Energy Statement
(incl. BREEAM LZC Feasibility Study)

Site Address:
49-53 Glengall Road
London
SE15 6NF

Prepared on behalf of:
Southern Housing Group
Fleet House
59-61 Clerkenwell
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Job No: 32865
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1.0 Key Project Information

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Development Details:

Glengall Road Development

Glengall Road
London

170 Residential Apartments.

Commercial area 3,607m^2

Client Details:

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2.0 Executive Summary

2.1 The Development

Baily Garner was commissioned by Southern Housing Group to develop an energy strategy for the proposed Glengall Road development, a new residential development in the London Borough of Southwark.

Development of the site to provide a mixed-use building comprising of ground, mezzanine floor commercial space and 12 upper floors providing residential accommodation with cycle parking and ancillary facilities.

The development features the following sustainability and servicing measures:

- High performance building fabric has been maximised to reduce the energy required to heat the dwellings and non-residential areas.
- High efficiency lighting in all areas with PIR/Occupancy sensors in common areas and commercial space.
- Ventilation provided via mechanical means with heat recovery (MVHR) in residential areas with very low specific fan power.
- Communal hybrid Low Temperature Heat Network with a Low Carbon Air Source Heat Pump led system and gas boiler providing a fraction of the heat. This system will provide provision for future connection to a district energy network.

2.2 Energy & Carbon Targets

The development is governed by the requirements of the draft New London Plan.

The New London Plan and Southwark's Local Plan require at least a 35% carbon reduction over Part L on site and for the remainder (to zero carbon) to be offset via a carbon offset payment.

Policy SI2 Minimising greenhouse gas emissions states that a minimum on-site reduction of at least 35% beyond Building Regulations is expected. Residential development should aim to achieve 10%, and non-residential development should aim to achieve 15% 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 via either:

- Through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or
- Off-site provided that an alternative proposal is identified and delivery is certain.

2.3 Existing Energy Strategy

The existing Energy Statement (issued November 2017 by CDi) achieves a 45% Carbon reduction. However, upon reading the report it is unclear how they have achieved this carbon reduction. There are a few issues:

- Not all building fabric U-value details are shown, only external walls and glazing. Values are needed for the ground floor, the floor over the commercial units, roofs and doors. No energy criteria or SAP worksheets are provided that confirm the details used to calculate the DER and TER results shown in Appendix A.

- The Dwelling Fabric Energy Efficiency (DFEE) and Target Fabric Energy Efficiency (TFEE) results are shown in appendix A of their report, which indicate Building Regulations AD L1A – Criteria 2 is achieved. However, no energy criteria or SAP worksheets are provided that confirm the details used to calculate the DFEE and TFEE results shown in Appendix A.

- It is noted that CHP is proposed with a CHP engine size of 75kWe. This seems large for the size of this development and requires that ideally 75kW electricity be used on site in the landlord's areas. If it is not used on site it would need to be exported to the grid at a lower price than it costs to purchase and is not as economically feasible.

- It is noted that PV is proposed to be incorporated in the scheme. There is no indication on the size, location or output (kWp) of any proposed array.

- An air permeability of 3m3/hm2 has been assumed for the commercial unit. However, clause 1.1 within the energy statement states that 4m3/hm2 was used. The AD L2A calculation for the commercial unit is done as a combined calculation. However, this should be carried out to individual units as these will be occupied separately. Building Control will require each unit's calculation and separate EPCs will be required at handover. The air permeability is set at 3m3/hm2, which is a high target for commercial unit, means that air test would need to be carried out to each of the units (as they are not connected) at post construction stage to ensure the Part L2A calculations pass using actual air test values. Ideally the air permeability for the commercial units should be set at 5m3/hm2.

- The Energy Hierarchy was not defined on how the 45% was achieved via the Be Lean, Be Clean and Be Green stages.

Given the lack of evidence and information in the report the client has requested Baily Garner to carry out a new Energy Strategy for the Glengall Road site. It is also important to note that the existing strategy is not feasible and a clear strategy to reduce carbon emissions by 45% has not been established. In this report we have targeted the minimum 35% carbon reduction using SAP10 calculations tool as required by the New London Plan.

2.4 Technology Summary – Lean, Clean & Green

Be Lean

The target emissions & lean stage calculations have been based on the use of a highly efficient gas boiler installation with a focus on improvements in fabric energy efficiency only. The fabric values and building services in use to achieve an overall 20% carbon reduction site wide are as follows:

Table 2-0-1 Building Services specification for dwellings at Lean stage

Element	Performance Target
External Wall	U-value = 0.15 W/m2K
Sheltered Wall	U-value = 0.15 W/m2K
Exposed Floor (basement)	U-value = 0.10 W/m2K
Exposed Floor (residential floor above commercial)	U-value = 0.13 W/m2K
Roof	U-value = 0.12 W/m2K
Door (residential)	U-value = 1.2 W/m2K
Door (commercial glazed)	U-value = 2.2 W/m2K
Glazing (residential)	U-value = 1.4 W/m2K g=0.4
Glazing (non-residential)	U-value = 1.6 W/m2K g=0.5
Air Permeability (residential) **Air Permeability (non-residential)**	3.0 m3/hr.m2@50Pa 5.0 m3/hr.m2@50Pa
Thermal Bridging	SAP K1 Approved psi values for residential
Party wall U-value (W/m²K)	0.00 (fully filled insulation)
Riser wall U-value (W/m²K)	0.22

Table 2-0-2 Building Services specification for dwellings at Be Lean stage

Element	Specification
Ventilation	Mechanical ventilation with heat recovery (MVHR) systems in each dwelling. Windows half open in summer and summer bypass mode on MVHR for summer nights.
Internal lighting	100% low energy lighting.
Heating plant	Combi boiler achieving 90% efficiency (Manufacturer's declaration)
Heat emitters	Radiators
Overheating control	Openable windows and MVHR for overheating control.

