MAX FORDHAM

Aylesbury Estate Regeneration, Phase 2B

Energy Assessment

For Planning

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05	30/05/22	Updated Planning Issue

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1.0 INTRODUCTION

This energy assessment has been prepared in support of the full planning application for the redevelopment of phase 2B of the Aylesbury Estate and demonstrates that the development incorporates climate change mitigation measures to comply with applicable energy policies and energy remains an integral part of the developments design and evolution.

The Southwark Plan 2022 sets ambitious carbon reduction standards. Major residential developments should reduce onsite Carbon emissions by 100% on 2013 building regulations. Major non-residential development must reduce caron emissions on site by 40%.

The energy reduction strategy for Aylesbury Phase 2B follows the prescribed energy hierarchy. Be-lean, Be clean, Be green, Be seen and Offset.

At the time of writing May/June 2022 the government is in the process of updating the building regulations and the GLA have indicated that they will update the energy strategy methodology to closer align with the new building regulations. In this section of the report we present the carbon saving when calculated with latest building regulation carbon factors.

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)
Baseline	847.6	0	0
Be Lean	700.2	147.5	17%
Be Clean	700.2	0	0
Be Green	253.8	446.4	53%
Cumulative On site	-	593.8	70%

Figures calculated using SAP 10.2 – Latest building regulation carbon factors

Be lean

As required by the Southwark Plan hierarchy the proposed development prioritises demand reduction at the 'Be Lean' stage. This is evidenced by the fact that proposed improvement is significantly better than the 10% target prescribed by the current London Plan. Aylesbury Phase 2B is part of wider redevelopment of the Aylesbury estate, we have worked with Notting Hill Genesis to develop a building fabric standard that is not only suitable for now but also looks to the future and aims to meet the requirements of the 2025 future homes standard.

The 'Be Lean' measures proposed for Aylesbury Phase 2B result in a carbon reduction of 147.5tones which equates to a 17% saving over 2013 building regulations using Sap 10.2 carbon factors.

Be Clean

The 'Be Clean' stage of the energy hierarchy relates to connection to an off-site district heating network such as SELCHP district heating. Unfortunately, SELCHP have confirmed that the Aylesbury estate is currently too far from their network to be able to be connected. The heat delivered by the SELCHP heat network is very low carbon, as the electricity and heat produced by the network are generated by burning waste.

A district heating network connection is not currently available to Aylesbury, however the proposed heat network has been designed to allow a connection to SELCHP or another heat network should one be available in the future.

The Earls Sluice is a sewer running close to the Aylesbury Estate, Southwark have carried out investigations in the past to assess if the sewer could be used as a heat source for a heat network. The Southwark studies have confirmed that the sewer does have sufficient capacity to serve the Aylesbury estate, the same studies have also confirmed that the system would be unlikely to be financially viable.

As the Earls Sluice has the potential to meet the heating needs of the whole of the Aylesbury Estate it makes sense to reinvestigate this option as more dwellings are constructed and sufficient heat load is available. The proposed network for Aylesbury Phase 2B has been designed to be compatible with a heat network served by the Earls Sluice if it's deemed to be viable in the future.

Be Green

The Aylesbury Phase 2B site will benefit from a significant amount of onsite renewable energy. Over 90% of the annual heat demand will be met by an onsite Air Source Heat Pump. A modern highly efficient ASHP is proposed and will have a COP of 3.25.

In addition to the ASHP the proposed development will benefit from a significant amount of PV. The available roof space could accommodate up to 184kWp of PV panel.

The 'Be Green' measures proposed for Aylesbury Phase 2B result in a carbon reduction of 446.4tones which equates to a 53% saving over 2013 building regulations using Sap 10.2 carbon factors.

Be Seen

The final stage of the energy hierarchy is 'Be Seen' the proposed development. The 'Be Seen' stage requires that the developments energy use can be monitored and tracked post completion to ascertain if the performance in use is in line with the Mayor's and Southwark's net zero carbon targets. The development will be provided with a comprehensive set of energy sub-meters to track and record the developments energy use.

Overall Performance

Using the latest building regulation carbon factors. When all the above stages of the energy hierarchy are followed the proposed development demonstrates a carbon reduction of 70% when compared to 2013 Building regulations.

2.0 EXECUTIVE SUMMARY

The number of dwellings, commercial spaces and associated gross internal floor areas for the site are shown in Table 1 for each building. The GIA is shown alongside the dwelling area, which is used for the SAP calculations.

Table 1: Space allocation

Site	Dwellings			Non-domestic Space
	Quantity	GIA (m^2)	Dwellings (m^2)	Area (m^2)
Building 04A	209	19,818	15,183	318
Building 04B	24	2,581	2,327	-
Building 04D	88	9,346	7,114	-
Building 05A	250	22,434	17,141	480
Building 05C	43	4,391	3,491	-

This energy statement shows how the proposed development meets the net zero carbon target for both the domestic and non-domestic portions of the development. At least 35% of the reductions beyond the minimum requirements of Part L 2013 of the Building Regulations are achieved on site, and shortfall to achieve zero carbon emissions is met through a cash-in-lieu contribution. In achieving CO_2 reductions, a series of measures have been adopted incorporating the four-step energy hierarchy comprising of Be Lean, Be Clean, Be Green and Be Seen measures.

CO_2 emissions have been established using building regulations approved compliance software for estimating energy performance against Part L 2013 of building regulations. Residential emissions are calculated through the Part L 2013 of the building regulations methodology based on Standard Assessment Procedure (SAP) 2012 whilst non-residential emissions are calculated through the Part L 2013 of the building regulations methodology based on National Calculation Methodology (NCM). However, in accordance with the requirements of the latest GLA planning guidance, outputs have been manually converted to SAP 10.0 emission factors using the applicable spreadsheet.

Demand reduction measures used in the Be Lean stage include passive enhancements such as enhanced fabric U-values, improved air tightness and active enhancements such as Mechanical Ventilation with Heat Recovery (MVHR) and low energy lighting. An overheating risk assessment was carried out for the development using dynamic thermal modelling in line with applicable CIBSE guidelines which showed the measures proposed successfully address the risk of overheating. Measures for mitigating overheating risk and reduction of cooling demand include reduced distribution heat losses in heat network within the building, openable windows and MVHR with summer bypass. Where active cooling is required for commercial spaces, high efficiency systems will be specified. These Be Lean measures deliver a building that performs 16% (residential) and 32% (commercial) better than current building regulations minimum requirements from energy efficiency measures alone.

With energy demand reduced, supplying energy efficiently and cleanly to reduce CO_2 emissions has been considered by following the heating hierarchy of the London plan in the Be Clean stage. A phase level heat network designed to reduce distribution losses is proposed with provision to connect to a future area-wide district heating network or a site-wide heating network (incorporating low carbon technologies that may be available at the time of later phases) as the site evolves across the phasing program.

During the Be Green phase of the CO_2 emission reductions, usage of renewable energy technologies on site was considered and the development is proposed to have a district heating system fed by central Air Source Heat Pumps (ASHP) with local Heat Interface Units (HIUs). Back up gas boilers are proposed for peak heat loads and to provide redundancy. In addition, solar PV is proposed on appropriate areas of roof to maximise on-site renewable energy generation, resulting in on-site CO_2 savings in excess of the minimum requirements.

The overall effect of these measures is that the regulated carbon emissions are reduced by 63% for domestic and 40% for non-domestic, giving a site wide improvement of 61% over Building Regulation Part L 2013 minimum requirements. The remaining CO_2 emissions for the residential and commercial schemes would be met through a payment to the Southwark Council's carbon offset fund.

Application of the energy hierarchy and the resultant CO_2 reductions at each step for residential elements and the commercial elements of Phase 2B are shown in Figure 1 and Figure 2 respectively.

