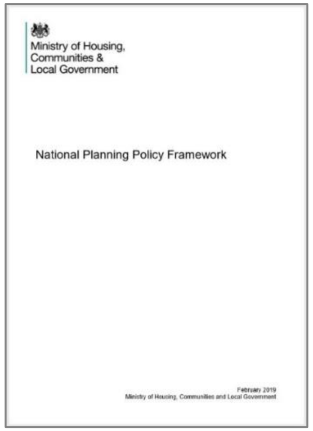
3. Propose methods to reduce energy consumption and further reduce the Carbon Dioxide (CO_2) emissions via the use of on-site renewable and Low/Zero Carbon technologies – **Be Green**.

The energy strategy considers the site layout and requirements for the building to produce a design that incorporates the most appropriate technologies available and suitable for the site and are both commercially viable and compliant with all policies applicable to the development.

Planning Policy

In this section of the report, National, Regional and Local planning policies and requirements are presented. The energy and sustainability strategies to meet the policies have also briefly been introduced. The details of how the scheme incorporates these policies have been presented in the body of this report. The following policies will apply to the development;

The National Planning Policy Framework (NPPF)


Ministry of Housing, Communities & Local Government

National Planning Policy Framework

February 2019
Ministry of Housing, Communities and Local Government

The National Planning Policy Framework (NPPF) was published in February 2019 and outlines what the government deems comprises a sustainable development in England. The government's objective is to streamline the process and encourage sustainable development, promoting the local communities needs and priorities.

The NPPF describes sustainable development as having three dimensions; economic, social and environmental. These are defined as follows:

Economic – Assisting the creation of a strong competitive economy with affordable energy costs.

Social – Assisting communities to be strong and healthy by providing a high quality of built environment, accessible local services and providing security of supply.

Environmental – Assisting to protect our environment, both built, natural and historical, by reducing Carbon Dioxide (CO_2) emissions and promoting a move to low carbon economies.

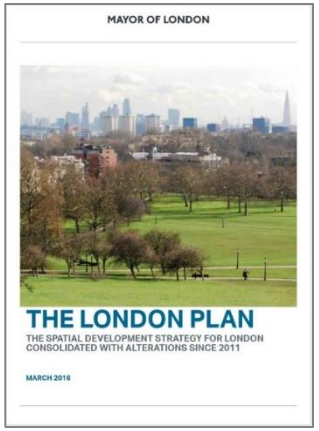
The above framework is used as the basis for councils to develop their own local policy. Section 10 of the framework addresses climate change, flooding and costal change. The main key points of this section are as follows:

- Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change.
- Local planning authorities should plan for new developments in locations and ways which reduce the greenhouse gases. They should actively support energy efficiency improvements to existing buildings.
- Local authorities should expect new developments to comply with the adopted Local Plan policies for decentralised energy supply unless this is demonstrably not feasible or viable. New developments should consider the landform, layout, orientation, massing and landscaping to minimise energy consumption.
- Local planning authorities shall recognise the responsibility on all communities to contribute to energy generation from renewables or low carbon sources. Promoting and designing their policies to maximise renewable and low carbon energy development.
- Identify opportunities for developments to draw its energy from decentralised, renewable or low carbon energy supply systems

Further considerations include:

- Minimising Carbon Dioxide (CO_2) emissions
- Vulnerability of fuel supply
- Move towards existing 'zero carbon' policy targets.

The London Plan 2016



The following are the key policies from the Greater London Authorities London Plan 2016 which impact energy:

Policy 5.2 Minimising carbon dioxide emissions

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

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

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

Residential buildings:

Year	Improvement on 2010 Building Regulations 2010
2013	25 per cent (Code for Sustainable Homes level 4)
2013 – 2016	40 per cent
2016 – 2031	Zero Carbon

Policy 5.3 Sustainable Design and Construction

Strategic

A. The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.

Planning Decisions

B. Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

C. Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:

   a. Minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems).
   b. Avoiding internal overheating and contributing to the urban heat island effect

c. Efficient use of natural resources (including water), including making the most of natural systems both within and around buildings.

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:
    a. Connection to existing heating or cooling networks;
    b. Site wide CHP network;
    c. 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.

Planning Decisions

B. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

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.

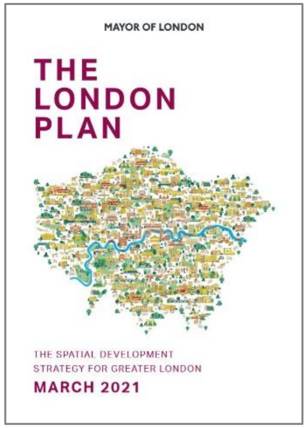
Planning Decisions

B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:
    a. Minimise internal heat generation through energy efficient design

b. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
c. Manage the heat within the building through exposed internal thermal mass and high ceilings
d. Passive ventilation
e. Mechanical ventilation
f. 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. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

The London Plan 2021



This document was in draft form during the assessments, however, was a material consideration for the strategy. The following are the key policies from the Greater London Authorities London Plan 2021 which impact energy:

Policy SI 2 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 lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

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

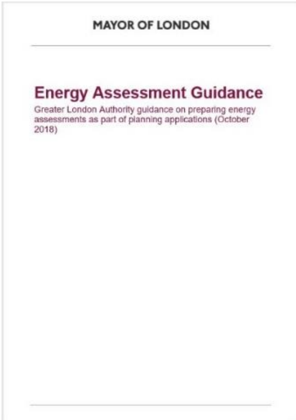
Policy SI 4 Managing heat risk

A. Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems 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

Energy Assessment Guidance October 2018


MAYOR OF LONDON

Energy Assessment Guidance

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

The main updates to the GLA Energy Assessment Guidance Oct 2018 that will need to be considered for new planning applications are:

- Use of the revised SAP 10 carbon emissions factors required, this makes electricity generating items.
- 10% and 15% improvement on emissions required at 'Be Lean' for Domestic and Non-Domestic respectively.
- Dynamic Overheating Assessment to CIBSE TM59 required.
- Combined Heat and Power (CHP) now not favourable.
- Renewable energy generation to be maximised meaning all available roof space to be provided with Photovoltaic (PV) panels.
- Biodiverse roofs to all roofs except amenity or plant roof spaces.

London Borough of Camden Planning Policy

The Council's strategy for the long-term use of land and developments in the borough is detailed in their document Camden Local Plan. This was adopted on July 3rd 2017 and has replaced the Core Strategy and Camden Development Policies documents as the basis for planning decisions and future development in Camden.