Table 2-0-3 Building Services specification for non- residential at Be Lean stage

Element	Specification
Ventilation	In ceiling air handling plant with fresh air intake and exhaust at ceiling level. Low specific fan powers and heat recovery with a minimum of 70% efficiency. Intake and exhaust louvres to be provided at the façade.
Internal lighting	High efficiency lighting will be provided to exceed the minimum requirements of the Non Domestic Building Services Compliance Guide. Lighting power densities of 2W/m2/100 lux will be targeted. Occupancy sensing is assumed.
Heating plant	Gas boiler achieving 90% efficiency (Manufacturer's declaration).
Cooling	Natural ventilation
Heat and cooling emitters	Radiators

Be Clean

The site is within London's Heat Network Priority Areas. The London Heat Map shows the nearest existing district energy system to be approximately 4.5km from the development site with no proposed future connections.

This scheme has 170 units that provide a sufficient base load for CHP. However, it is estimated that only very little of the annual electricity generated would be used on site in the landlord's common parts, the remainder would therefore be exported to the grid. Energy companies are not obliged to purchase surplus energy from CHP and there is no feed-in tariff available for CHP. Based on this scenario, a payback period would not make this economically viable.

The inclusion of CHP in the scheme is therefore not feasible. No further carbon reductions were made at this stage.

Be Green

Air source heat pumps have been selected as the most appropriate technology. The system shall use communal air source heat pump system to provide water at low temperature to internal HIU units to provide heating and hot water with a fraction of the heat provided by gas boilers. The minimum CoP of the air source heat pump system is 2.50. We based our calculation on a heat fraction of 20/80, 20% by boiler and 80% by ASHP system. The actual heat fraction will be determined at detail design stage ensuring the same carbon reduction is achieved at this Be Green stage.

The minimum PV requirement to achieve the previous 45% carbon reduction is 38.5kWp of PVs.

See Appendix A for Life Cycle Cost Analysis for LZC Technologies and Appendix B for available Grants and Incentive Schemes.

The table below summarises the change from the lean to be green stage for the development:

Table 2-4 Dwelling building services changes at Green stage

Element	Specification
Heating plant	**Dwellings**: Communal hybrid Low Temperature Heat Network with a Low Carbon Air Source Heat Pump led system and gas boiler providing a fraction of the heat. This will provide both heating and hot water to dwellings. **Commercial units**: Communal hybrid Low Temperature Heat Network with a Low Carbon Air Source Heat Pump led system and gas boiler providing a fraction of the heat. This will provide both heating and hot water to the commercial areas. Cooling provided by air source heat pump with minimum EER of 3.5.
Heat emitters	**Dwellings**: Under floor heating (recommended) or radiators. **Commercial units**: Warm air distribution system.

2.5 Domestic Performance – The New London Plan (SAP10)

Table 2-5 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings (Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	45	27%
Savings from heat network / CHP	0	0%
Savings from renewable energy	21	13%
Cumulative on site savings	**66**	**40%**
Annual savings from off-set payment	101	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**3,034**	-
Cash in-lieu contribution (£)	**182,046**	

Table 2-6 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings.

	Regulated non-domestic carbon dioxide savings (Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0	0%
Savings from heat network / CHP	0	0%
Savings from renewable energy	36	59%
Total Cumulative Savings	**36**	**59%**

2.6 Site-wide performance

Table 2-9 Site wide performance under the New London Plan (SAP10)

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2013 baseline	228		
Be lean	183	45	20%
Be clean	183	0	0%
Be green	126	57	25%
	-	CO2 savings off-set (Tonnes CO2)	-
Off-set	-	**2,594**	-

Carbon Offset

The cash in lieu contribution to the borough's carbon offset fund to achieve zero carbon is **£155,640** (2,594 tones CO_2 over 30 years x £60) under the New London Plan.

Overall, the site achieves **45%** carbon reduction.

3.0 Project Description

Baily Garner LLP has been instructed by Southern Housing Group to provide an energy statement in connection with the proposed development at Glengall Road in the London Borough of Southwark.

The proposed development is located on Glengall Road in London south of Bianca Road. Development of the site to provide a mixed-use building comprising of ground and mezzanine floor with 12 upper floors providing residential accommodation and cycle parking and ancillary facilities.

Figure 3-1 Proposed Site Location Plan.

Figure 3.2 Street View of Site.

4.0 Policy

In this section the main legal and policy drivers for energy and sustainability are examined. This includes both national and local policy.

4.1 National Legislation

The UK Climate Change Act (2008) sets a legally binding target for reducing UK CO2 emissions by at least 80% by 2050 compared to 1990 baseline emissions. The Act is supported by the UK Low Carbon Transition Plan (2009), which sets out the UK's approach to meeting our carbon reduction commitments. Most recently, the Government has accepted the Committee on Climate Change's 4th carbon budget recommendations which cover the period 2022 – 2027. These set a CO2 reduction target in law of 50% reduction by 2027 from 1990 levels.

The Building Regulations Part L sets maximum limits for CO2 emissions from dwellings and non-residential development and sets minimum fabric energy efficiency standards for dwellings. Part L 2013 has been used as the basis of this report however the development will need to comply with the revision of Part L which is current at the start of construction.

Floods and Water Management Act 2010 sets requirements in order to provide better, more comprehensive management of flood risk for people, homes and businesses.