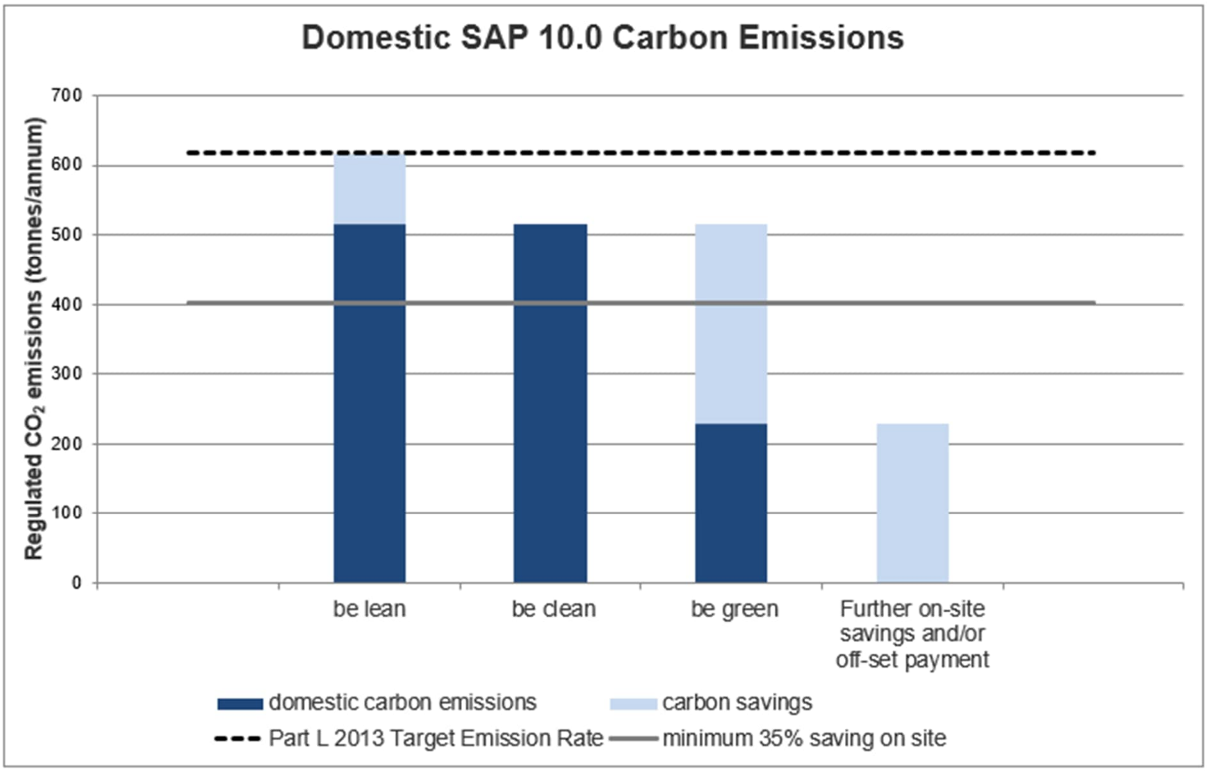


Figure 1: Residential scheme energy hierarchy and predicted CO_2 emissions

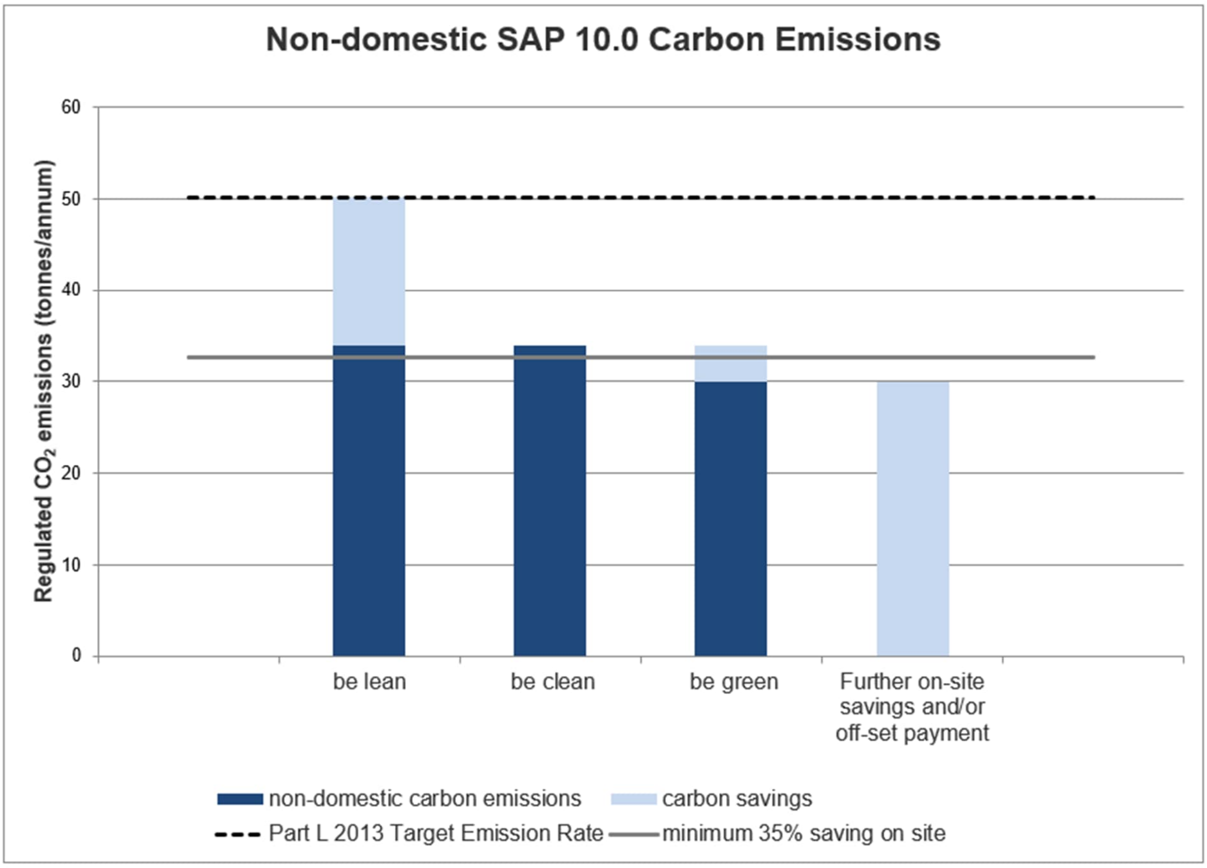


Figure 2: Commercial scheme energy hierarchy and predicted CO_2 emissions.

CO_2 emissions and associated savings after application of each stage of energy hierarchy to residential and commercial parts of Phase 2B are shown in Table 2 and Table 3 respectively.

Table 2: CO_2 emissions summary for residential scheme under SAP10.0 emissions factors

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)	Unregulated CO_2 emissions (Tonnes CO_2/annum)
Baseline	616.6	0	0	420.7
Be Lean	515.2	101.4	16%	420.7
Be Clean	515.2	0	0	420.7
Be Green	229.5	285.7	46%	420.7
Cumulative On site	-	387.0	63%	-
Carbon Shortfall	229.5	-	-	-
Cumulative savings for offset payment (Tonnes CO_2)	6,886			
Cash-in-lieu contribution	£ 654,187 (Assuming £95/tonne of CO_2 for a 30-year period)			

Table 3: CO_2 emissions summary for non-domestic scheme under SAP10.0 emissions factors

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)	Unregulated CO_2 emissions (Tonnes CO_2/annum)
Baseline	50.1	0	0	24.4
Be Lean	34.0	16.1	32%	24.4
Be Clean	34.0	0.0	0%	24.4
Be Green	29.9	4.1	8%	24.2
Cumulative On site	-	20.2	40%	-
Carbon Shortfall	29.9	-	-	-
Cumulative savings for offset payment (Tonnes CO_2)	898			
Cash-in-lieu contribution	£85,347 (Assuming £95/tonne of CO_2 for a 30-year period)			

NB: these figures include all elements of the development modelled using dynamic thermal modelling – i.e. the residents room, commercial lets, plus communal residential areas.

Sitewide CO_2 emissions and associated savings after application of each stage of energy hierarchy to Phase 2B is shown in Table 4 which is the total of residential and commercial scheme emissions shown above.

Table 4: Sitewide CO_2 emissions summary under SAP10.0 emission factors for Phase 2B

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)	Unregulated CO_2 emissions (Tonnes CO_2/annum)
Baseline	666.7	-	-	445.1
Be Lean	549.2	117.5	18%	445.1
Be Clean	549.2	0	0%	445.1
Be Green	259.5	289.7	43%	444.9
Cumulative On site	-	407.2	61%	-
Carbon Shortfall	407.2	-	-	-
Cumulative savings for offset payment (Tonnes CO_2)	7,785			
Cash-in-lieu contribution	£739,524 (Assuming £95/tonne of CO_2 for a 30-year period)			

3.0 INTRODUCTION

3.1 Site Context

This energy assessment has been prepared in support of the full planning application for the redevelopment of phase 2B of the Aylesbury Estate. The proposed development comprises:

'Demolition of the existing buildings and redevelopment to provide a mixed use development comprising five buildings of a variety of heights with basements, providing affordable and market homes (Class C3); flexible floorspace for commercial, business and service uses (Class E) and local community and learning uses (Class F1/F2(a)(b)); public open space and play space; private and communal amenity space; formation of new accesses and routes within the site; alterations to existing accesses; and associated car and cycle parking; refuse storage; hard and soft landscaping and associated works.'

The site is located along Thurlow Street and Albany Street in Southwark as shown in Figure 2

Figure 2: Proposed Aylesbury Estate regeneration phase 2B development site

The proposed development would comprise ground and upper floor residential units along with some limited ground floor commercial spaces within the site. Space usage and gross internal floor area is shown in Table 5.

Table 5: Proposed space allocation

Site	Dwellings			Non-domestic Space
	Quantity	GIA (m^2)	Dwellings (m^2)	Area (m^2)
Building 04A	209	19,818	15,183	318
Building 04B	24	2,581	2,327	-
Building 04D	88	9,346	7,114	-
Building 05A	250	22,434	17,141	480
Building 05C	43	4,391	3,491	-

The 2015 Outline Planning Permission (ref. 14/AP/3844)

The Site is located in the southeast of the Aylesbury Regeneration Area. The principle of the regeneration of this area has been established within local planning policy and through the grant of outline planning permission (reference 14/AP/3844) for the phased redevelopment of the Aylesbury Estate to provide a mixed use development of up to 2,745 residential units, employment, retail and community floorspace.

The Site sits within the existing street pattern and comprises the land bound by Kinglake Street to the north, Bagshot Street to the east, Albany Road to the south and Thurlow Street to the west. As set out within the Southwark Plan (2022), the Site is within an area designated as the Aylesbury Area Action Core - Phase 2. The Site comprises the southern part of Phase 2, and for the purposes of this planning application, including pre-application consultation, is known as Phase 2B.

While much of the Site sits within the boundary of the outline planning permission, the proposed development is a standalone planning application which builds upon the principles established within the masterplan and comprises a high quality residential led development that will contribute towards the regeneration of the wider Aylesbury Estate.

The energy strategy as approved under the outline planning permission was split into two sections: a detailed application for the First Development Site (FDS) and an outline application for the masterplan of the rest of the site. The energy strategy for the FDS was based on a gas-fired CHP led district heating system located within that part of the site and serving the FDS. The energy strategy for the later sections of the site was based on them being fed by a centralised gas-fired CHP led district heating system located outside the First Development Site.

At the time gas-fired CHP was considered the best approach for district heating networks, but the strategy also acknowledges that “Given the extended timeline of the regeneration of the Aylesbury estate it is also important to allow flexibility to include other technologies that may be feasible at a later stage. Several areas that may impact the inclusion of this are; changes to Policy, de-carbonisation of grid and technological changes.”

In the intervening years the electricity grid has de-carbonised to the point that gas-fired CHP led heat networks are no longer considered appropriate. Therefore it is considered appropriate for this energy strategy to depart from the previous strategy and to be brought in line with current policy.

Due to the rapidly changing nature of the heat pump technology which is currently proposed, this energy strategy also moves away from the approach of having only one energy centre to serve the whole of the rest of the Aylesbury Estate and instead proposes energy centres for each phase of work under the outline planning permission. These phases are each large enough to allow good economies of scale for the energy centres and this approach will allow each phase to benefit from the latest technologies.

3.2 Design Evolution and pre-app consultation

The design of both the site and the individual buildings has been carried out with consideration of sustainability and energy requirements throughout the design process. Max Fordham have been involved from the outset, feeding into the holistic design of the buildings and helping to create an integrated design.

Consultation has been carried out with the GLA during the pre-application stage. The first meeting with the GLA was on 25th February 2021 and the Energy Strategy was specifically discussed at meetings on 6th July 2021 and 7th December 2021. Alongside these meetings written information was received from the GLA in the form of Energy Memos, with the latest version and responses to specific GLA queries included in Appendix 12.

3.3 Aims and Objectives

The aim of this energy assessment is to demonstrate that the proposed redevelopment of Phase 2B of the Aylesbury Estate Regeneration Area incorporates climate change mitigation measures to comply with applicable energy policies.

Objectives in achieving this would include

- Establishing requirements of applicable policies
- Carrying out a detailed energy assessment for the detailed planning application for Phase 2B of the regeneration project.
- Applying the "Be Lean, Be Clean, Be Green, Be Seen" energy hierarchy to the development to achieve zero Carbon emissions
- Demonstrating that overheating has been mitigated via suitable passive measures incorporated in the building envelope and services design.

4.0 PLANNING POLICY

The planning application for the development meets the criteria for a referable application due to the potential strategic importance to London, having more than 150 residential units.