Camden Local Plan 2017

Policy A1 Managing the impact of development

The Council will seek to protect the quality of life of occupiers and neighbours. We will grant permission for development unless this causes unacceptable harm to amenity. We will:

a. seek to ensure that the amenity of communities, occupiers and neighbours is protected;
b. seek to ensure development contributes towards strong and successful communities by balancing the needs of development with the needs and characteristics of local areas and communities;
c. resist development that fails to adequately assess and address transport impacts affecting communities, occupiers, neighbours and the existing transport network; and
d. require mitigation measures where necessary.

The factors we will consider include:

e. visual privacy, outlook;
f. sunlight, daylight and overshadowing;
g. artificial lighting levels
h. transport impacts, including the use of Transport Assessments, Travel Plans and Delivery and Servicing Management Plans;
i. impacts of the construction phase, including the use of Construction Management Plans;
j. noise and vibration levels;
k. odour, fumes and dust;
l. microclimate;
m. contaminated land; and
n. impact upon water and wastewater infrastructure.

Policy CC1 Climate change mitigation

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

We will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met; c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
d. support and encourage sensitive energy efficiency improvements to existing buildings;
e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
f. expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and

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

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

Policy CC4 Air quality

The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.

Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.

Camden Planning Guidance Energy efficiency and adaptation (March 2019)

The Council has prepared this Camden Planning Guidance (CPG) on Energy and resources to support the policies in the Camden Local Plan 2017. This guidance is therefore consistent with the Local Plan and forms a Supplementary Planning Document (SPD) which is an additional "material consideration" in planning decisions.

This document should be read in conjunction with and within the context of the relevant policies in Camden's Local Plan, other Local Plan documents and other Camden Planning Guidance documents

This guidance provides information on key energy and resource issues within the borough and supports Local Plan Policies CC1 Climate change mitigation and CC2 Adapting to climate change.

Key Messages:

- All new build major development to demonstrate compliance with London Plan targets for carbon dioxide emissions.
- All new major developments in Camden are expected to assess the feasibility of decentralised energy network growth (paragraph 8.25 Local Plan).
- All development in Camden is expected to reduce carbon dioxide emissions through the application of the energy hierarchy.
- Developments of five or more dwellings and/or more than 500sqm of any gross internal floorspace to achieve 20% reduction in carbon dioxide emissions from on-site renewable energy generation

Calculation Methodology

The Energy Assessment undertaken follows the detailed methodology set out within the Greater London Authority (GLA) guidance document *“Energy Assessment Guidance – GLA guidance on preparing energy assessments as part of a planning application (October 2018)”*.

As such, the schemes regulated energy demand and carbon emissions have been calculated using the Standard Assessment Procedure (SAP) 2012, and the Simplified Building Energy Model (SBEM). These are the Government’s approved tools for assessing regulated carbon emissions from dwellings and non-residential areas respectively, and are used to demonstrate compliance with *Building Regulations Part L: Conservation of Fuel and Power*. In the case of dwellings, the unregulated energy demand has been estimated using the latest version of Bredem-12, as developed for use in the now repealed *‘Code for Sustainable Homes’*, and for non-residential areas, extracted from the SBEM results.

The ‘Baseline’ case for emissions was determined by using the ‘Target Emission Rate’ (TER) from the compliance calculations. These figures provide an emission rate for the ‘notional’ target building, and hence a figure for acceptable total regulated emissions.

The emissions saving from energy efficiency proposals (BE LEAN) was determined by comparing the total emissions from the TER figures, with the predicted emission rate (DER or BER), based on the proposed specification. The potential emission savings from decentralised energy (BE CLEAN) and renewable energy (BE GREEN) proposals, were then appraised, in line with the GLA requirements.

It should be noted that the compliance methodology was produced with the sole intention of demonstrating compliance with the *Building Regulations Part L*. As such, standardised assumptions are made regarding building occupancy, use, conditioning setpoints etc. It is therefore important to note that they are intended to be used on a comparable scale, rather than give accurate predictions of real energy use. The results herein are provided solely for the purposes of demonstrating compliance and are not envisioned as an accurate prediction of operational energy use.

The energy calculations have been undertaken by an accredited Energy Assessor.

Site Plan

The development is located within the West Hampstead area of the London Borough of Camden. The approved development comprises 180 mixed tenure residential dwellings (use Class C3), flexible non-residential use (Class A1-A3, D1, D2), employment floorspace (Use Class B1) and community space (Use Class D1) in buildings ranging from 3 to 7 storeys. New vehicular access from West End Lane and the provision of accessible car parking spaces, in addition to new public open space, the widening of Potteries Path and associated cycle parking and landscaping.

Figure 1 Aerial View of Site

The local area to the north, east and west is predominantly residential. The site is bound by the Thameslink Railway line to the south, residential dwellings to the north with a small playground to the east. The west block of the site faces onto West End Lane which comprises small shops. Further to the west and east are more residential roads and directly south of the railway line is an office block and an over ground railway line.

Base Line

Part L calculations have been undertaken to assess regulated energy use, accounting for energy demands from space conditioning (heating and cooling), hot water, and electricity for pumps, fans and lighting. A separate calculation has been completed for unregulated energy demand.

The energy assessment has first established the regulated CO_2 emissions assuming the development complied with Part L 2013 of the Building Regulations using the Building Regulations approved compliance software. When determining this baseline, it has been assumed that the heating would be provided by gas boilers and that any active cooling will be provided by electrically powered equipment.

The TER is the maximum permitted emissions for each dwelling and is expressed in $kgCO_2/m^2$. Thus, the total baseline emissions for the scheme are the sum of all the products of the TER and the total floor area (TFA). All dwellings have been assessed so there is no requirement to account for multiple dwelling types.

The unregulated emissions from the dwellings can be estimated using BREDEM-12, the developer has no control over this aspect of energy use, no energy saving measures can be proposed. Therefore, no change to the unregulated emissions will occur. The cooking figures assume that the all ovens/hobs are electric and are of a normal size.

Residential

The table below details the Baseline for the Residential Dwellings.

Scenario - Residential Scheme	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline Regulated	181.1	-	-
Baseline Unregulated	92.6	-	-

Non-Residential

The table below details the Baseline for the Non-Residential elements.

Scenario – Non-Residential Scheme	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline Regulated	21.84	-	-
Baseline Unregulated	7.9	-	-

Site-Wide

The table below details the Baseline for the whole site including the residential and non-residential areas.

Scenario – Site Wide	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline Regulated	202.9	-	-

Be Lean

This section outlines the proposals to reduce the energy demand and Carbon Dioxide emissions through passive measures. The performance and savings are compared against those previously calculated baseline emissions.

At an early stage, the design team have explored a range of energy efficiency measures including enhanced U-values, enhanced construction details to minimise thermal bridging and the use of efficient mechanical ventilation systems. At this 'Be Lean' stage the Mayor has set new efficiency targets in the GLA guidance:

- Domestic developments should achieve at least a 10 per cent improvement on Building Regulations from energy efficiency
- Non-Residential developments should achieve at least a 15 per cent improvement on Building Regulations from energy efficiency.