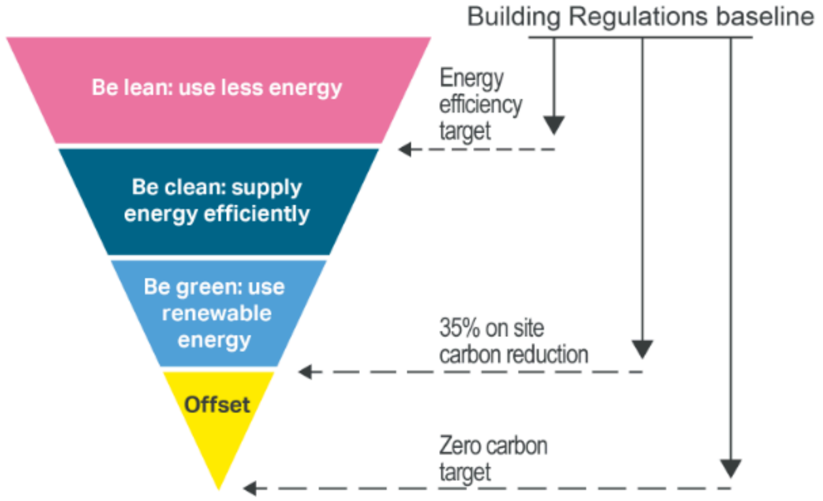
The National Planning Policy Framework came into force in March 2012 following submission of the Outline Planning Application. The document consolidated over two-dozen previously issued Planning Policy Statements (PPS) and Planning Policy Guidance Notes (PPG) for use in England. The NPPF will have significant impact on future local planning policy in respect of sustainability.

4.2 Regional Policy – Greater London Authority & the New London Plan

The Greater London Authority has developed The New London Plan as a proposed replacement for the current 2016 version of The London Plan, the New London Plan is a material consideration in planning decisions. The Mayor is using the New London Plan for development control purposes and this application will be assessed against the relevant policies. We have therefore provided the assessment on this basis.

[Policy SI2 Minimising greenhouse gas emissions], The Mayor is committed to London becoming a zero-carbon city. This will require reduction of all greenhouse gases, of which carbon dioxide is the most prominent. London's homes and workplaces are responsible for producing approximately 78 per cent of its greenhouse gas emissions. If London is to achieve its objective of becoming a zero-carbon city by 2050, new development needs to meet the requirements of this policy. Development involving major refurbishment should also aim to meet this policy.

The energy hierarchy should inform the design, construction and operation of new buildings. The priority is to minimise energy demand, and then address how energy will be supplied and renewable technologies incorporated. An important aspect of managing demand will be to reduce peak energy loadings.



Source: Greater London Authority

Major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

- **Be Lean:** use less energy and manage demand during construction and operation.
- **Be Clean:** exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.
- **Be Green:** generate, store and use renewable energy on-site.
- **Offset:** Zero Carbon target

In meeting the zero-carbon target a minimum on-site reduction of at least 35% beyond Building Regulations is expected. Residential development should aim to achieve 10%, and non-residential development should aim to achieve 15% 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:

- Through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or
- Off-site provided that an alternative proposal is identified and delivery is certain.

4.3 Local Policy – London Borough of Southwark Policy

The London Borough of Southwark implements planning policies requiring high environmental standards in new-build homes. It includes the following energy and sustainability targets:

- New residential development must achieve at least a 35% carbon reduction over Part L 2013 on site and offset the remainder (to zero carbon) via a cash in lieu payment.
- New non-residential development must achieve a 35% carbon reduction over Part L 2013 on site.
- Proposals for major non-residential development must achieve BREEAM Excellent. The commercial units are below 500m2 and so may be exempt from this requirement.

- All major developments located within identified decentralised energy opportunity areas should apply the council's 'Decentralised Energy (DE) Protocol'.
- Major developments are expected to achieve at least a 20% reduction in CO_2 emissions through renewables.

4.4 SAP10

From January 2019, planning applicants are encouraged to use updated (SAP10) carbon emission factors to assess the expected carbon performance of a new development. Applicants should continue to use the current Building Regulations methodology for estimating energy performance against Part L 2013 requirements (as outlined in Section 6) but with the outputs manually converted for the SAP10 emission factors to produce the result in accordance to the draft New London Plan.

Here are the Carbon Factors used for SAP10 and current SAP 2012:

Fuel type	Fuel Carbon Factor (kgCO2/kWh)	
	SAP 2012	SAP 10
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.233

London Plan Guidance requires major new developments to use the GLA SAP10 Tool to estimate calculated emissions to the proposed new carbon emissions that will become part of SAP 10 (the next iteration of building regulations).

5.0 Baseline Carbon Emissions

The first stage of the energy assessment is to determine the baseline site energy demand and CO_2 emissions (target emission rate) for the domestic areas. This was undertaken using accredited SAP software for the domestic areas.

For the domestic areas, representative apartments were calculated in detail using Stroma FSAP 2012 in accordance with Approved Document L1A and the SAP conventions by a qualified domestic energy assessor. Unregulated carbon emissions were then calculated using the approved methodology, as set out in the SAP 2012 document.

Table 5-1 & 5-2 summarises the baseline carbon emissions (target emission rate) for the domestic and non-domestic areas of the development.

Table 5-1 SAP10 Baseline: Carbon Emissions for domestic areas

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	171	117

Table 5-2 SAP10 Baseline: Carbon Emissions for non-domestic areas

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	112	75

6.0 Be Lean: Reduce Energy Demand

The first step to achieving Building Regulations compliance is to reduce energy demand and carbon emissions. This can be achieved through passive measures, such as improving the performance of the building fabric and the services.

6.1 Building Fabric

The building is proposed to be constructed using a concrete frame and traditional masonry façade. Low U-values will be specified to reduce the heating demand to the building.

The SAP 2012 calculations indicate the fabric energy efficiency (DFEE) and the target fabric energy efficiency (TFEE) figures for the block to be 29.15 and 36.60kWh/m²/annum respectively. This represents a 20% improvement over Building Regulations AD L1A – Criteria 2.

The currently proposed building fabric specification is shown in Table 6-1.