The policies considered for the preparation of this energy statement include The London Plan by Greater London Authority (GLA) March 2021, The Southwark Plan 2022 and the energy assessment guidance by GLA as shown in Figure 3.

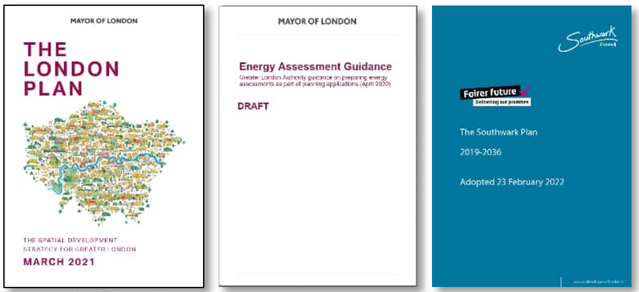


Figure 3: Planning policy reviewed

4.1 The London Plan by GLA

The spatial development strategy the mayor is required to publish under the legislation establishing Greater London Authority (GLA) is known as the London Plan. As the overall strategic plan for London, it sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. In the London Plan, the Mayor of London lays out the London-wide policy context within which London boroughs should set their detailed local planning policies. The London Plan promotes climate change mitigation, sustainable development, health and equality within London.

Chapter 9 of the London Plan 2021 concerns Sustainable Infrastructure and sets out the policies that concern energy usage and carbon dioxide emissions. Key energy focused policies are as follows:

- Policy SI2 Minimizing greenhouse gas emissions - Major developments should be zero Carbon by reducing CO_2 emissions following be lean, be clean, be green and be seen energy hierarchy. Minimum onsite CO_2 reduction of 35% is required of which 10% and 15% should be achieved through Be Lean measures for domestic and non-domestic respectively.
- Policy SI3 Energy Infrastructure - Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system and the heat source should be selected in accordance with the heating hierarchy
- Policy SI4 Managing heat risk – Developments should minimise adverse impacts on urban heat island effect and reduce potential for overheating and reliance of air conditioning following the cooling hierarchy

4.2 The Southwark Plan 2022

Southwark Plan 2022 2011 is the statutory development plan setting out the vision and strategy for the development of the London Borough of Southwark and contains policies that will be used in determining planning applications, in line with the London Plan.

Strategic Policy 6 – Climate Emergency concerns tackling climate change, air quality and urban heat island effect and sets out the policies that concern energy usage and carbon dioxide emissions. Key energy focused policies are as follows:

- P69 – Sustainability standards. The first three of these relate to non-residential floorspace >500m2, so are not applicable to the commercial units within this development. The fourth is relating to reducing the risk of overheating. This is addressed in chapter 8.0 Cooling and Overheating.

- P70 – Energy. This broadly follows the requirements of the GLA and these elements are addressed throughout this energy strategy. A whole life cycle carbon report is included within the application (as a separate document to this energy strategy)

4.3 Energy Assessment Guidance by GLA

The guidance document explains how to prepare an energy assessment to accompany strategic planning applications referred to the Mayor as set out in London Plan. It is for anyone involved in, or with an interest in developing energy assessments including developers, energy consultants and local government officials.

The guidance explains how the energy assessment should be carried out to achieve compliance with London Plan policies. It provides detailed guidance on the following:

- Requirements for different types of planning application
- Integration with other supporting documents for planning applications
- Structure and contents of the energy assessment
- Usage of carbon emission factors for reporting CO_2 emissions
- The methodology for establishing CO_2 emissions for the development
- Application of Be Lean, Be Clean and Be Green measures and associated calculations
- Evaluation and mitigation of overheating and reducing active cooling requirements
- Managing peak demand and incorporate energy flexibility into developments

5.0 METHODOLOGY

The energy assessment follows the methodology set out in GLA Energy assessment guidance. Accordingly, baseline CO_2 emissions for a building regulations Part L 2013 compliant building for domestic and non-domestic elements of the development was established, and the three-step energy hierarchy consisting of Be Lean, Be Clean and Be Green measures was applied to the baseline to achieve CO_2 reductions. The detailed calculations shown in following sections are for the detailed elements of the development (Site A).

5.1 Dwellings

Regulated CO_2 emissions were calculated through the Part L 2013 of the Building Regulations methodology SAP 2012. SAP calculations were carried out using building regulations approved compliance software FSAP 2012 Version 1.0.5.8. These figures were then converted to suit the SAP 10.0 emission factors using the GLA's approved spreadsheet.
A total of 68 unique dwelling types were identified and 153 variants (e.g. floor level, orientation) of these were modelled to represent the whole residential part of the development. A summary of the dwelling variants, total number of dwellings of each variant, cumulative floor area of variants and the typical dwelling type layouts are shown in Appendix 1. CO_2 emissions for each variant of dwelling was then multiplied by the cumulative floor area for the dwelling variant to obtain related CO_2 emissions.

Table 6: Dwelling types

Dwelling Type Reference	Description	No of Units	Floor Area (m^2)
	See appendix 1		

5.2 Commercial Spaces & Non-domestic areas

Regulated CO_2 emissions were calculated through the Part L 2013 of the Building Regulations methodology based on the National Calculation Methodology (NCM) and presented through BRUKL outputs. Calculations were carried out using building regulations approved compliance software IES VE with BRUKL compliance. These figures were then converted to suit the SAP 10.0 emission factors using the GLA's approved spreadsheet.

Breakdown of commercial and heated non-domestic area space allocation for site is shown in Table 7 and ground floor layout showing the proposed commercial spaces is shown in Figure 4.

Table 7: Commercial & non-domestic spaces

Description	Building	Floor Area (m^2)
Resident's Room + GF lobby, etc.	4A	318
Shell & Core Retail	5A	480
Other circulation etc.	All buildings	6,843

Figure 4: Commercial spaces & Resident's Room in Phase 2B (shown in blue)

5.3 Unregulated CO_2 Emissions

Regulated carbon emissions controlled under the Building Regulations comprise of space heating, space cooling, hot water, lighting and auxiliary energy (associated with pumps, fans, controls). In addition, usage of small power equipment including plug loads and other electrical equipment, ICT including telecoms, security etc and catering services would result in unregulated carbon which is not included in Part L assessments. These were estimated by BRE Domestic Energy Model (BREDM) based on occupancy of dwellings using FSAP software for residential scheme. Unregulated CO_2 emissions for the commercial scheme were established based on BRUKL outputs.

5.4 Carbon Emission Factors

The results generated from SAP and BRUKL compliance software are based on current building regulations carbon emission factors which do not account for the recent improvement of carbon emission factors. However, in line with GLA expectation to use new emission factors until the formal adoption of these in the future building regulations, SAP 10.0 carbon emission factors have been used when estimating CO2 emissions for the development. This has been followed by manually converting the outputs from SAP 2012 methodology for SAP 10.0 emission factors, using the spreadsheet provided by GLA. A comparison of the carbon emission factors extracted from the spreadsheet is shown in Table 8.

Table 8: Comparison of CO_2 emission factors

Fuel Type	Carbon Emission Factor ($kgCO_2/kWh$)	
	SAP 2012	SAP 10.0
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.233

6.0 BASELINE EMISSIONS

6.1 Residential

Regulated CO_2 emissions for a Part L 2013 of the Building Regulations complaint development was calculated to establish the baseline CO_2 emissions for the residential scheme. The resultant Target Emission Rate (TER) relates to the maximum permissible regulated CO_2 emissions for each dwelling. In establishing TER for each dwelling type, a communal boiler system for heating and hot water was assumed. Resultant TER, cumulative floor area and the regulated CO_2 emissions for each dwelling type, and TER worksheets for each dwelling type containing modelling inputs can be found in Appendix 2.

The baseline regulated CO_2 emissions for the residential scheme is:

Building	TER ($kgCO_2/m^2$.annum)	Floor Area (m^2)	Cumulative CO_2 Emissions (Tonnes CO_2/annum)
residential	13.6	45,256	616.6

6.2 Non-domestic Spaces

Regulated CO_2 emissions for a Part L 2013 of the Building Regulations complaint development was calculated to establish the baseline CO_2 emissions for the non-domestic spaces. The resultant Target Emission Rate (TER) relates to the maximum permissible regulated CO_2 emissions for the commercial scheme. In establishing TER for commercial spaces, a communal gas boiler system for heating and hot water and an electrically powered active cooling system were assumed. Resultant TER, cumulative floor area and the regulated CO_2 emissions for non-domestic spaces are shown in Table 9. TER worksheets for non-domestic spaces containing modelling inputs can be found in Appendix 4.

Baseline regulated CO_2 emissions for the commercial spaces is:

Non-Domestic Space	TER ($kgCO_2/m^2$.annum)	Floor Area (m^2)	Cumulative CO_2 Emissions (Tonnes CO_2/annum)
All non-domestic	6.6	7,652	50.1

Table 9: Regulated baseline commercial CO_2 emissions

6.3 Unregulated Emissions

Unregulated energy usage accounts for a significant portion of a building's operational energy usage and resultant CO_2 emissions. Estimation of unregulated energy and total operational energy of a building pose significant challenges and could vary significantly from predictions due to factors such as assumptions and simplifications in energy models and variations in small power usage, operation of specialist activities such as lifts, operating hours, occupant density and management of the building as shown in Figure 5.

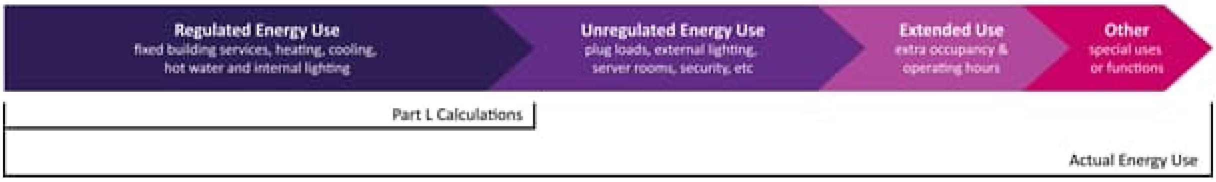


Figure 5: Total operational energy consumption of a typical building

Estimated unregulated CO_2 emissions for residential and commercial schemes of the development are shown in Table 10.

Table 10: Unregulated CO_2 emissions

Scheme	Total Floor Area (m^2)	Unregulated CO_2 Emissions (Tonnes CO_2/annum)
Residential	45,256	420.7
4A Resident's Room + GF lobby, etc.	318	0.9
5B Commercial Space	480	2.5
Residential circulation space	6,843	20.7
Total unregulated CO_2 Emissions		444.9

The development will incorporate the following measures to minimise unregulated emissions:

- Installation of energy efficient white goods
- Installation of energy efficient lifts
- Provision of building user guides and tenant fit-out guides

7.0 BE LEAN

This section outlines the demand reduction measures incorporated in order to exceed the requirements of Building regulation Part L 2013 requirements. These energy efficiency measures which include passive and active design measures have been applied to meet the following targets set out in London Plan:

- Domestic developments should achieve at least a 10% improvement on Building Regulations from energy efficiency
- Non-domestic developments should achieve at least a 15% improvement on Building Regulations from energy efficiency

Passive design measures contribute to reducing the energy demand of the building without an energy requirement whilst active design measures further reduce the energy demand by application of energy efficient building services systems.