Thermal Envelope

Fundamental to achieving energy efficiency in any new building is a suitably designed and specified thermal envelope. Passive design features such as appropriate orientation, balancing solar gain and limiting heat loss by using high levels of insulation, reducing air leakage and minimising thermal bridging are all proven techniques to reduce energy consumption.

Residential Fabric Elements

The following tables illustrate the proposed building fabric performance specification, with respect to the limiting values stipulated in Part L 2013. It is shown that the proposed specification represents a significant betterment of the minimum standards.

Element – Residential Areas	Maximum Proposed U-value	Minimum (Part L1A) U-value	Improvement
External Walls (including walls to unheated common spaces)	0.16 W/m²K	0.30 W/m²K	47%
Party Wall – Fully Filled/Solid	0.00 W/m²K	0.00 W/m²K	-
Roofs – All except terraces	0.12 W/m²K	0.20 W/m²K	40%
Roofs - Terraces	0.20 W/m²K	0.20 W/m²K	0%
Ground Floors	0.12 W/m²K	0.25 W/m²K	52%
Exposed floors to unheated areas (Garages, refuse, cycle stores, entrance lobbies, plant rooms etc)	0.12 W/m²K	0.25 W/m²K	52%
Residential floors over Commercial Spaces	0.12 W/m²K	0.25 W/m²K	52%
Doors	1.4 W/m²K	2.0 W/m²K	30%
Glazing – U-value	1.2 W/m²K	2.0 W/m²K	40%
Glazing – G-value	0.4	-	-
Air Permeability	3 m³/hm²	10 m³/hm²	70%
Thermal Junctions	Calculated		

All dwellings will need to be air pressure tested to achieve an air permeability of 3.0 m³/hm², if the client uses sample air test then the average result will need to be 1.0 m³/hm² prior to a penalty of 2.0 m³/hm² being added to achieve the target air permeability of 3.0 m³/hm².

The following thermal junctions and Psi values have been assumed on the project; it is intended that if accredited details do not exist then these will be calculated at the design stage.

Junction	Psi Value	ACD	Default
E2-Other lintels	0.3	Yes	No
E3-Sill	0.04	Yes	No
E4-Jamb	0.05	Yes	No
E5-Ground floor (normal)	0.32	No	Yes
E20-Exposed Floor (normal)	0.32	No	Yes
E7-Party floor between dwellings	0.07	Yes	No
E9-Balcony between dwellings, wall insulation continuous	0.04	No	Yes
E24-Eaves (insulation at ceiling / inverted)	0.24	No	Yes
E14-Flat roof	0.08	No	Yes

Junction	Psi Value	ACD	Default
E15-Flat roof with parapet	0.56	No	Yes
E16-Corner (normal)	0.09	Yes	No
E17-Corner (inverted)	-0.09	Yes	No
E18-Party wall between dwellings	0.06	Yes	No
E25-Staggered party wall between dwellings	0.12	No	Yes
P1-Party - Ground floor	0.16	No	Yes
P3-Party - Intermediate floor between dwellings	0.00	No	Yes
P4-Party - Roof (ceiling insulation)	0.24	No	Yes
P7-Exposed floor (normal)	0.16	No	Yes

Non-Domestic Fabric Elements

The following tables illustrate the proposed building fabric performance specification, with respect to the limiting values stipulated in Part L 2013. It is shown that the proposed specification represents a significant betterment of the minimum standards.

Element – Non-Residential Areas	Maximum Proposed U-value	Minimum (Part L2A) U-value	Improvement
External Walls	0.16 W/m²K	0.35 W/m²K	54%
Walls to Un-heated Spaces	0.16 W/m²K	0.35 W/m²K	54%
Ground Floors	0.12 W/m²K	0.25 W/m²K	52%
Glazing – U-value	1.2 W/m²K	2.2 W/m²K	45%
Glazing – G-value	0.4	-	-
Air Permeability	3 m³/hm²	10 m³/hm²	60%

Glazing Elements

Solar control glazing has been specified where appropriate. For commercial areas it has been shown that the solar gains criteria within Part L2A can be satisfied by specifying low G-Values, in the region of 0.4. To balance useful heat gain with useful natural light, and limiting excessive gains, the G-Values will be subject to further review at design stage, but the limits set by Part L and the GLA guidance will be maintained.

The proposed glazing percentage of each façade is detailed below, where opaque panels are not counted as 'glazing':

Block	Façade	Approximate Percentage Glazed
West Block	North	19%
	East	25%
	South	44%
	West	38%
East Block	North	23.0%
	South	41.0%
	East	39.9%
	West	37.0%

Building services

For the 'Be Lean' case, the GLA guidance states that the same heating specifications must be used as per the 'baseline' case. This is so that the improvements from energy efficiency measures alone can be understood.

The heating systems used within the assessment are a community heating system, supplied by gas fired boilers. A thermal efficiency of 95.6% has been specified by the M&E design team, which will be the targeted efficiency of the supplementary boilers within the scheme.

Therefore, the applicable building services improvements are limited to the ventilation, lighting and auxiliary power equipment.

The below tables detail the proposed building services specification.

Residential Services	Specification
Heating system	Community heating scheme – As 'Baseline', with proposed gas boiler efficiency of 95.6%
Heating system controls	Charging system linked to use, and at least two room thermostats
Hot water system	From community system
Internal fixed lighting	100% 'Low Energy'
Ventilation	MVHR

Non - Residential Services	Specification
Heating system	Community heating scheme – As 'Baseline', with proposed gas boiler efficiency of 95.6%
Hot water system	From community system +2% for correct sizing using manufacturers software
Internal fixed lighting	100Lm/W efficacy luminaires, with presence detection where practical
Ventilation	Balanced supply and extract and heat recovery, with low specific fan powers (SFP's). SFPs <1.2W/(l/s) and heat recovery at >85%. Demand control via speed control linked to room sensors.
Power factor correction	Yes – greater than 95%
Out of range alarms for services and lighting (BMS)	Yes - throughout

Be Lean Results

Residential

The table below details the CO_2 savings from the 'Be Lean' assessment for the Residential Dwellings.

Scenario - Residential	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	181.1	-	-
Be Lean	157.1	13	13

As detailed in the table above, the passive design proposals demonstrate a 10.52% reduction in CO_2 emissions for the development over the regulatory requirement of the building regulations.

Non-Residential

The table below details the CO_2 savings from the 'Be Lean' assessment for the non-residential elements.

Scenario – Non-Residential	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	21.8	-	-
Be Lean	18.2	17	17

As detailed in the table above, the passive design proposals demonstrate a 17% reduction in CO_2 emissions for the development over the regulatory requirement of the building regulations.