Table 6-1 Fabric performance targets

Element	Performance Target
External Wall	U-value = 0.15 W/m2K
Sheltered Wall	U-value = 0.15 W/m2K
Exposed Floor (basement)	U-value = 0.10 W/m2K
Exposed Floor (residential floor above commercial)	U-value = 0.13 W/m2K
Roof	U-value = 0.12 W/m2K
Door Residential	U-value = 1.2 W/m2K
Door Commercial (glazed)	U-value = 2.2 W/m2K
Glazing (residential)	U-value = 1.4 W/m2K g=0.4
Glazing (non-residential)	U-value = 1.6 W/m2K g=0.5
Air Permeability (residential) **Air Permeability (non-residential)**	3.0 m3/hr.m2@50Pa 5.0 m3/hr.m2@50Pa
Thermal Bridging	SAP K1 Approved psi values for residential
Party wall U-value (W/m²K)	0.00 (fully filled insulation)
Riser wall U-value (W/m²K)	0.22

6.2 Building Services

Energy efficient building services are proposed for the development in Table 6-2 and Table 6-3.

Table 6-2 Building Services specification for dwellings at Lean stage

Element	Specification
Ventilation	Mechanical ventilation with heat recovery (MVHR) systems in each dwelling. Windows half open in summer and summer bypass mode on MVHR for summer nights.
Internal lighting	100% low energy lighting.

Element	Specification
Heating plant	Combi boiler achieving 90% efficiency (Manufacturer's declaration)
Heat emitters	Radiators
Overheating control	Openable windows and MVHR for overheating control.

Table 6-6-2 Building Services specification for non- residential at Be Lean stage

Element	Specification
Ventilation	In ceiling air handling plant with fresh air intake and exhaust at ceiling level. Low specific fan powers and heat recovery with a minimum of 70% efficiency. Intake and exhaust louvres to be provided at the façade.
Element	**Specification**
Internal lighting	High efficiency lighting will be provided to exceed the minimum requirements of the Non Domestic Building Services Compliance Guide. Lighting power densities of 2W/m2/100 lux will be targeted. Occupancy sensing is assumed.
Heating plant	Gas boiler achieving 90% efficiency (Manufacturer's declaration).
Cooling	Air source heat pump with minimum 3.5 EER
Heat and cooling emitters	Radiators

6.3 Carbon Emission Reduction

The improvements made achieve a 20% reduction to the domestic areas and 7% to non-domestic areas from passive means alone. Overall a 20% carbon reduction is achieved following the guidance within the GLA New London Plan.

Table 6-4 Be Lean: Fabric Energy Efficiency

	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	36.79	29.29	**20%**

Table 6-5 to Table 6-6 shows the Lean carbon emissions and associated passive energy improvements achieved prior to the application of Clean and Green stages for the domestic and non-domestic areas respectively under the New London Plan and under the Current Plan.

Table 6-5 SAP10 Be Lean: Carbon Emissions for domestic areas

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	45	27%

Table 6-6 SAP10 Be Lean: Carbon Emissions for non-domestic areas

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0	0%

7.0 Be Clean: Supply Energy Efficiently

To complete the second step of the energy hierarchy as required and defined by the London Plan, an assessment of local heat networks and opportunities for on-site combined heat and power is to be considered.

7.1 District and Community Heating

District heating is used for distributing heat generated in a centralised location on site. Usually district heating is more energy efficient due to concurrent production of both heat and electricity from combined heat and power generation plants.

The site is within London's Heat Network Priority Areas. There are several District Heating schemes in London where the plant supplies electricity, heat and cooling through a network of heating and chilled water pipes to a variety of neighbouring buildings.

The potential to connect to an existing district heating network can be investigated using the National Heat Map (http://tools.decc.gov.uk), or London Heat Map (https://maps.london.gov.uk/heatmap/) where CHP installations and Thermal Power Station can be located.

Figure 7-1: District Heating near to site, existing & proposed. (Source: London Heat Map)

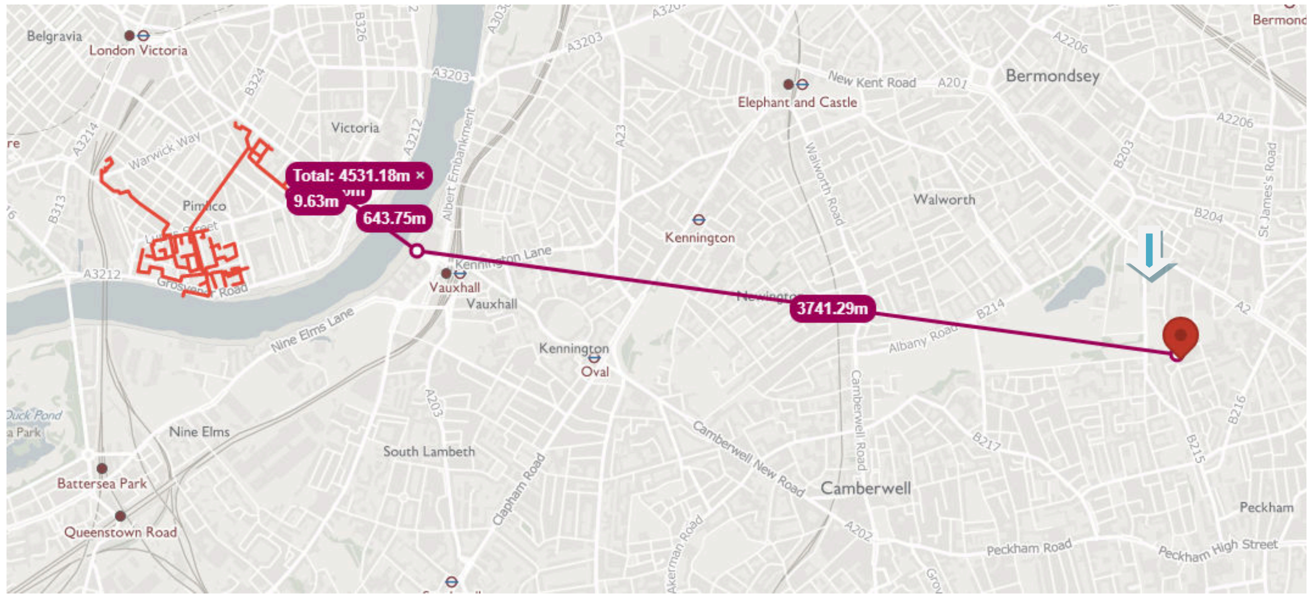


Figure 7-1 shows locations of CHP district heating installations and thermal power installations near to the development site. Proposed networks are shown in red, whereas any existing networks would be shown in yellow. The location of the proposed development is indicated by the arrow.