7.1 Passive Design Measures

Consideration has been given to the building fabric in order to reduce the energy demand and associated CO_2 emissions of the development. Passive design measures considered include the following:

- Optimising building form, orientation and site layout
- Use of natural ventilation
- Maximising day lighting
- Use of high-performance glazing
- Optimising glazing ratio and use of solar shading
- Use of enhanced thermal insulation and improvements to U-Values
- Improvements to fabric air permeability
- Minimising thermal bridging

Further details in relation to these measures can be found in the Design and Access Statement. Proposed initial building fabric performance targets set for the residential and commercial schemes are shown in Table 11 which will be detailed at relevant stages.

Table 11: Typical building fabric performance targets

Element	Proposed Performance	
	Residential	Commercial
External walls	0.15 $W/m^2.K$	0.15 $W/m^2.K$
Walls to unheated spaces	0.2 $W/m^2.K$	0.15 $W/m^2.K$
Roofs	0.11 $W/m^2.K$	n/a
Ground floor	0.11 $W/m^2.K$	0.11 $W/m^2.K$
Separating floor (between residential and commercial)	0.12 $W/m^2.K$	0.15 $W/m^2.K$
Windows	0.8 $W/m^2.K$ and G Value – 0.4	1.4 $W/m^2.K$ and G-Value – 0.4
Doors	1.0 $W/m^2.K$	1.0 $W/m^2.K$
Air Permeability	3.0 $m^3/h.m^2$ at 50 Pa	3.0 $m^3/h.m^2$ at 50 Pa
Thermal bridging	0.12	0.12
Glazed area/Façade Area	Approximately 40%	Approximately 45%

7.2 Active Design Measures

Following the application of passive design measures, active design measures have been applied to further reduce the energy demand and CO_2 emissions. Active design measures considered include the following:

- Use of mechanical ventilation with heat recovery (MVHR) system with summer bypass
- Installation of low energy LED lighting with photocell/timer clock/presence detection controlling where possible
- Use of smart meters for heat and electricity networks
- Use of programmable thermostatic controls with individual zone control for heating and hot water
- Provision of Building Management System (BMS) for central plant metering and controls
- Use of variable speed pumps and fans for heating/cooling
- Optimal distribution temperatures and use of enhanced thermal insulation for heating pipework to reduce distribution losses

Since the final heating proposal consists of renewable/low carbon energy alongside backup communal boilers, communal boilers have been assumed as the heat source during the Be Lean phase.

7.3 Be Lean Results - Residential

Resultant Dwelling CO_2 Emission Rate (DER) and the cumulative regulated CO_2 emissions for each dwelling type after the application of passive and active measures which form the Be Lean phase and the DER worksheets for each dwelling type containing modelling inputs can be found in Appendix 3.

Regulated CO_2 emissions for the residential scheme is 515.2 tonnes CO_2/annum following the application of Be Lean measures, which is a 16% improvement over the baseline as shown in Table 12, meeting the target set out in London Plan.

Table 12: CO_2 emissions savings for residential scheme after Be Lean measures under SAP10.0 emissions factors

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)
Baseline	616.6	-	-
Be Lean	515.2	101.4	16%
Cumulative On site	-	101.4	16%

7.4 Be Lean Results - Commercial

Resultant Building CO_2 Emission Rate (BER) and cumulative regulated CO_2 emissions for commercial spaces after the application of passive and active measures which form the Be Lean phase are shown in Table 13. BER worksheets for commercial spaces containing modelling inputs can be found in Appendix 4.

Table 13: Regulated commercial spaces CO_2 emissions after Be Lean measures under SAP10.0 emissions factors

Commercial Space	BER ($kgCO_2/m^2$.annum)	Floor Area (m^2)	Cumulative CO_2 Emissions (Tonnes CO_2/annum)
All non-domestic	4.4	7,652	34.0

Regulated CO_2 emissions for the commercial spaces is 34 tonnes CO_2/annum following the application of Be Lean measures which is a 32% improvement over the baseline as shown in Table 14, meeting the target set out in London Plan.

Table 14: CO_2 emissions savings for commercial scheme after Be Lean measures under SAP10.0 emissions factors

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)
Baseline	50.1	0	0
Be Lean	34.0	16.1	32
Cumulative On site	-	16.1	32

Total energy demand for each building use for residential and commercial schemes following the demand reduction measures is shown in Figure 6 which relates to the energy consumption by plant.

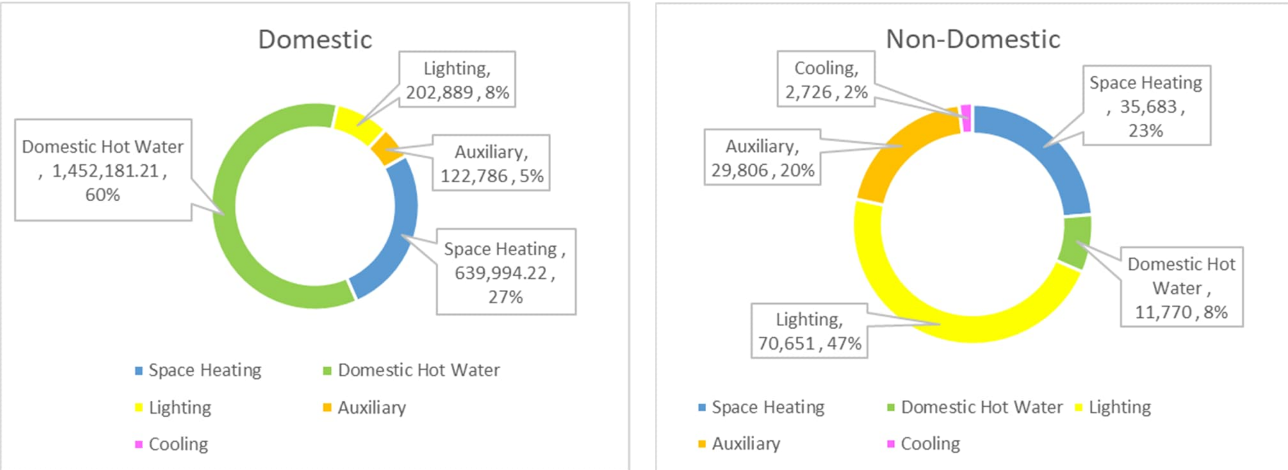


Figure 6: Energy demand (MWh/year) after the Be Lean measures for domestic (left) and non-domestic (right)

For the residential scheme, the total Part L Fabric Energy Efficiency Standard (FEES) for the development is shown in Table 15.

Table 15: Fabric Energy Efficiency Standard

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement
Development Total	38.23	30.25	21%

8.0 COOLING AND OVERHEATING

It is required to identify potential overheating risk in residential accommodation early in the design process and then incorporate suitable passive measures within the building envelope and services design to mitigate overheating and reduce cooling demand in line with London Plan.

8.1 The Cooling Hierarchy

Measures to reduce the cooling demand have been considered under the following categories set out in London Plan cooling hierarchy:

1. Reduce the amount of heat entering the 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. Passive ventilation
5. Mechanical ventilation
6. Active cooling systems

<u>Reduce the amount of heat entering the building</u>

Balconies and deck access roofs provide external shading to the dwellings below, and trees offer external shading in summer where present. Deep window reveals also help to provide shading to the glazing. High efficiency building fabric with low U-values incorporated in design would reduce the heat transfer from outside during summer months. The g-value and glazing ratio of windows has been selected to optimise the amount of solar heat gains and natural daylight levels throughout the year.

<u>Minimise internal heat generation</u>

The heat distribution infrastructure and building services within the building have been designed to minimise heat losses to spaces and improve system efficiencies. A communal heat network is proposed but is designed to minimise the pipework lengths, and so minimise the heat losses from this. All necessary pipe work and ductwork are insulated to exceed the requirements of Building Regulations to further reduce heat losses into spaces. High efficiency LED lighting is used to reduce the heat gains from lighting with optimised lighting control in communal areas.

<u>Passive ventilation</u>

High levels of passive ventilation have been considered to reduce the likelihood of the dwellings overheating. The dwelling and window designs are provided to maximise the openable area available to each occupied space. The majority of dwellings are dual aspect allowing higher levels of natural ventilation through opening windows compared to single sided ventilation. The dwelling floor plates are relatively shallow and so occupied spaces are provided close to the façade openings.

<u>Mechanical Ventilation</u>

MVHR units are provided in dwellings for mechanical ventilation. The units are equipped with full summer bypass function to make use of free cooling during the summer months. MVHR units are provided with a boost mode to enable occupants to increase ventilation if required.

8.2 Overheating Risk Analysis

A detailed overheating risk analysis was carried out for the development, undertaking dynamic overheating modelling. The report containing modelling inputs, assumptions and results can be found in Appendix 5. The following measures have been considered during the overheating modelling:

Residential

The completed Good Homes Alliance Overheating Risk Tool can be found in Appendix 6. This shows a high risk of overheating. This is to be expected of a residential development in central London with flats and a communal heating system.

The project has undertaken dynamic overheating modelling in line with the guidance and data sets in CIBSE TM59 and TM49 respectively.

The dynamic modelling includes losses from pipework for communal heating systems. Where the pipework runs in communal areas the communal areas are included in the overheating modelling.

Internal blinds are not used in the modelling, in line with the emerging requirements of the Future Homes Standard.

Design Weather Files

The dynamic overheating modelling has been carried out using CIBSE Design Summer Years for London (TM49:2014). The overheating modelling for both the residential and non-residential aspects of the development has been conducted using the following design weather file:

- DSY1 (Design Summer Year) for the 2020s, high emissions, 50% percentile scenario

In addition to the above further testing has also been undertaken using the 2020 versions of the following more extreme design weather years:

- DSY2 – 2003: a year with a very intense single warm spell
- DSY3 – 1976: a year with a prolonged period of sustained warmth.

Compliance

Overheating analysis carried out has shown the passive measures above have successfully addressed the risk of overheating.

The development meets CIBSE compliance criteria for the DSY1 weather scenario with only one of the spaces failing the criteria. This is a small kitchen, which suffers from high internal gains as well as solar gains. The design team is working to optimise the window design to reduce the risk of overheating whilst also maintaining the daylight within the kitchen.

8.3 Active Cooling Systems

Active cooling is used for the development's commercial spaces only.