Site-Wide

The table below details the CO_2 savings from the 'Be Lean' assessment for the whole site including the Residential and Non-Residential areas.

Scenario – Site-Wide	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	202.09	-	-
Be Lean	175.4	14	14

As detailed in the table above, the passive design proposals demonstrate an 14% reduction in CO_2 emissions for the development over the regulatory requirement of the building regulations.

The GLA guidance also requires schemes to report the below figures at this 'Be Lean' stage:

Building use	Energy demand following energy efficiency measures (MWh/year)					
	Space Heating	Hot Water	Lighting	Cooling	Auxiliary	Unregulated electricity
Residential Total	271.99	385.26	51.27	-	30.82	397.42
Non-Domestic Total	38.96	1.32	29.22	6.32	6.42	29.66

Criteria	Dwelling Part L Fabric Energy Efficiency Standard (FEES)
Total TFEE	46.27 kWh/m^2
Total DFEE	43.73 kWh/m^2
Improvement	5%

Summertime Overheating

Effects of overheating have been well documented over recent years, often cited to result from climate change and modern materials and construction techniques.

Although guidance exists across the industry to forecast the risk of overheating, design considerations are often required at concept stage to provide adequate mitigation.

Requirements

For new-build construction projects, reducing the risk of overheating should be given consideration at the earliest possible opportunity. Although certain measures can be incorporated at later stages, the most robust and effective techniques are often inherent to a building's design.

The 'cooling hierarchy', referred within Policy 5.9 of The London Plan indicates the preferred approach to reducing overheating risk and a reliance upon mechanical cooling. The hierarchal steps are:

1. Minimise heat generation through energy efficient design.
2. Reduce the amount of heat entering a building in summer.
3. Manage the heat within the building through exposed thermal mass and high ceilings.
4. Passive ventilation.
5. Mechanical ventilation.
6. Mechanical cooling.

Proposed mitigation strategy

A dynamic thermal model has been constructed to support this Energy Statement, and an overheating risk analysis of a large selection of representative apartments undertaken.

The mitigation strategy proposals include the following:

- Solar control glass with a g-value of 0.40 or below, shall be installed throughout the development
- The community heating system shall be designed in line with the CIBSE CP1: Heat Networks Code of Practice, in order to minimise heat gains in the summer and aid efficient operation
- Windows were assumed fully openable during the entire 24/7 occupied period except for those deemed to have a security risks, such as accessible windows on the podium etc.
- Allowances for windows deemed a security risk to be securely restricted to 200mm to enable the windows to remain partially open overnight, to facilitate the night purging of built-up heat.

To further reduce overheating risk, the Home User guides shall include advisory information to residents, regarding behavioural measures that can be adopted to further reduce the risk of overheating. This shall highlight the importance of keeping windows open overnight during periods of excessively high temperatures in order to purge built up heat, and advise on effective use of windows and shading co-efficient of blinds.

In summary, the design can be shown to limit overheating risk to levels compliant with industry guidance, subject to the design alterations and assumptions stated within the full thermal comfort report. However, potential thermal discomfort is shown in certain apartments should the occupants not operate blinds and windows effectively.

Part L1A assessments have shown that Appendix P of SAP 2012 shows either a 'Slight' or 'Medium' risk of likelihood of high internal temperatures during hot weather.

For non-domestic buildings the BRUKL output reports contain an 'HVAC Systems Performance' table comparing the cooling demand of the actual and notional buildings for different building elements. The below table shows the actual cooling demand is below that of the notional for each of the non-domestic spaces in the development where an active cooling load exists.

	Area weighted average non-domestic cooling demand (MJ/m^2)	Total area weighted non-domestic cooling demand (MJ/year)
Notional	80.2	5.465
Actual	85.6	6.318

Overheating Checklist

Section 1 – Site features affecting vulnerability to overheating		
Site Location	Urban – within central London or in a high-density conurbation	Yes
	Peri-urban – on the suburban fringes of London	No

Section 1 – Site features affecting vulnerability to overheating		
Air quality and/or Noise sensitivity – are any of the following in the vicinity of buildings?	Busy roads / A roads	Yes
	Railways / Overground / DLR	Yes
	Airport / Flight path	No
	Industrial uses / waste facility	No
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	Yes
	Are residents likely to be at home during the day (e.g. students)?	No
Dwelling aspect	Are there any single aspect units?	Yes
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	No (22.2%)
	If yes, is this to allow acceptable levels of daylighting?	-
Security - Are there any security issues that	Single storey ground floor units	Yes

Section 1 – Site features affecting vulnerability to overheating		
could limit opening of windows for ventilation?	Vulnerable areas identified by the Police Architectural Liaison Officer	No
	Other	Podiums

Section 2 - Design features implemented to mitigate overheating risk		
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	No
	Will green roofs be provided?	Yes
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	No
Materials	Have high albedo (light colour) materials been specified?	Yes
Dwelling aspect	% of total units that are single aspect	47%
	% single aspect with N orientation	0%
	% single aspect with S orientation	19%
	% single aspect with E orientation	12%

Section 2 - Design features implemented to mitigate overheating risk		
	% single aspect with W orientation	15%
Glazing ratio - What is the glazing ratio (glazing; internal floor area) on each facade?	North	4.0%
	South	7.0%
	East	4.8%
	West	6.2%
Daylighting	What is the average daylight factor range?	0.5%-10.2%
Window opening	Are windows openable?	Yes. Windows overlooking podiums and to ground floors shall have restricted openings for security, however, this can be overridden.
	What is the average percentage of openable area for the windows?	73.5%
Window opening - What is the extent of the opening?	Fully openable	Yes
	Limited (e.g. for security, safety, wind loading reasons)	200mm

Section 2 - Design features implemented to mitigate overheating risk		
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	Openings to be securely openable to 200mm
Shading	Is there any external shading?	No
	Is there any internal shading?	Yes
Glazing specification	Is there any solar control glazing?	Yes
Ventilation - What is the ventilation strategy?	Natural – Background	No
	Natural – purge	Yes
	Mechanical – background (e.g. MVHR)	Yes
	Mechanical – purge	No
	What is the average design air change rate	0.5 (Trickle)
Heating system	Is communal heating present?	Yes
	What is the flow/return temperature?	65°C F /35°C R
	Have horizontal pipe runs been minimised?	Yes
	Do the specifications include insulation levels in line with the London Heat Network Manual	Yes

Be Clean

Once the 'Be Lean' stage has been completed and the demand for energy has been minimised the hierarchy requires that the Energy Statement demonstrate how the developments energy will be supplied. The selection of the energy system shall be in accordance with the order of preference set out in the London Plan Policy 5.6b. The order of preference outlined in Policy 5.6b is as follows:

- Connection to existing heating or cooling networks
- Site wide CHP network
- Communal heating and cooling.