Referring to the London Heat Map, the closest existing district heating network is located approximately 4.5 kilometres from the development. This is too far for a connection to the development to be feasible. There are no proposed future connections to this network. It is proposed to provide space within the plant room to allow for future connection to a district heating network should this prove feasible.

7.2 Combined Heat and Power (CHP)

On the basis that the development cannot be supplied from a district heating network, the feasibility of providing a centralised CHP led LTHW heating system has been reviewed.

Electricity generation results in the production of waste heat. Combined Heat and Power (CHP) is a highly efficient process that captures and uses this waste heat by positioning the electricity generating plant on or near to the site. This process could reduce carbon emissions by up to 26% compared to the separate means of conventional generation i.e. via a boiler and grid sourced electricity.

CHP systems need an electrical and thermal base load to be able to operate. Where there is no electrical load available, an export agreement will need to be obtained to allow the CHP to operate. This has financial implications and such agreements can be difficult to obtain for small and micro sized systems.

Initial energy profiles suggest that the provision of 170 units would provide a sufficient base thermal load to be viable for the use of on-site micro CHP unit. The CHP would be able to meet a substantial proportion of the base load throughout the year.

It is estimated at this stage, however, that only a very small percentage of the annual electricity generated would be able to be used on site, in landlord's areas, and the remainder would need to be exported to the grid. Generally, surplus energy from CHP cannot be sold to the grid.

As the life expectancy of a CHP engine is only 6-7 years, the payback period would not be economically viable and the inclusion of CHP is therefore not feasible.

This project therefore proposes the use of centralised gas-fired boilers with future connection potential to a district energy system should one become available in the area. Space would be set aside in the plant room for this purpose.

The boiler efficiency has also been examined and for the clean stage, more efficient centralized boilers are proposed than in the be-lean case permits (89.5%). Therefore the improvement shown here in the be-green case is for higher efficiency centralized boilers with a seasonal efficiency of approximately 95%.

7.3 Flue Gas Heat Recovery (FGHR)

FGHR captures heat from the flue gases as they exit the boiler and then uses this to pre-heat the incoming cold water that is fed into the boiler. This reduces the amount of gas required to heat the water to the required temperature.

FGHR is only suitable for individual boiler systems because it pre-heats the water to each dwelling separately and this would not be feasible on a centralised scale. As the proposed development has a centralised boiler system, this technology is therefore considered not feasible in this case.

7.4 Waste Water Heat Recovery (WWHR)

WWHR captures heat from the waste water of the shower and uses this to pre-heat the incoming cold water that is fed into the system. This reduces the amount of energy required to heat water to the required temperature.

This technology is a relatively new technology and its benefits are still being calculated. It is not considered necessary for the proposed development.

7.5 Carbon Emissions Reduction

Table 7-1 and Table 7-2 shows the carbon reductions after the application of energy efficient supply at the Be Clean stage for the domestic and non-domestic areas.

Table 7-1 SAP10 Be Clean: Carbon Emissions for domestic areas

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	45	27%
Savings from heat network / CHP	0	0%

Table 7-2 SAP10 Be Clean: Carbon Emissions for non-domestic areas

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0	0%
Savings from heat network / CHP	0	0%

8.0 Be Green: Renewable Energy Provision

To complete the third step of the energy hierarchy required and defined by the London Plan, further analysis has been carried out taking into consideration 'Be Green' technologies. There are several renewable technologies listed in the London Renewables Toolkit. The following technologies have been evaluated.

8.1 Wind Turbines

Wind turbines can produce electricity without carbon dioxide emissions ranging from watts to megawatt outputs. Wind turbines harness the power in the wind, converting it into electrical energy for use within the development and/or export to the grid.

The main factor affecting the output of wind turbines is the average wind speed. A small difference in wind speed will make a large difference to output. An efficient wind turbine strategy requires a minimum wind speed of 4-5 m/s.

The Department of Energy and Climate Change (http://www.decc.gov.uk/) provides national data relating to the UK wind speed. The average wind speed in this area is reported to fluctuate between 4.4 and 4.7 m/s at 10m above ground level.

The wind speeds are shown to fluctuate within an adequate range however as this development site is located in a medium density urban area, it is anticipated that wind turbines would also present difficulties in achieving planning permission due to the noise, visual impact and mechanical vibration of the turbines. **On this basis this technology has not been investigated further.**

8.2 Ground Source Heat Pumps

Ground source heat pumps use pipes which are buried in external ground to extract heat from the ground. This heat can then be used to heat radiators, underfloor or warm air heating systems and hot water in the home.

A ground source heat pump circulates a mixture of water and antifreeze around a loop of pipe - called a ground loop - which is buried in your garden. Heat from the ground is absorbed into the fluid and then passes through a heat exchanger into the heat pump.

On the basis of the site location, it is anticipated this technology would face practical and technical difficulties in respect to drilling bore holes or laying trench based pipe loops due to the possible presence of existing sewage and telecom networks, water and gas pipes. Depending on ground investigation and feasibility analysis on ground source heat pump **this option maybe considered**.