The cooling demand for the actual and notional building established from BRUKL output report for commercial spaces is shown in Table 16, which shows that the mitigation measures taken have reduced the cooling demand of the actual building.

Table 16: Cooling demand comparison – commercial

Building	Area weighted average non-domestic cooling demand (MJ/m^2)	Total area weighted non-domestic cooling demand (MJ/year)
Actual	20.0	9,814
Notional	43.1	21,103

9.0 BE CLEAN

Following the reduction of energy demand in the Be Lean stage, the London Plan requires the development to demonstrate how the energy systems will supply energy efficiently and cleanly to reduce CO_2 emissions in the Be Clean stage of the energy hierarchy.

9.1 Heating Hierarchy

The development is within a heat network priority area (HNPA) where a moderate to high heat density exists and this requires the development to have communal low temperature heating system selected in accordance with the heating hierarchy below:

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 (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

Connecting to a local or planned heat network

The potential to connect to an existing heat network was investigated in the production of the outline planning application. This concluded that connecting to an existing heat network such as SELCHP and planned Heygate was not feasible due to the distance, related cost and available capacity.

The London Heat Map shows a proposed extension to the SELCHP network to the south of the site. In the course of preparation of this energy assessment we have been corresponding with SELCHP and they have confirmed that the project cannot connect to their network.

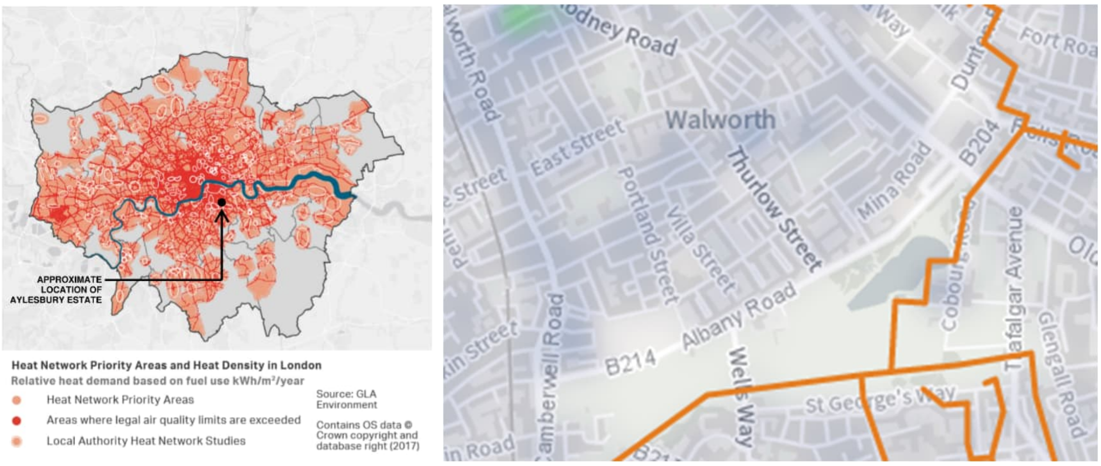


Figure 7: Site location in a HNPA (left) and proposed heat network (SELCHP) from London heat map (Right)

Therefore, the development was identified as a development in an HNPA but no firm plans for a heat network currently exists as outlined in energy assessment guide.

Low emission Combined Heat and Power (CHP)

Due to the rapid decarbonization of the electricity grid resulting in reduced CO_2 savings and air quality concerns associated with combustion-based systems, CHP was not considered a viable option compared to the possibility of using renewable technologies identified above.

Ultra-low NOx boilers

Renewable technologies are considered for the development with back up boilers sized for back up and topping up during peak load conditions in order to generate heat cost effectively and in a low carbon manner. Whilst the decarbonisation of the grid means that electric boilers are attractive from a CO_2 point of view, the distance of the development from a suitable primary substation with sufficient capacity for this additional electrical power makes the supply for these electric boilers unaffordable (see below). The use of gas boilers in these peak scenarios also helps to reduce the peak electrical demand across the wider grid.

Gas vs Electric boilers

Discussions with UKPN have indicated that for the 'expected' case (heating via Heat Pumps with gas fired boiler peak / backup), local network reinforcement of the local 11kV HV network will be required to deliver this load (and any loads in excess of this). However this could likely be supplied from this Verney Road primary substation, albeit with the 11kV HV cable network in the local vicinity of the site needing to be reinforced to allow this.

UKPN also stated that a 'worst case' peak electrical load (all electric heating) would likely need power provided by a different supply. This would be from the more distant Bankside or Chadwick Road primary substations, plus reinforcement of the local 20kV HV network emanating from this location. It is likely that a dedicated higher voltage supply would be required from Bankside. This would require costly upgrades at Bankside and the installation of long dedicated 33kV or 66kV supplies from Bankside to the development site.

The cost of this supply and the associated network upgrade costs that would be borne make electric boilers an unaffordable option.

9.2 Proposed Network Strategy

Since the development is identified as a development in an HNPA but with no firm plans for a heat network currently existing, as outlined in the energy assessment guide it is required to provide a communal heat network allowing for a safeguarded single point of connection to the site and designed for the minimum amount of energy centres in order to future proof the development for easy connection to an area-wide heat network in the future.

The proposal for this development is to provide an energy centre to serve the whole of the application site. The intention is that this would be connected up to the heat networks that serve each of the subsequent phases, such that one large heat network will exist across all of the later phases of the Aylesbury Estate Regeneration masterplan.

It is not proposed that the heat network will connect to existing heat networks within the area due to the differing network temperatures.

Following a feasibility study outlined in subsequent sections of this report, Air Source Heat Pumps (ASHP) have been identified as the primary low-carbon heat source for the site. ASHPs will provide the primary source of energy for space heating and hot water services in the energy centre.

At this stage it is anticipated that heat pumps will be the main source of heating in subsequent application sites elsewhere in the Aylesbury Estate. However, it is also expected that heat pump technology will advance significantly over the coming years, and it would be advantageous to install the most efficient technology available at the time the heat load is connected in order to maximise the carbon savings and to meet more stringent planning requirements that may be present at that time. For example, with the recent changes in CO_2 emission factors, there has been a fundamental change in appropriate technology for new developments, where CHP led energy centres no longer provide carbon savings when assessed with the new carbon factors, and also the temperatures of CHP lead networks are not appropriate for current heat pump technology.

Independent energy centres would also result in reduced distribution losses compared to a site wide network served by a single energy centre due to reduced heating pipe runs.

For the reasons above, the current proposal is for the development to be served by an energy centre as shown in Figure 8. This energy centre will be provided with connections to allow it to be connected to an area-wide heat network should one become available at some point in the future.

Figure 8: Proposed energy centre location for the site

9.3 Proposed Energy Centre and Communal Heat Network

Proposed layout of the energy centre and the schematic drawing of the communal heat network can be found in Appendix 8. The energy centre is located in basement of block 4A housing pumps, back up boilers, thermal stores and ancillary equipment whilst ASHPs would be located on the roof of the tower. The floor area of the energy centre is approximately 290m^2 whilst the roof area allocated for plant including the ASHPs is 304m^2.

The energy centre is provided with a significant volume of thermal storage to allow the ASHP to run as long as possible to maximise its contribution to the overall heat demand. The thermal stores may also be useful in the future if an alternative intermittent renewable secondary heat source is identified.

The proposed heat network is designed to comply with and to exceed the best practice standards (where possible) outlined in the CIBSE Heat Networks: Code of Practice CP1. It is aimed to improve the quality of the heat network by incorporating recommendations such as using low temperature systems, enhanced insulation to minimize distribution losses and high quality HIUs with low standing losses which would result in an heat network that will generate and deliver heat in an efficient and a low cost manner.

Temporary energy centres

The construction is likely to be phased to suit vacant possession of buildings and the resulting demolition sequence / availability of site areas. It is likely that buildings 4B, 4D and 5C will be constructed prior to 4A, which will house the site's energy centre. As such, a temporary energy centre or two temporary energy centres will be installed to provide heat, bulk water storage and back-up power generation in the interim situation(s).

The temporary energy centres will be designed to work with the heat network as designed for the final situation. Due to the expected short period of operation these are to be containerised gas boiler solutions and it is not proposed to install the Air Source Heat Pump in a temporary arrangement as it will not have the attached load to function properly / efficiently.

9.4 Be Clean Results

Regulated CO_2 emissions for the residential scheme stay the same at 515.2 tonnes CO_2/annum following the application of Be Clean measures.

Regulated CO_2 emissions for the commercial scheme stay the same at 34.0 tonnes CO_2/annum following the application of Be Clean measures.

10.0 BE GREEN

Following the reduction of energy demand in the Be Lean stage and ensuring energy is supplied efficiently and cleanly to the development in Be Clean stage, opportunities to use renewable energy on-site were considered as required by the Be Green stage of London Plan energy hierarchy.

10.1 Feasibility Analysis

The following renewable technologies were considered feasible for the site:

- Solar Photovoltaic Cells
- Air Source Heat Pumps
- Ground/Water Source Heat Pumps
- Solar Thermal Panels
- Wind Energy
- Biomass Heating

Site specific analysis carried out to investigate which technologies are best suited to the development is show in Table 17.

Table 17: Analysis of renewable technologies considered feasible

Technology	Function	Suitability	Notes
Solar photovoltaic cells (PV)	Electricity generation from solar energy.	Medium	Produces high grade electricity. Not economically viable due to the reduction in FiT with long payback periods, even if all the electricity is used on site. If generated electricity is used on site the cost of installation is mitigated as PV eventually pays back itself throughout its lifetime. PVs could play an important role in the project becoming zero carbon in years to come. The viability of this will depend on the rate of change for; rising cost of electricity, efficiency increase of the panels, and overall cost of the installation continuing to fall. It's a viable measure in order to comply with the GLA energy assessment.
Air-source heat pump	Space heating by extracting heat from the external air and rejecting heat to the air, via the communal heating network	High/Medium	Works most efficiently with low heat network temperatures. Certain ASHP systems are more suitable than others for generating the relatively high grade heat needed for a heat network. More efficient than gas boilers in most weather conditions. Not as efficient as ground source or water source heat pumps but less costly to install and maintain.