Building Services Specification

The below tables detail the proposed building services specification.

Residential Services	Specification	
	Private Apartments	Affordable Apartments
Heating system	Heat Network	Heat Network
Heating system controls	Charging system linked to use, programmer and TRVs	Charging system linked to use, programmer and TRVs
Cooling	None	None
Hot water system	From Hydraulic Interface Unit	From Hydraulic Interface Unit
Internal fixed lighting	100% 'Low Energy'	
Ventilation	MVHR – SFPs 0.52-0.59 W/l/s	MVHR – SFPs 0.52-0.59 W/l/s
Water Usage	<105 litres/person/day	
Heat Emitter	Underfloor Heating	Radiators

Heat Network

A heat network is the process of heating and/or cooling a group of buildings from central energy generation plant(s) via a network of distribution pipes. It is widely used for urban environments including residential, commercial, local authority, government, and industrial buildings. It is also used extensively for universities and hospitals. A heat network is an alternative to the more traditional installation of individual heating or cooling plants in each building.

Heat networks are prioritised by regional and local planning authorities. Specifically, Policy 5.5 of The London Plan 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.

Where a decentralised heat network exists in the vicinity of the proposed development, the feasibility of connecting the development to the heat network must be investigated if:

- The proposed development falls within 1km of an existing decentralised network, or

- The development falls within 1km of a decentralised energy network that is likely to be operational within three years of occupation of the proposed development.

The London Heat Map has been investigated for the development (see Figure 3). Yellow lines denote existing district heat networks and red lines denote proposed district heat networks.

From the review of the surrounding area, using the London Heat Map, it has been found that the immediate vicinity of the development is outside the areas detailed as ‘Heat Mapping Decentralised Energy Potential’, not near any existing DH network, and not close enough to any potential DH network for it to be feasible to connect to.

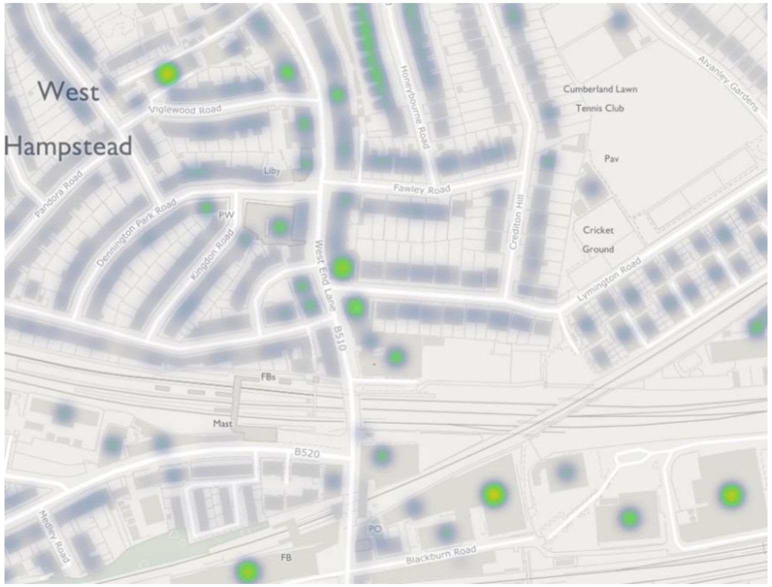


Figure 2 London Heat Map

Site Wide Heat Network

As described above, the proposals are to provide one site wide heat network, which will enable easy connection to a wider heat network in the future, should one become available. The heat source incorporated with the energy centres has been explored to establish what kind is most feasible to provide the targeted carbon savings.

The GLA guidance has been updated and referable applications are encouraged to use the updated SAP10 carbon emission factors. The impact of the new emission factors is significant in that technologies generating on-site electricity (such as gas-engine CHP and solar PV) will not achieve the carbon savings they have to date.

Ignoring delivery losses, the resulting carbon emissions from delivering heat from a CHP engine, a gas boiler, and a direct electric heater, are all now similar. There is therefore minimum, if any, emissions savings for a scenario where heat is delivered from CHP. It is therefore considered not to be feasible and has not been investigated further.

The only heat source which is shown to provide a significant emissions saving is heat pumps. The proposals are therefore to utilise this technology as much as practical to generate heat for the development. Analysis has shown that the use of Air Source Heat Pumps is the more efficient than Ground Source Heat Pumps for this project, it is therefore proposed to utilise ASHPs.

Distribution losses

The losses from distribution pipework have been calculated, and are based on pipe length, design temperatures, and the level of insulation proposed. The losses are included with the energy calculations at this ‘Be Clean’ stage, as required by the GLA guidance.

The calculations are contained within the appendices. They are incorporated into the energy calculation as described below.

Heat demand from central plant (MWh)	Distribution losses (MWh)	Percentage losses
727.38	72.7	10%

The design team are committed to designing and delivering the communal heating systems in compliance with the CIBSE Heat Networks: Code of Practice for the UK and in partnership with energy services companies that are, or are working towards, being registered participants of the Heat Trust.

Future proof to achieve Zero Carbon

The development will be provided with a future connection point for when a DH network becomes available. This is a requirement of the London Plan, as described above. Should a DH network become available in the future, the development can connect to it, if economically feasible.

The above will largely depend on the carbon conversion factor of the DH network, and this will therefore dictate how close to carbon zero this site can achieve in the future. If feasible, this will allow the site to reduce emissions from heating and hot water as far as practically possible. This would then leave the electrical demand for the site. As the grid becomes 'de-carbonised' the carbon factor associated with the electricity will reduce.

This has been demonstrated by the introduction of SAP10 carbon emissions where the grid electricity carbon factor has been reduced from 0.519 to 0.233, a dramatic reduction. If we see similar reductions in the future, the carbon emissions associated with electricity will reduce in line. Further to this, the installed PV array will continue to deliver a proportion of the electricity, and when it needs replacing it is likely that the technology will have improved, so the same amount of panel area will be able to provide a larger amount of electricity.

The timeline to achieve carbon zero will therefore be dependent on any future DH Networks, the future carbon factor of grid electricity, and the development of PV efficiency.

Be Clean Results

There are currently no existing district heating networks within the vicinity of the development and so connection to an existing network is not currently an option. The development site has been investigated and found to be outside areas identified as having decentralised energy potential. However, on-site heat networks are considered to still be applicable due to the sites size and density, and a communal heat network for development is considered appropriate.

In line with the London Plan requirements, the communal heat networks shall be designed in such a way, as to allow for efficient connection to a future district scheme, should one become available. Accordingly, the proposals have shown that enough space has been allocated for a sufficiently large energy centre.