8.3 Air Source Heat Pumps

Air source heat pumps (ASHP) extract heat from the outside air via an evaporator located externally. This heat can then be used in the same way as ground source heat pumps to heat radiators, underfloor or warm air heating. Additional electric heat elements would be needed to raise the temperature of domestic hot water to safe levels

Air source heat pumps require external plant space to operate. The proposed development would require large external plant space on the roof to accommodate a centralised air source heat pump system. Hence a decision to have gas boilers to provide a small fraction of the heating has been considered, this allows the air source heat pumps to reduce in size and work more efficiently during the cold winter months.

A low temperature heat network with a low carbon air source heat pump led system with gas boiler supplying to internal HIU units located within each dwelling is considered for this development. This will provide heating and hot water to the dwellings and commercial units. To maximise the carbon reduction **air source heat pumps is included in this analysis.**

Element	Specification
Heating plant	**Dwellings**: Communal hybrid Low Temperature Heat Network with a Low Carbon Air Source Heat Pump led system and gas boiler providing a fraction of the heat. This will provide both heating and hot water to dwellings. **Commercial units**: Communal hybrid Low Temperature Heat Network with a Low Carbon Air Source Heat Pump led system and gas boiler providing a fraction of the heat. This will provide both heating and hot water to the commercial areas. Cooling provided by air source heat pump with minimum EER of 3.5.
Heat emitters	**Dwellings**: Under floor heating (recommended) or radiators. **Commercial units**: Warm air distribution system.

8.4 Biomass Boilers

An efficient biomass heating strategy requires both efficient biomass boilers and large central plant room containing the biomass boilers with gas back up boilers.

One of the issues with biomass boilers is the supply of the fuel. Currently, within the UK there is abundance in the supply of wood chip batches which can be used for fuel within Biomass, however, this type of fuel leads to greater inefficiencies compared to other types of biomass fuel such as wood pellets that are currently limited in supply, although suppliers within the UK are increasing. Wood pellets are more controllable in terms of their moisture content and heat calorific value whereas the heat calorific value of the wood chips batches may vary as the moisture content varies within natural resources and subsequently it can cause issues for the heat demand, maintenance and servicing of boilers.

In addition to these issues, high NOx emissions, the management of fuel deliveries, traffic routing, storage space issues and highway design is problematic for developments located in urban locations. On this basis, **the biomass option is not recommended**.

8.5 Solar Thermal Panels

Typically solar thermal hot water systems are used to provide between 40%-60% of the total annual hot water demand within low density domestic housing where each dwelling can be individually served. Due to limited roof space after the provision of both the PV panels and plant space, **the solar thermal option is not recommended**.

8.6 Photovoltaic Panels (PV).

Photovoltaic panels are a semi-conductor based technology that converts the sunlight's energy into electricity. When sunlight strikes the surface of a PV cell, this electrical field provides momentum and direction to light-stimulated electrons, resulting in a flow of current when the solar cell is connected to an electrical load.

The PV systems should be unshaded for the maximum output. It is important to highlight that even a small shading patch on the panel, can significantly reduce the performance. The generated electricity can be used both in the development and potentially exported to the grid to benefit from feed-in tariffs when excess electricity is generated.

In order to achieve the existing target of 45% sitewide carbon reduction PV is required in conjunction with the hybrid system. A minimum of 38.5kWp of PV is required. This achieves an overall carbon reduction of 45%. An assessment of the roof space was carried out and the external air source heat pump units and the PVs can be accommodated with safe access for maintenance. Structural engineers will need to allow for the additional weight on the roof to ensure the load of the units can be taken through the structure.

On this basis, **the photovoltaic panels are recommended**. Please see below a summary of the proposed PV array.

Table 8-1 Proposed PV Array Summary

Proposed Array (kWp)	No. of panels	Active Area (m^2)	Pitch (degrees)	Orientation	Annual Generation (kWh/yr)
38.5	87	189.1	~15	South	32,817.55

8.7 Carbon Emissions Reduction

Table 8-2 to Table 8-3 below summarises the results from the provision of renewable technology for the domestic areas.

Table 8-2 SAP10 Be Green: Carbon Emissions for domestic areas

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	45	27%
Savings from heat network / CHP	0	0%
	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from renewable energy	21	13%

Table 8-3 SAP10 Be Breen: Carbon Emissions for non-domestic areas

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0	0%
Savings from heat network / CHP	0	0%
Savings from renewable energy	36	59%

9.0 Conclusion

The development of the site to provide a mixed-use building comprising ground and mezzanine floor commercial space with 12 upper floors providing residential accommodation and cycle parking and ancillary facilities.

The building features the following sustainability and servicing measures, in line with the accepted energy hierarchy:

- High performance building fabric has been maximised to reduce the energy required to heat the dwellings and non-residential areas.
- High efficiency lighting in all areas with PIR/Occupancy sensors in common areas and commercial space.
- Ventilation provided via mechanical means with heat recovery (MVHR) in residential areas with very low specific fan power.
- Communal hybrid Low Temperature Heat Network with a Low Carbon Air Source Heat Pump led system and gas boiler providing a fraction of the heat. This system will provide provision for future connection to a district energy network.

9.1 Performance

Fabric Energy Efficiencies

The SAP10 calculations indicate the fabric energy efficiency (DFEE) and the target fabric energy efficiency (TFEE) figures for the block to be 29.29 and 36.79kWh/m²/annum respectively. This represents a 20% improvement over Building Regulations AD L1A – Criteria 2.

Be Lean

All dwellings achieve Building Regulations AD L 2013 compliance for both carbon emissions (DER/TER) and fabric energy efficiency (DFEE/TFEE) through passive measures alone.

Be Clean

The site is within London's Heat Network Priority Areas. Connection to a district heating network was found to be unfeasible, as the nearest connection is over 4.5km from the site, as indicated on the London Heat Maps (Refer to Figure 7.2).