Technology	Function	Suitability	Notes
			Requires an external evaporator unit to reject heat which may result in larger plant areas and noise. Made preferential recently due to updated London plan carbon factors. The electrical carbon factor has been reduced in line with UK electricity grid carbon factors. This makes electrically powered heat pumps more viable. Renewable heat incentive helps to offset additional fuel cost. It's a viable measure in order to comply with the GLA energy assessment.
Ground/water source heat pump	Space heating and domestic water pre-heat by exchanging energy with the ground, via the communal heating network	Low	Boreholes or lake water heat exchanger leads to significantly high install cost which makes it not cost effective Waste Water heat pump (from Earle's Sluice) was discounted due to the significant install cost of this connection. More efficient than the ASHP due to steadier temperature of the ground source compared to external air. High maintenance cost. Viability has increased due to reduction in electrical carbon factor. Risk of ground cooling and system efficiency reduction when predominantly used as a heating only installation
Solar thermal panels	Direct hot water generation from solar energy.	Low	Hot water use profile is unpredictable and predominantly in the evening High maintenance requirement – need covering to prevent overheating in summer Not as efficient (cost or roof area) as PV panels, difficult to integrate with heat network on a large scale.
Wind energy	Electricity generation from wind.	Low	Visual impact. Risk of noise break-out to neighbouring areas. Turbulent nature of wind within central London means the output is poor and the payback is almost infinite.

Technology	Function	Suitability	Notes
Biomass heating	Combustion of biomass material for space and hot water heating.	Low	Concerns over true carbon cost. Uncertainty in supply and unit cost of biomass fuel. Flue is required to clear surrounding buildings. High maintenance and fuel costs. Significant negative impact on local air quality.

10.2 District Heating System

Following the analysis a district heating system comprising of communal air source heat pumps (ASHP) coupled with dwelling heat interface units (HIUs) have been identified as a suitable renewable technology for providing renewable heat to the proposed heat network.

Warm water is circulated around the building at low temperatures (65 ºC Flow/35ºC Return) using central ASHPs whilst HIUs in each dwelling take heat from the communal system to provide heat to the central heating system and domestic hot water systems within each dwelling.

The majority (typically greater than 70%) of the heat requirements in modern dwellings is for DHW, which has a fairly consistent demand throughout the year. The ASHPs have been sized to deliver the whole of the development's DHW demand and approximately 91% of the development's space heating demand. Back-up boilers will be used to top up the remainder of the additional short peak heating demand whilst providing system resilience.

Proposed location of the heat pump is shown in Figure 9.

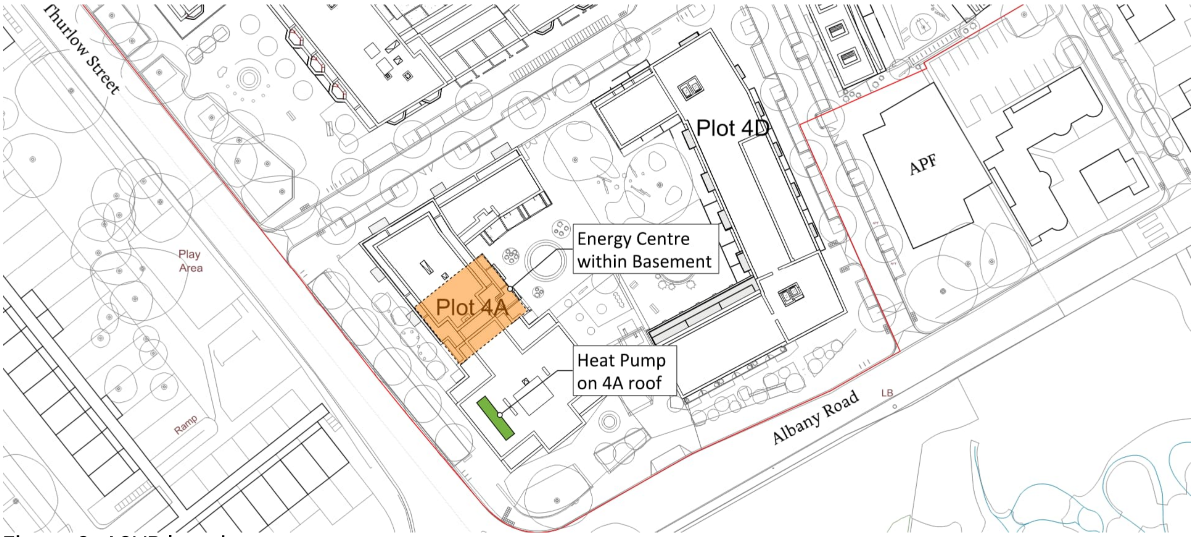


Figure 9: ASHP location

Details of Seasonal Coefficient of Performance (SCOP) calculations, estimated heating energy provided by heat pumps with how heat pumps are run with backup boilers with varying sink temperatures, Manufacturer datasheets showing performance under test conditions for the specific source and sink temperatures of the proposed development, estimated heating cost to the occupants and distribution loss calculations pertaining to the system can be found in Appendix 9.

ASHP CO_2 Emissions Savings - Residential

Regulated CO_2 emissions for the residential scheme is 255.6 tonnes CO_2/annum following the application of ASHP under Be Green measures, which is a 42% improvement over the baseline as shown in Table 18.

Table 18: CO_2 emissions savings for residential scheme ASHP under Be Green measures

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)
Baseline	616.6	-	-
Be Lean	515.2	101.4	16%
Be Clean	515.2	0	0%
Be Green - ASHP	255.6	260.0	42%
Cumulative On site	-	361.7	59%

ASHP CO_2 Emissions Savings - Commercial

Resultant Building CO_2 Emission Rate (BER) and cumulative regulated CO_2 emissions for commercial spaces after the application of ASHP under Be Green phase are shown in Table 19.

Table 19: Regulated commercial spaces CO_2 emissions after ASHP under Be Green measures

Commercial Space	BER (kgCO_2/m2.annum)	Floor Area (m^2)	Cumulative CO_2 Emissions (Tonnes CO_2/annum)
All non-domestic	3.9	7,652	29.9
	Total Regulated CO_2 Emissions		29.9

Regulated CO_2 emissions for the commercial spaces is 29.9 tonnes CO_2/annum following the application of ASHP under Be Green measures, which is a 40% improvement over the baseline as shown in Table 20.

Table 20: CO_2 emissions savings for commercial scheme after ASHP under Be Green measures

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)
Baseline	50.1	-	-
Be Lean	34	16.1	32%
Be Clean	34	0	0%
Be Green - ASHP	29.9	4.1	8%
Cumulative On site	-	20.2	40%

10.3 Solar Photovoltaic (PV) Panel Provision

The GLA expects all major development proposals to maximise on-site renewable energy generation, regardless of whether the 35% on-site target has already been met through earlier stages of the energy hierarchy. In line with this Solar PV was considered for the site in order to maximise CO_2 reductions achieved on site.

PV arrays having a total peak capacity of 0.64 kW_p have been considered to achieve a 35% total CO_2 reduction over Building Regulation Part L 2013 minimum requirements for the commercial units alone (NB: the non-domestic elements of the scheme in total are achieving >35% reduction). However, it is estimated that available roof area would enable installation of a solar PV array up to a capacity of 184 kW_p as shown in Figure 10. This would be revisited during stage 3 of the design considering roof usage and protection from overshading in order to maximise on-site renewable energy generation. It is expected that solar PV will feed directly into the landlord's electricity supply feeding communal demand with any surplus electricity produced exported to the grid.

The efficiency of the panels is likely to continue to increase between now and the point of installation, where the last few years have seen significant development in panel efficiency. As the efficiency improves the output/m^2 of the panel will increase and may result in greater CO_2 savings being achieved on-site.

Figure 10: Solar PV installations areas shown in blue

NB: the areas shown above are the gross areas of roof that will have PV panels on them, not the actual areas of PV panels themselves. This is because the PVs will need to be suitably aligned and spaced for access / avoiding self-shadowing etc. The peak output figures quoted above are based on the expected actual PV array size within these roof areas.

10.4 Be Green Results - Residential

Resultant Dwelling CO_2 Emission Rate (DER) and the cumulative regulated CO_2 emissions for each dwelling type under Be Green phase can be found in Appendix 10.

Regulated CO_2 emissions for the residential scheme is 229.5 tonnes CO_2/annum following the application of Be Green measures, which is a 63% improvement over the baseline as shown in Table 21.

Table 21: CO_2 emissions savings for residential scheme after Be Green measures

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)
Baseline	616.2	-	-
Be Lean	515.2	101.4	16%
Be Clean	515.2	0.0	0%
Be Green	229.5	285.7	46%
Cumulative On site	-	387.0	63%

10.5 Be Green Results - Commercial

Resultant Building CO_2 Emission Rate (BER) and cumulative regulated CO_2 emissions for commercial spaces after the application of Be Green measures are shown in Table 22. BER worksheets for commercial spaces containing modelling inputs can be found in Appendix 11.

Table 22: Regulated commercial spaces CO_2 emissions after Be Green measures

Commercial Space	BER ($kgCO_2$/m2.annum)	Floor Area (m^2)	Cumulative CO_2 Emissions (Tonnes CO_2/annum)
All non-domestic	3.9	7,652	29.9
	Total Regulated CO_2 Emissions		29.9

Regulated CO_2 emissions for the commercial spaces is 29.9 tonnes CO_2/annum following the application of ASHP under Be Green measures, which is a >40% improvement over the baseline as shown in Table 23.

Table 23: CO_2 emissions savings for commercial scheme after Be Green measures

Stage	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	Regulated CO_2 savings (%)
Baseline	50.1	0	0
Be Lean	34.0	16.1	32%
Be Clean	34.0	0.0	0%
Be Green	29.9	4.1	8%
Cumulative On site	-	20.2	40%

11.0 CARBON OFFSETTING

Application of the Be Lean, Be Clean and Be Green energy hierarchy to the development has resulted in a 63% and 40% reduction of CO_2 emissions over Building Regulations Part L 2013 targets for residential and commercial schemes respectively as identified above. Subject to confirmation of the extent of PV installations, it was identified that no further Carbon savings are possible on site.

However, the development aims to be zero carbon for both the residential and commercial schemes, and the remaining CO_2 emissions for the residential and commercial schemes are 229.5 Tonnes CO_2/annum and 29.9 Tonnes CO_2/annum respectively. The site wide cumulative shortfall of 259.5 Tonnes CO_2/annum would be met through a Carbon offset payment to Southwark Council's carbon offset fund. This is currently set at £95 per tonne of CO_2 which is payable for a period of 30 years for the calculation of offset payments.

The CO_2 offset price for the detailed application site is calculated to be £739,524 which would be recalculated during the detailed design stages of the project.

12.0 AIR QUALITY IMPACTS

Heat generation would be using grid electricity for primary ASHPs and back up boilers as identified in previous sections.