The proposals show the design heat losses, based on pipe length, design temperatures, and insulation levels. In addition, variable flow control systems to lower flow rates and lower return temperatures at part-load, will be investigated and included in the heat loss calculations as the design progresses. Throughout the design stage, the design team will pay careful attention to ensure systems operate with low return temperatures, in line with the CIBSE Heat Networks: Code of Practice for the UK.

Based on the specified 'Fabric' measures listed above within the Be Lean section and incorporating the heat network to all dwellings the reductions in emissions for the site is predicted below:

Residential

The table below details the CO_2 savings from the 'Be Clean' assessment for the Residential Dwellings.

Scenario - Residential	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	181.1	-	-
Be Lean	157.1	13	13
Be Clean	157.1	0	13

Non-Residential

The table below details the CO_2 savings from the 'Be Clean' assessment for Non-Residential areas.

Scenario – Non-Residential	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	21.8	-	-
Be Lean	18.2	17	17
Be Clean	18.2	0	17

Site-Wide

The following table details the CO_2 savings from the 'Be Clean' assessment for the whole site including the Residential and Non-Residential areas.

Scenario – Site-Wide	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	202.9	-	-
Be Lean	175.4	14	14
Be Clean	175.4	0	14

Be Green

Once the 'Be Lean' and 'Be Clean' stages have been completed and assessed the demand for energy has been minimised the hierarchy requires that the Energy Statement demonstrate how the developments energy will be supplied.

Overview

Renewable energy is defined as energy derived from energy flows that occur naturally and repeatedly in the environment. Renewable technologies generally utilise direct or indirect energy from the sun, the exceptions being geothermal, which uses heat from the earth's core, and tidal electricity generation which uses the gravitational forces between the earth and the moon. As this report is only concerned with practical options for on-site renewable energy geothermal and tidal energy sources are not considered further.

The remaining technologies can be summarised as follows:

- Solar thermal: direct heating of water for space heating or domestic hot water;
- Photovoltaic: direct generation of electricity from sunlight;
- Hydroelectricity: use of solar (water cycle) driven water flows to generate electricity;
- Wind turbines: use of solar driven air movement to generate electricity;
- Heat pumps: extraction of solar heat from the earth, atmosphere or water bodies, for space heating or domestic hot water;
- Bio-fuels: combustion of solid or liquid bio-fuels to produce heat or electricity;

The following section contains an overview of the technologies selected for this development. For more detailed analyses of all listed technologies, and the reasons for their exclusion, please see Appendix A.

Heat Pumps

Heat pumps collect low temperature heat from renewable sources and "concentrate" it to a usable temperature. Fossil fuel based (grid) electricity is generally required to operate the pumps and the renewable component of the output is therefore by convention taken as the difference between the output energy and the input energy. A typical heat pump will deliver 3-4 kWh of useful energy for every 1 kWh of input energy. A heat pump operating in this way can therefore be deemed to have delivered 2-3 kWh of renewable energy.

The introduction of SAP10 carbon emission factors has, in most cases, resulted in heat pumps being the only viable option to reduce carbon emissions in line with London Plan target requirements.

The proposals are to locate Air Source Heat Pumps (ASHP) within the lower ground floor plant room of the East Block, providing heated water to be used for space heating and hot water, which will be transferred to basement level where a gas boiler will heat the water further if required. It will then be distributed around the block and transferred into dwellings via heat interface units (HIU). It is anticipated that the ASHP will provide 70% of the total heating and hot water heat demand, with the gas boiler doing the remaining 30%. There will be no requirement to boost the hot water locally within the dwellings.

The heat pumps shall be air to water type and connect to the main heat network within the plant room. The use of air to water heat pumps in conjunction with gas boiler top up enables the future connection to an area wide heat network.

The heat pumps shall provide 522MWh 70% of the total 746 MWh annual heat demand for the site. The heat pumps are to operate at a 51°C flow in the summer and 56°C flow in the winter. The gas boilers shall be utilised to increase the heat network flow temperature to 60°C in the summer and 65°C in the winter. The heat network return temperatures shall be 30°C in the summer and 35°C in the winter. The manufacturer currently considered to provide the ASHPs has calculated their SCOPs based on BS EN 14825. On this basis the interpolated SCOP for the ASHP is 2.94, please see the appendices for the manufacturer's calculations. The onsite BMS control system shall monitor the LTHW circuit flow and return temperatures to ensure that the system runs efficiently with priority to the air source heat pumps.

Use of heat meters and the BMS control system shall monitor the performance of the system to ensure it is achieving the expected design performance.

For the non-residential areas, a plate heat exchanger shall be provided to each of the commercial units with connection to the heat network to provide hot water. Heating and cooling shall be via VRF heat pumps with an estimated SCOP of 2.3 and SEER of 2.6.

Solar photovoltaics

Photovoltaic technology – the direct generation of electricity in semi-conductor panels when these are exposed to sunlight, is not new. The first PV cells were demonstrated in the late 1950s although the physics had been known since the beginning of the 20th century. There are three types of modern silicon semiconductor panels; monocrystalline; polycrystalline; and thin film; plus a new technology that involves screen printing non-silicon nano-technology inks on to a flexible substrate. In many ways, these products are similar, with outputs ranging from 50 to 150 kWh/m^2. However, the main thrust of development now is towards reducing cost, with potential cost reductions of up to a factor of 10 being claimed for the nano-technology systems once they are in volume production.

Photovoltaic panels are conceptually straightforward. The panels produce “zero carbon" electricity that is used in place of grid electricity, and the carbon dioxide emissions saved are the emissions that would have occurred had the electricity been produced by a power station feeding the grid.

Photovoltaic panels have certain siting constraints. To produce the maximum output, they should face due south, although south-east to south-west is certainly acceptable, and even east or west will be acceptable if the angle of inclination is no more than 20º. When not in direct sunlight, but shaded by obstacles such as adjacent buildings or trees, the output of the affected panel is significantly reduced. As groups of panels are connected electrically in "series" a reduced output from one panel will reduce the output from all the panels in the group. This means that it is particularly important to avoid over-shading. However, photovoltaic panels have many advantages, they are clean, silent, reliable, low maintenance, and are easy to install. They also have a very long life – up to 40 years – which is at least double that typically quoted for other technologies. PV can be relatively expensive in terms of capital cost per kWh, and due to the revision of SAP10 carbon emission factors, they do not provide the CO2 reduction that they have done in the past.

Unlike most solar thermal panels, and most other renewable energy technologies, photovoltaic panels are “zero carbon” in use. They simply produce electricity when exposed to sunlight. However, the situation is rather different when the carbon dioxide emissions are determined using a “whole life cycle analysis” approach that includes the energy and other greenhouse gas emissions associated with panel manufacture (panel manufacture uses large amounts of electricity and greenhouse gases such as SF6 which has a Global Warming Potential 24,000 time greater than CO_2).