This scheme has 170 units, which provides a reasonably sufficient base load for CHP. However, it is estimated that very little of the annual electricity generated would be used on site in the landlord's common areas and the remainder would therefore be exported free to the grid.

Based on this scenario, a payback period renders this option economically unviable. The inclusion of CHP in the scheme is therefore deemed not feasible.

Be Green

Air source heat pumps have been selected as the most appropriate technology. Investigation into whether ground source heat pumps are feasible for this site is ongoing. The minimum CoP of the ground/air source heat pump system for dwellings and commercial units is 2.5. The system shall use communal ground/air source heat pump system to provide water at low temperature to internal HIU units to provide heating and hot water. Gas boilers will provide a fraction of the heat. In our assessment the heat fraction used is 20/80 with 20% provided by boiler and 80% by ground/air source heat pump. The actual heat fraction will be determined when detail design is carried out ensuring the same carbon reduction is achieved at Be Green stage.

The minimum PV requirement to achieve the existing target of 45% carbon reduction, 38.5kWp of PVs is required.

See Appendix A for Life Cycle Cost Analysis for LZC Technologies and Appendix B for Available Grants and Incentive Schemes.

The summary of performance for the domestic and non-domestic areas, as well as the site wide performance, is shown in the tables below.

Table 9-1 Carbon Emissions for domestic areas

	Draft New London Plan (SAP10)	
	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	45	27%
Savings from heat network / CHP	0	0%
Savings from renewable energy	21	13%
Cumulative on-site savings	**66**	**40%**
Annual savings from off-set payment	101	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**3,034**	-
Cash in-lieu contribution (£)	**182,046**	

Table 9-2 Carbon Emissions for non-domestic areas

	Draft New London Plan (SAP10)	
	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0	0%
Savings from heat network / CHP	0	0%
Savings from renewable energy	36	59%
Total Cumulative Savings	**36**	**59%**

Table 9-3 Shortfall in regulated carbon dioxide savings

	Draft New London Plan (SAP10)	
	Annual Shortfall (Tonnes CO_2)	Cumulative Shortfall (Tonnes CO_2)
Total Target Savings	21	-
Shortfall	-15	-440
Cumulative savings for off-set payment	**-26,397**	-

Table 9-10 Site wide carbon dioxide savings

	Draft New London Plan (SAP10)		
	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2013 baseline	228		
Be lean	183	45	20%
Be clean	183	0	0%
Be green	126	57	25%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**2,594**	-

Carbon Offset

Under the New London Plan the development achieves **45%** site wide carbon reduction over Part L 2013. This falls short of the London Zero Carbon target for dwellings. This will result in a cash in lieu contribution to the borough's carbon offset fund to **achieve zero carbon** is **£155,640** (2,594 tonnes CO2 over 30 years x £60), to offset the remaining carbon emissions.

The energy strategy conforms to the New London Plan in line with policy SI2 *Minimising greenhouse gas emissions*.

10.0 APPENDIX A: Life Cycle Cost Analysis for LZC Technologies

Construction

The installation of ASHP and PV do not incur high costs when incorporated into the construction phase of the development as opposed to a retrofit scheme. There are many companies who can supply these services to ensure prices remain competitive.

Operation

ASHP and PV both have relatively low operational costs. The costs included in this section are utilities, cleaning and management costs.

Future prices for utilities are extremely difficult to predict, especially over a long period of time such as 60 years. However, for the purpose of this study, the fuel price has been calculated using the supporting table of the Treasury Green Book supplementary appraisal guidance on valuing energy use.

The electricity generated by the PV array can either be utilised directly onsite or exported back to the National Grid, providing a saving in electricity bills for the scheme. Similarly, the use of ASHP can also provide a net saving in utility bills during operational stage as a result of its high efficiency when compared with gas boilers.

Generally, ASHP system require little day to day management as the systems will be managed through a Building Management System. PV requires no management once they have been installed. The only requirement would be to check the levels of energy production on a clear day to ensure that the expected production is being achieved.

Energy savings and all maintenance costs for both the PV array and ASHP have been accounted for as part of the LCC analysis to calculate the payback periods.

Maintenance

This section includes the costs related to planned maintenance, replacements and repairs.

All ASHPs will require an annual service, with the pressures and system performance checked. The standard estimated life span of ASHP systems is 20 years. PV panels do not require servicing or maintenance except the occasional hose down to ensure they remain clean and clear. PV panels have an estimated lifespan of 25 years.

Table 110-1 LZC Life Cycle Cost Summary

	60-year Life Cycle Cost	
	PV	**ASHP**
Construction		
Capital Costs	£86,130	£150,000
Operational		
Gas Utility	n/a	-£2,381,550
Electricity Utility	-£287,149	£2,511,673
RHI	n/a	-£1,951,019
Maintenance		
Planned Maintenance	n/a	£427,500
Replacements	£172,260	£300,000
Total	**-£28,758**	**-£943,407**
Payback Period	**19 years**	**11 years**