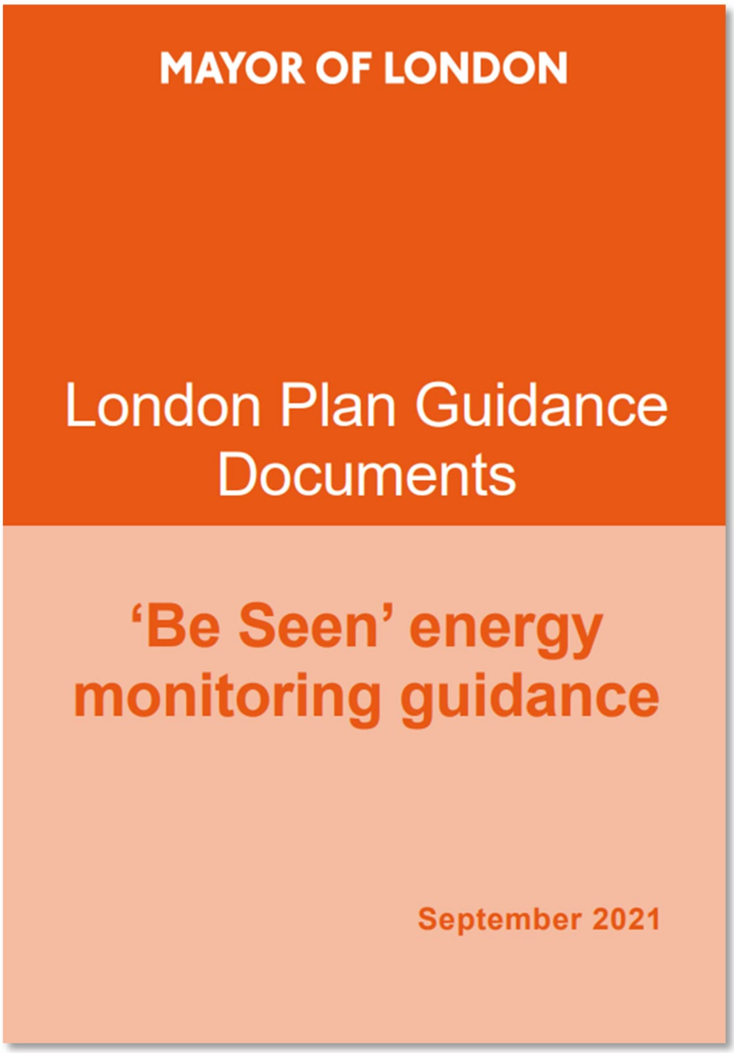
In order to assist the assessment of air quality impacts in line with London Plan policy, reporting template for air quality impacts is shown in Table 24. The data required to fill in the table has been derived from the fuel consumption information provided under GLA carbon emission spreadsheet

Table 24: Reporting template for air quality impacts

Energy Source	Total fuel consumption – Residential (MWh/year)	Total fuel consumption – Commercial (MWh/year)
Grid electricity	802,425	128,523
Gas boilers (communal/individual)	202,719	0
Gas CHP	N/A	N/A
Connection to existing DH network	N/A	N/A
Other gas use (e.g. cookers)	N/A	N/A

13.0 MONITORING (BE SEEN)

We will be following the latest Be Seen energy monitoring guidance


MAYOR OF LONDON

London Plan Guidance Documents

'Be Seen' energy monitoring guidance

September 2021

The building's energy performance will be monitored post-construction through the installation of smart meters for heat and electricity networks which would enable occupants to monitor, manage and reduce their energy usage. In addition, a Building Management System (BMS) for the energy centre would be provided which will facilitate monitoring, managing and control of central plant.

14.0 FLEXIBILITY AND PEAK ENERGY DEMAND

This section outlines the measures taken to minimise both annual and peak energy demand in the development in order to maximise the energy flexibility of the development and to minimise power infrastructure upgrades required to deliver the project.

Demand side flexibility allows building systems to control the energy consumption for a period of time when required in response to an external driver such as energy price or grid availability. Buildings with this ability provides advantages to developer by reducing infrastructure costs, and to the occupiers by reducing impact of future energy cost rises.

Table 25: Summary of site-wide peak demand, capacity and flexibility potential

	Electrical	Heat	Enabled Through...
Estimate peak demand (MW)	2.36MVA	1.50MW	Realistic estimates of demand profiles and peak demand
available capacity (MW)	2.4MVA	2.0MW	Early engagement with the DNO or IDNO to establish available capacity
Flexibility potential (MW)	n/a	n/a *	Modelling of flexibility using demand profiles * this is already incorporated in peak demand figure
Revised peak demand (MW)	2.36MVA	1.50MW	Revision to peak demand considering available capacity, engagement with third parties and flexibility potential
Percentage flexibility predicted (%)	0	n/a	Calculations from flexibility potential as a proportion of peak demand

14.1 Peak Demand

The development uses grid electricity for heat generation, building services systems and unregulated energy usage (by occupants). Peak electricity demand for the site is estimated to be 2.36MVA. The diversity factors and loads assumed in estimating the demand for the site has been consulted with the Independent Connections Provider (ICP) at this stage and would be detailed as the design progresses.

The modelling for the sitewide heat loads has utilised the latest heat networks guidance with a view to incorporating storage volumes to minimise peak loads. As such the estimated demand at this stage includes the flexibility potential from thermal storage and this will not show up as a saving in the table.

14.2 Available Capacity

There are several new development schemes nearby and UKPN are expecting that significant reinforcement of the local electrical network will be required to facilitate these schemes, including the Aylesbury Estate regeneration.

The electricity supply to the Aylesbury Estate will be at 11kV and originate from the Verney Road primary substation. The works required include for network reinforcement and works to the Verney Road primary substation.

14.3 Flexibility Potential

The energy centre(s) are provided with buffer vessels for energy storage. The large buffer vessels will potentially allow the ASHP to run at lower capacity or switch off during peak electricity network demand.

Communal heating system utilizes central plant allowing to apply increased diversity to equipment to enable a reduction to the peak electricity demand. Demand reduction measures outlined in Be Lean section have helped to reduce the peak demand of the development.

Solar PV will feed directly into the landlord's electricity supply feeding communal demand with any surplus electricity produced exported to the grid.

Table 26: Summary of interventions for achieving flexibility

Flexibility achieved through:	Yes / No	Details
Electrical energy storage (kWh) capacity	no	n/a
Heat energy storage (kWh) capacity	yes	Thermal mass within LTHW buffer vessels
Renewable energy generation (load matching)	no	PV generation is below the site base load
Gateway to enable automated demand response	no	n/a
Smart systems integration (e.g. smart charge points for EV, gateway etc.)	no	n/a
Other initiative	yes	Gas boilers to provide peak and back-up heating to the district heating, allowing for demand control on the electrical side.

15.0 CONCLUSIONS

The aim of this energy assessment was to demonstrate that the proposed redevelopment of Phase 2B of the Aylesbury Estate Regeneration Area incorporates climate change mitigation measures to comply with applicable energy policies. The assessment involved establishing applicable policies and applying CO_2 reduction measures to the development in accordance with the GLA's three step Be Lean, Be Clean, Be Green energy hierarchy.

During the Be Lean phase of the hierarchy passive and active demand reduction measures were incorporated to the development. This resulted in a development achieving 16% and 32% reduction of CO_2 emissions over Building regulations Part L 2013 minimum requirement for residential and commercial schemes respectively by utilizing energy efficiency measure alone to reduce the demand as far as practically viable. Furthermore, an overheating analysis carried out for the development showed the passive design measures within the building envelope and services design successfully mitigating overheating and reducing cooling demand for the development.

Following the reduction of energy demand in the Be Lean stage, supplying energy efficiently and cleanly to reduce CO_2 emissions was investigated in the Be Clean stage of the energy hierarchy. No opportunities to connect to existing or planned district heating networks were identified and CHP was considered unviable for the development. However, with the development located in a heat network priority area, a communal heat network was proposed to future proof the development for easy connection to an area-wide heat network in the future.

Opportunities to use renewable energy on-site were considered in the Be Green stage of the energy hierarchy. A communal heating system comprising central air source heat pumps and dwelling level HIUs and solar PV were identified as feasible renewable technologies following a site-specific feasibility analysis. Application of these technologies reduced the CO_2 emissions of the development by 46% and 8% for residential and commercial schemes respectively.

Application of the Be Lean, Be Clean and Be Green energy hierarchy to the development resulted in a 63% and 40% reduction of CO_2 emissions over Building Regulations Part L 2013 minimum requirements for residential and commercial schemes respectively with a site wide improvement of 61%. However, in line with the developments' aim to be zero carbon for both residential and commercial schemes, the remaining CO_2 emissions would be met through a carbon offset payment to Southwark Borough Council's carbon offset fund.

Results show that the development complies with the energy policies of the London Plan and Southwark Council as a result of climate change mitigation measures incorporated into the development. The energy assessment demonstrates energy remains an integral part of the development's design and evolution in order to address the climate change emergency declared and the ambition set by the Mayor of London for London to be net zero carbon.

APPENDICES

Appendix 1 – Representative dwelling types and variants used for SAP

Block	Size	Dwelling Type	Core Type	No	SubType1	No	SubType2	No	SubType3	No	SubType4	Total No.
04A	1B2P	Flat	01_ne_m	7	01_sw_m	7	01_ne_g	1	01_sw_g	1		32
04A	1B2P	Flat	02_ne_m	15	02_sw_m	15	02_ne_t	1	02_sw_t	1		48
04A	2B3P	Flat	03_ne_m	23	03_sw_m	23	03_ne_t	1	03_sw_t	1		24
04A	2B3P	Flat	04_se_m	23	04_se_t	1						48
04A	2B4P	Flat	05_ne_m	23	05_sw_m	23	05_ne_t	1	05_sw_t	1		12
04A	1B2P	Flat	06_sw_m	8	06_sw_g	2	06_sw_t	2				0
04A	1B2P	Flat										0
04A	1B2P	Flat										1
04A	2B3P	Flat	09_nw_t	1								3
04A	2B4P	Flat	10_nw_m	3								1
04A	2B4P	Flat	11_nw_t	1								1
04A	2B4P	Maisonette	12_nw_t	1								3
04A	3B5P	Flat	13_nw_m	3								3
04A	3B5P	Maisonette	14_nw_g_0	2	14_nw_g_1	1						1
04A	3B5P	Maisonette	15_sw_t	1								1
04A	3B5P	Maisonette	16_sw_t	1								5
04A	3B6P	Flat	17_ne_m	4	17_ne_t	1						3
04A	3B6P	Maisonette	18_sw_g	2	18_ne_g	1						0
04A	3B6P	Maisonette										0
04A	3B6P	Maisonette										6
04A	4B6P	Flat	21_nw_m	4	21_nw_g	1	21_nw_t	1				1
04A	5B8P	Maisonette	22_sw_t	1								4
04B	2B3P	Flat	25__sw_m_0	1	25_sw_m_1	1	25_ne_m_0	1	25_ne_m_1	1		6
04B	2B4P	Maisonette	26_sw_t_0	2	26_sw_t_1	1	26_ne_t_0	2	26_ne_t_1	1		6
04B	4B6P	Flat	27_sw_m	3	27_ne_m	3						6
04B	4B6P	Maisonette	28_sw_g_0	2	28_sw_g_1	1	28_ne_g_0	2	28_ne_g_1	1		2
04B	5B7P	Maisonette	29_sw_g	1	29_ne_g	1						2
04D	1B2P	Flat	35_nw_t_0	1	35_nw_t_1	1						9
04D	1B2P	Flat	36_sw_m	4	36_ne_m	4	36_sw_t	1				6
04D	2B4P	Flat	37_nw_m	4	37_nw_g	1	37_nw_t	1				9
04D	2B4P	Maisonette	38_nw_g_0	2	38_nw_g_1	1	38_nw_m_0	4	38_nw_m_1	2		0
04D	2B4P	Maisonette										6
04D	2B4P	Maisonette	40_nw_m_0	5	40_nw_m_1	1						20
04D	3B5P	Flat	41_sw_m_0	8	41_ne_m_0	8	41_sw_t_0	1	41_ne_t_0	1	41_sw_t_1	6
04D	3B5P	Flat	42_se_m	4	42_se_g	1	42_se_t	1				4
04D	3B5P	Flat	43_ne_m	3	43_ne_t	1						6
04D	3B5P	Maisonette	44_nw_m_0	5	44_nw_m_1	1						8
04D	4B6P	Maisonette	45_sw_g	4	45_ne_g	4						6
04D	4B6P	Maisonette	46_nw_g_0	5	46_nw_g_1	1						6
04D	1B1P	Flat	47_ne_m	4	47_ne_g	1	47_ne_t	1				13
05A	1B1P	Flat	50_ne_t	7	50_sw_t	6						0
05A	1B1P	Flat										2
05A	1B1P	Flat	52_nw_t	1	52_se_t	1						72
05A	1B2P	Flat	53_sw_m_0	42	53_ne_m_0	28	53_nw_m_1	1	53_se_m_1	1		14
05A	1B2P	Flat	54_ne_m	12	54_ne_t	2						0