Studies have shown that when analysed in this way the effective whole life emissions rate of a typical photovoltaic panel is approximately 0.050 $kgCO_2$/kWh compared to the much lower rates of 0.008 $kgCO_2$/kWh for wind turbines and 0.025 $kgCO_2$/kWh for biomass systems. So, although in the UK, the compliance methodologies do not consider “embodied” emissions, they are real, and for photovoltaic panels, substantially larger than for most other technologies. Of course, once the panels are manufactured in plants powered by renewable energy, this problem will be substantially reduced, and the new nano-technology systems are far less energy intensive.

This development proposal is well suited to photovoltaic panel technology, as the roofs should allow for minimal over-shading of equipment, and there is easy access for maintenance.

PV specification

It is calculated that a 128 kWp PV array shall be proposed for the development. From preliminary investigations it is estimated that this is the maximum that could be accommodated on the development, due to some roof space being taken by ASHPs/plant equipment.

The below table details the specifications applied to the calculations.

	Specification
Installed Peak Power West Block	89.15 kWp
Installed Peak Power East Block	38.85 kWp
Tilt	30°

Note that the specifics of the PV design shall be evaluated fully during detailed design by a suitably qualified specialist.

The system inverter will convert DC output to AC, bringing power into phase with the mains electricity supply. It is expected that the PV will feed directly into the landlord's electricity supply, and the power produced used to power the communal areas of the building (lifts, lighting etc). This generation is not likely to exceed the demand, however, if there is any surplus electricity produced, this can be exported to the grid to be utilised by others.

To represent the emissions reduction the PV array has been entered into the Part L1A calculations for the dwellings.

Roof plans showing the location of the proposed PV array for both the east and west blocks are shown below:

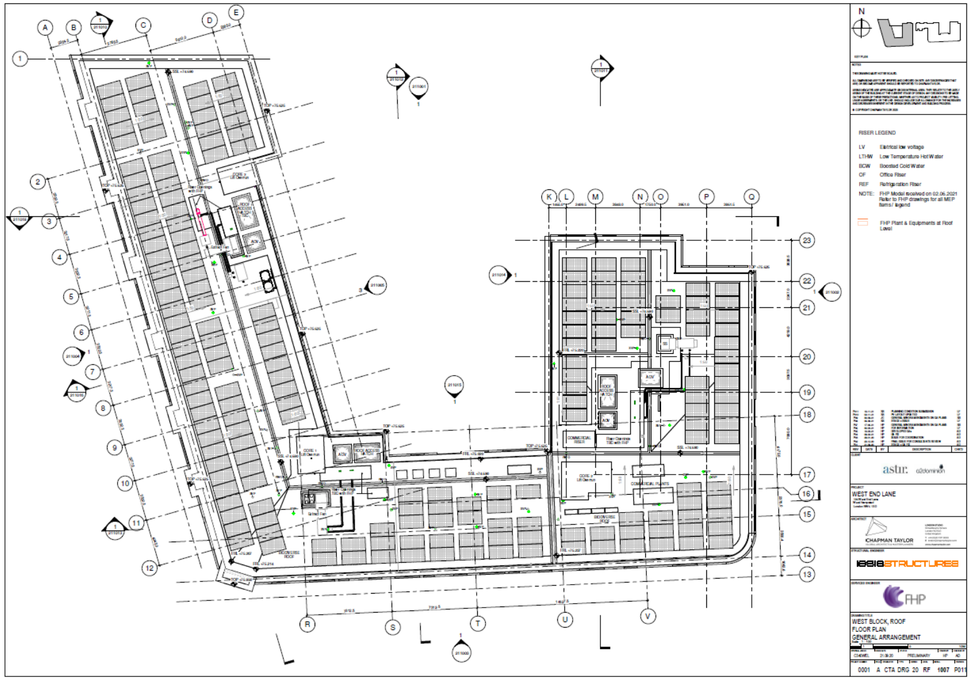


Figure 3 – indicative PV Array West Block Roof Layout

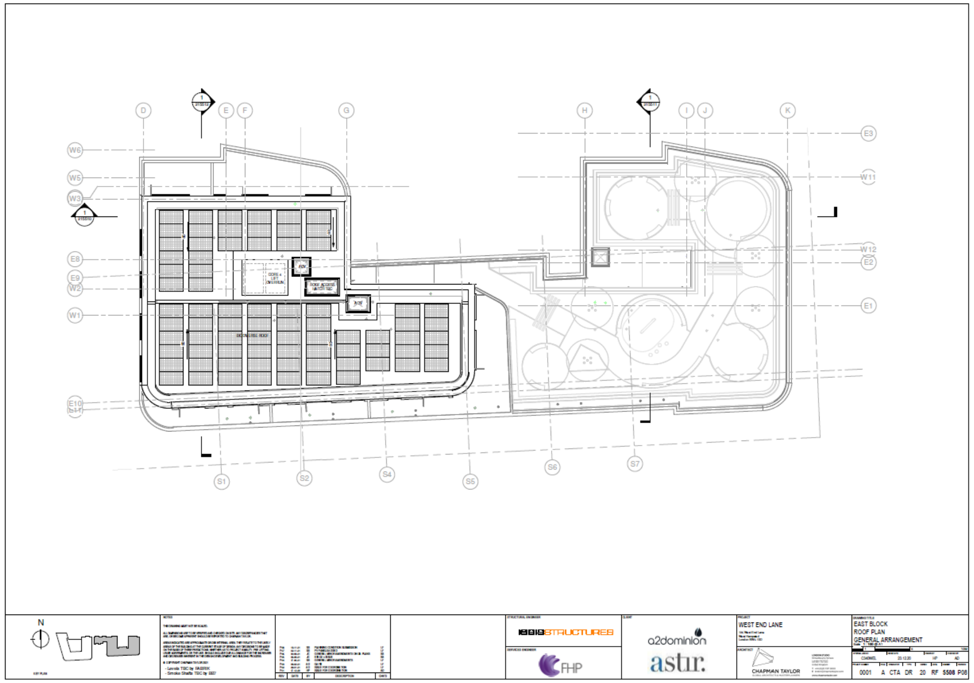


Figure 4 – indicative PV Array East Block Roof Layout

Air quality

The latest guidance from the GLA requires the predicted total fuel consumption for the development to be recorded in the following table, in order to assist in the assessment of air quality impacts. It is important to note that this indicative data is provided for information only, and that this document does not constitute an air quality impact assessment. It is noted however, that the act of incorporating an electrically powered lead heat source shall significantly reduce combustion on site; and should therefore be considered good practice with regard to minimising air quality impacts from the development.

The below figures also take into account the PV energy production.

Energy Source	Total fuel consumption - residential	Total fuel consumption – non-residential
Grid Electricity	721.4 MWh/year	83.4 MWh/year
Domestic/communal gas boiler	206.8 MWh/year	0 MWh/year

The proposed gas boilers will have NOx emissions that are less than 40mg/kWh.