Figure 10-1 PV Life Cycle Cost illustration

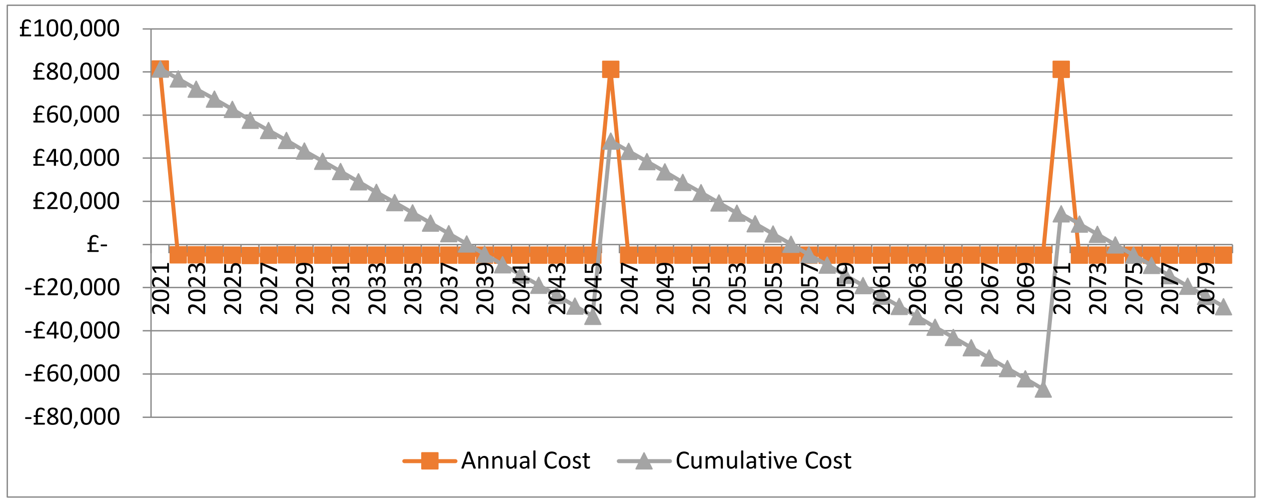
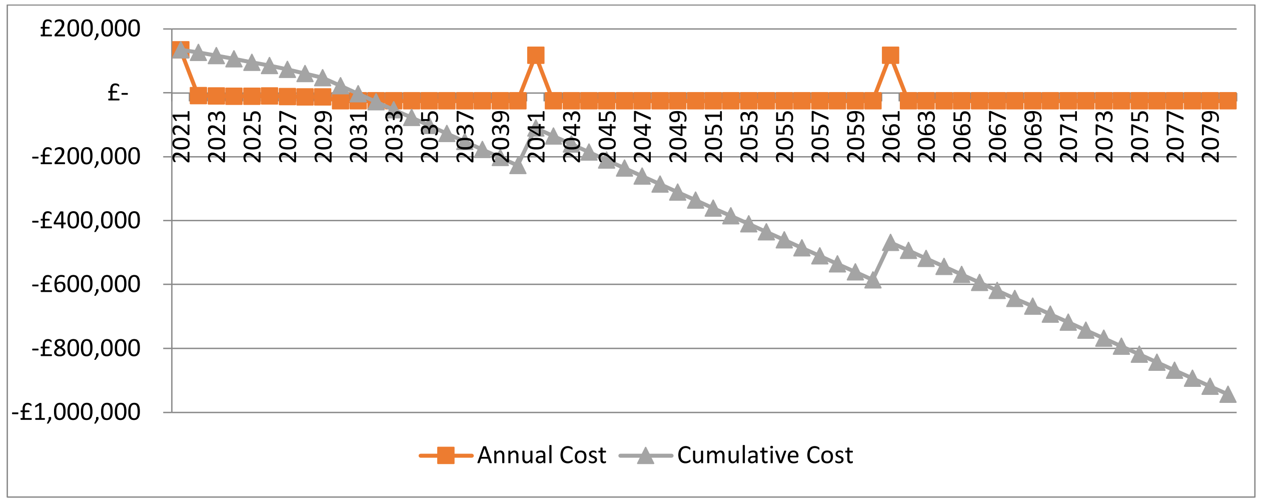


Figure 10-2 ASHP Life Cycle Cost illustration



11.0 Appendix B: Available Grants and Incentive Schemes

Available Grants

The London Borough of Southwark do not have any grants available for a project of this type and size.

Feed-In Tariff

The Feed-In Tariff (FIT) closed to new applicants on the 1st of April 2019, barring some exceptions. See https://www.ofgem.gov.uk/publications-and-updates/feed-tariffs-essential-guide-closure-scheme for more details.

Renewable Heat Incentive

The Renewable Heat Incentive (RHI) apply to heat generated through renewable heat technologies at industrial, commercial, public sector and domestic sites. It is intended to encourage the use of renewable heat technologies by communities, householders and/or businesses.

As with the FIT, the RHI is administered by the energy regulator Ofgem. The following technologies are included by the RHI scheme:

- Heat Pumps
- Biomass Systems
- Solar Thermal technologies

The non-domestic scheme is applicable to eligible renewable heat generators and producers of bio methane. Installations may be large-scale industrial heating systems or smaller community heating schemes. The RHI scheme provides financial incentives to installations for up to 20 years.

The domestic scheme provides financial incentives as quarterly payments for up to 7 years, however any public grants previously received are deducted from this amount.

The RHI has been included as part of the Life Cycle Costing analysis in Appendix A.

12.0 APPENDIX C: GLA Summary Tables

SAP10 PERFORMANCE

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings ($Tonnes\ CO_2$ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	167	115
After energy demand reduction	122	115
After heat network / CHP	122	115
After renewable energy	101	115

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	45	27%
Savings from heat network / CHP	0	0%
Savings from renewable energy	21	13%
Cumulative on site savings	**66**	**40%**
Annual savings from off-set payment	101	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**3,034**	-
Cash in-lieu contribution (£)	**182,046**	

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	61	75
After energy demand reduction	61	75
After heat network / CHP	61	75
After renewable energy	25	75

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0	0%
Savings from heat network / CHP	0	0%
Savings from renewable energy	36	59%
Total Cumulative Savings	**36**	**59%**

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO_2)	Cumulative Shortfall (Tonnes CO_2)
Total Target Savings	21	-
Shortfall	-15	-440
Cash in-lieu contribution (£)	**-26,397**	-

Sitewide

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2013 baseline	228		
Be lean	183	45	20%
Be clean	183	0	0%
Be green	126	57	25%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**2,594**	-

Fabric performance

	Target Fabric Energy Efficiency (kWh/m^2)	Dwelling Fabric Energy Efficiency (kWh/m^2)	Improvement (%)
Development total	36.79	29.29	20%