Be Green Results

The below tables detail the CO_2 savings from the 'Be Green' assessment.

Residential

Scenario - Residential Scheme	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	182.1	-	-
Be Lean	157.1	13	13
Be Clean	157.1	0	13
Be Green	74.6	46	59

As detailed in the table above, the Be Green design proposals demonstrate a 59% reduction in CO_2 emissions for the development over the regulatory requirement of the building regulations.

Non-Residential

The table below details the CO_2 savings from the 'Be Green' assessment for the Non-Residential areas.

Scenario – Non-Residential	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	21.8	-	-
Be Lean	18.2	17	17
Be Clean	18.2	0	17
Be Green	12.5	26	43

As detailed in the table above, the Be Green proposals demonstrate a 43% reduction in CO_2 emissions for the development over the regulatory requirement of the building regulations.

Site-Wide

The table below details the CO_2 savings from the 'Be Green' assessment for the whole site including the residential and Non-Residential areas.

Scenario – Site-Wide	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	202.9	-	-
Be Lean	175.4	14	14
Be Clean	175.4	0	14
Be Green	87.1	43	57

As detailed in the table above, the Be Green proposals demonstrate a 57% reduction in CO_2 emissions for the development over the regulatory requirement of the building regulations.

Conclusions

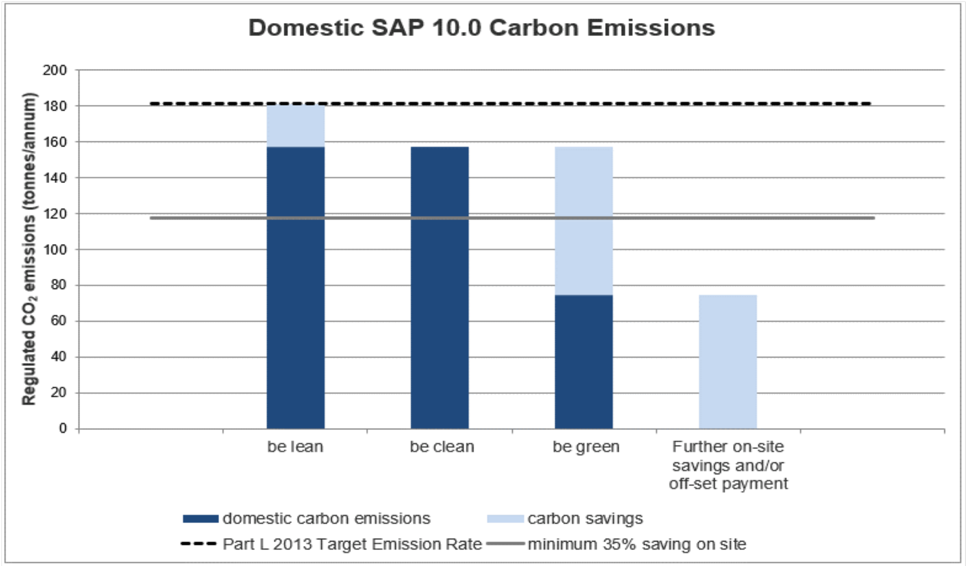
This Energy Statement has outlined the proposed preliminary specification for the development and the resulting savings implemented at each stage of the energy hierarchy. A fabric-first approach has been taken to realise savings against the current Building Regulations baseline.

The opportunity for building-level heating has been evaluated and found to be technically viable. Therefore, an ASHP/boiler community heating system shall be implemented, with provision made to allow for connection to a future district heating scheme if one becomes available. Additional energy and CO_2 savings will then be achieved using renewable energy technology.

Therefore, the foregoing results, reducing carbon emissions by 59% for dwellings and 43% for non-residential areas, show that the development proposals have been assessed in line with the applicable planning policies of the London Plan: Policy 5.2: Minimising Carbon Dioxide Emissions; Policy 5.3 Sustainable Design and Construction; Policy 5.6: Decentralised Energy in Development Proposals; and Policy 5.7: Renewable Energy.

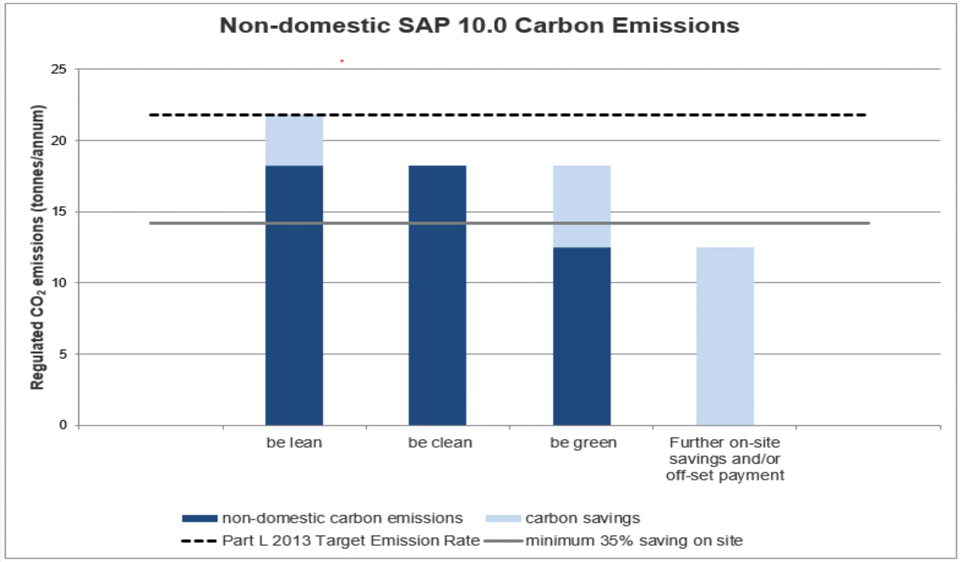
Residential CO_2 Emissions at Each Stage of the Hierarchy

Scenario - Residential Scheme	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	182.1	-	-
Be Lean	157.1	13	13
Be Clean	157.1	0	13
Be Green	74.6	46	59



Non-Residential CO_2 Emissions at Each Stage of the Hierarchy

Scenario – Non-Residential	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	21.8	-	-
Be Lean	18.2	17	17
Be Clean	18.2	0	17
Be Green	12.5	26	43



Site Wide regulated CO_2 savings at each stage of the energy hierarchy

Scenario – Site-Wide	Annual CO_2 emissions (Tonnes CO_2/annum)	CO_2 reduction (%)	Cumulative CO_2 reduction (%)
Baseline	202.9	-	-
Be Lean	175.4	14	14
Be Clean	175.4	0	14
Be Green	87.1	43	57