Block	Size	Dwelling Type	Core Type	No	SubType1	No	SubType2	No	SubType3	No	SubType4	Total No.
05A	1B2P	Flat										0
05A	1B2P	Flat										10
05A	1B2P	Flat	57_sw_m	8	57_sw_t	2						0
05A	1B2P	Flat										2
05A	1B2P	Flat	59_se_t	1	59_nw_t	1						14
05A	2B3P	Flat	60_se_m	7	60_nw_m	7						14
05A	2B3P	Flat	61_nw_m	6	61_se_m	6	61_nw_t	1	61_se_t	1		12
05A	2B3P	Flat	62_se_m_0	2	62_nw_m_0	2	62_se_m_1	4	62_nw_m_1	4		2
05A	2B3P	Flat	63_nw_t	1	63_se_t	1						10
05A	2B3P	Flat	64_sw_m	8	64_sw_t	2						0
05A	2B3P	Flat										0
05A	2B3P	Flat										0
05A	2B4P	Flat										14
05A	2B4P	Flat	68_nw_m	7	68_se_m	7						8
05A	2B4P	Flat	69_se_m	4	69_nw_m	4						0
05A	2B4P	Flat										10
05A	2B4P	Flat	71_se_m	5	71_nw_m	5						12
05A	2B4P	Maisonette	72_nw_t	8	72_se_t	4						10
05A	3B5P	Flat	73_sw_m	8	73_sw_t	2						2
05A	3B6P	Flat	74_nw_m	1	74_se_m	1						0
05A	2B3P	Flat										0
05A	2B3P	Flat										0
05A	2B4P	Flat										0
05A	2B4P	Maisonette										0
05A	3B5P	Maisonette										7
05A	4B6P	Maisonette	80_ne_g_0	5	80_ne_g_1	2						12
05A	4B6P	Maisonette	81_nw_g_0	6	81_nw_g_1	2	81_se_g_0	2	81_se_g_1	2		0
05A	4B7P	Maisonette										0
05A	1B2P	Flat										10
05A			##_##_#	10								2
05C	2B4P	Maisonette	85_se_g	2								6
05C	2B4P	Maisonette	86_se_g	6								6
05C	1B2P	Flat	87_sw_m	3	87_ne_m	3						2
05C	2B3P	Flat	88_sw_m	2								1
05C	2B3P	Flat	89_nw_m	1								2
05C	2B4P	Flat	90_sw_m_0	1	90_sw_t_1	1						2
05C	2B4P	Flat	91_nw_m	2								1
05C	2B4P	Maisonette	92_ne_g	1								4
05C	2B4P	Maisonette	93_nw_m	2	93_nw_t	2						12
05C	2B4P	Maisonette	94_nw_m	6	94_nw_t	6						2
05C	3B5P	Flat	95_sw_m	1	95_sw_t	1						1
05C	3B6P	Maisonette	96_ne_g	1								2
05C	4B7P	Maisonette	97_sw_t	1	97_ne_t	1						0
												614

Appendix 2 – TER worksheets for dwellings

See separate file

Appendix 3 – DER worksheets for dwellings after Be Lean measures

See separate file

Appendix 4 - BER worksheets for commercial spaces after Be Lean measures

See separate file

Appendix 5 - Overheating Risk Analysis Report

See separate file

Appendix 6 – Good Homes Alliance Early Stage Overheating Risk Tool

EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

Good Homes Alliance

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | **KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING**

Geographical and local context

Question	Option	Points	Score
#1 Where is the scheme in the UK? See guidance for map	South east	4	4
	Northern England, Scotland & NI	0	
	Rest of England and Wales	2	
#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	3	2
	Grtr London, Manchester, B'ham	2	
	Other cities, towns & dense sub-urban areas	1	

Question	Points	Score
#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context	1	1

Site characteristics

Question	Option	Points	Score
#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	**Day** - reasons to keep all windows closed	8	4
	Day - barriers some of the time, or for some windows e.g. on quiet side	4	
	Night - reasons to keep all windows closed	8	4
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4	

Question	Points	Score
#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	1	1
#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	1	0

Scheme characteristics and dwelling design

Question	Points	Score
#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	3	3
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	3	3

Question	Option	Points	Score
#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance		1	0
#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans	>2.8m and fan installed	2	0
	> 2.8m	1	

Solar heat gains and ventilation

Question	Option	Points	Score
#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space	>65%	12	4
	>50%	7	
	>35%	4	
#7 Are the dwellings single aspect? Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation	Single-aspect	3	3
	Dual aspect	0	

Question	Glazing	Full	Part	Score
#13 Is there useful external shading? Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per #6	>65%	6	3	1
	>50%	4	2	
	>35%	2	1	

Question		Openings compared to Part F purge rates: = Part F	+50%	+100%	Score
#14 Do windows & openings support effective ventilation? Larger, effective and secure openings will help dissipate heat - see guidance	Single-aspect	minimum required	3	4	2
	Dual aspect		2	3	

TOTAL SCORE		Sum of contributing factors:			Sum of mitigating factors:
23	=	27	minus		4

High — 12 — Medium — 8 — Low

score >12: Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	**score between 8 and 12:** Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	**score <8:** Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)

Appendix 7 – evidence of correspondence with SELCHP & Southwark LBC

SELCHP

Hi James,

Looking at the location of your project, I don't think it would be a viable option to connect to SELCHP DHN. The decision not to connect to Aylesbury Housing Estate has been confirmed by Southwark Council some time ago when we started looking at the expansion project.

I would consider an alternative energy solution to your project.
Cheers

Kindest Regards,

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Southwark LBC

We have been in discussion with Southwark LBC relating to the wider district heating scheme as well as their ambitions to include a sewage source heat pump for the Aylesbury Estate in the future. We are designing this heat network to be compatible with the wider heat network. It will also be compatible with a future sewage source heat pump, however this technology is not viable at this time.

Hi Josh,

Sorry to miss your call last week and the subsequent slow reply.

As per the table on page 8 of the report, Arup estimated the CAPEX to be £11.4m and the 40 year NPV to be -£8m so I don't think we can assume that the heat will be available to the development at just the costs shown below. Its those very figures which leave such a large project shortfall.

Are you able to run the options appraisal with the estimated CAPEX and operating assumptions provided by Arup (COP, electricity rate, network losses etc.) to compare against other options on the table and see how that comes out?

If necessary, I can ask Arup if they can attend a meeting with us to explain their assumptions further, but maybe we should have an initial call between us first to see where we've got to?

Many thanks,

Tom

Hi Folks,

As per our various discussions and emails of yesterday please find a link below that will take you to the work that Arup did looking at the potential for sewer source heat pumps within Southwark borough. It's the bottom report listed on the page, titled "Southwark HMMP Sewer Study Addendum Final Report"
https://www.southwark.gov.uk/housing/district-heating?chapter=4

The report covers the sewer network in the borough generally, shows flow data for various points, and then focuses in on five opportunities, one of which was the Aylesbury new build. I'm sure we made some assumptions on the development peak and annual heat loads which are probably not spot on, but hopefully close enough to give an indication of likely match.

I can see that the report only lists average flow rate in the sewer so I've dug out the daytime / night time split.

Daytime peak DWF flow rate (l/s)	Night time low flow rate (l/s)
1283	539

Hope this helps.

Kind regards,

Tom

Tom Vosper
Strategic Project Manager – Heat Networks
Housing Asset Management | London Borough of Southwark
160 Tooley Street, London SE1 2QH
(T): 020 7525 7244 | (M): 07522 348 570 | (E): tom.vosper@southwark.gov.uk
www.southwark.gov.uk

Hi Tom,

Following on from a message I left this morning on your voicemail, we've been through the ARUP report for the Earl's Sluice SSHP concept (attached) and have derived the following figures for both the likely carbon emission factor and energy cost.

Carbon emissions factor (kgCO2/kWh) calculations:

- Estimated proportion of heat from SSHP 80% (as per ARUP report, also sized to meet 50% of peak)
- Estimated proportion of heat from backup (Gas Boilers): 20%
- Assumed SSHP Annual Coefficient of Performance (COP): 3 kW/kW (Arup report says electricity use reduced by a third)
- Boiler efficiency: 95% (assumed)
- Network efficiency (to point of connection): 90% (as per ARUP report)
- Gas emissions factor (SAP 10): 0.210 kgCO2/kWh (as per ARUP report
- Electricity emissions factor (SAP 10): 0.233 kgCO2/kWh (as per ARUP report

-> Resulting carbon emissions factor: 0.117 kgCO2/kWh

Cost per kWh (£/kWh) calculations:

- Heat price (variable): 0.044 £/kWh (as per ARUP report)
- Fixed charge: 18 £/kW/yr
- Connection cost: 50 £/kW
- Gas price used: 2.49 p/kWh
- Electricity price used: 10.61 p/kWh

-> Calculated fuel cost per kWh 0.037 £/kWh
-> Assumed additional cost for system running 0.007 £/kWh (to take the fuel cost the heat price above)

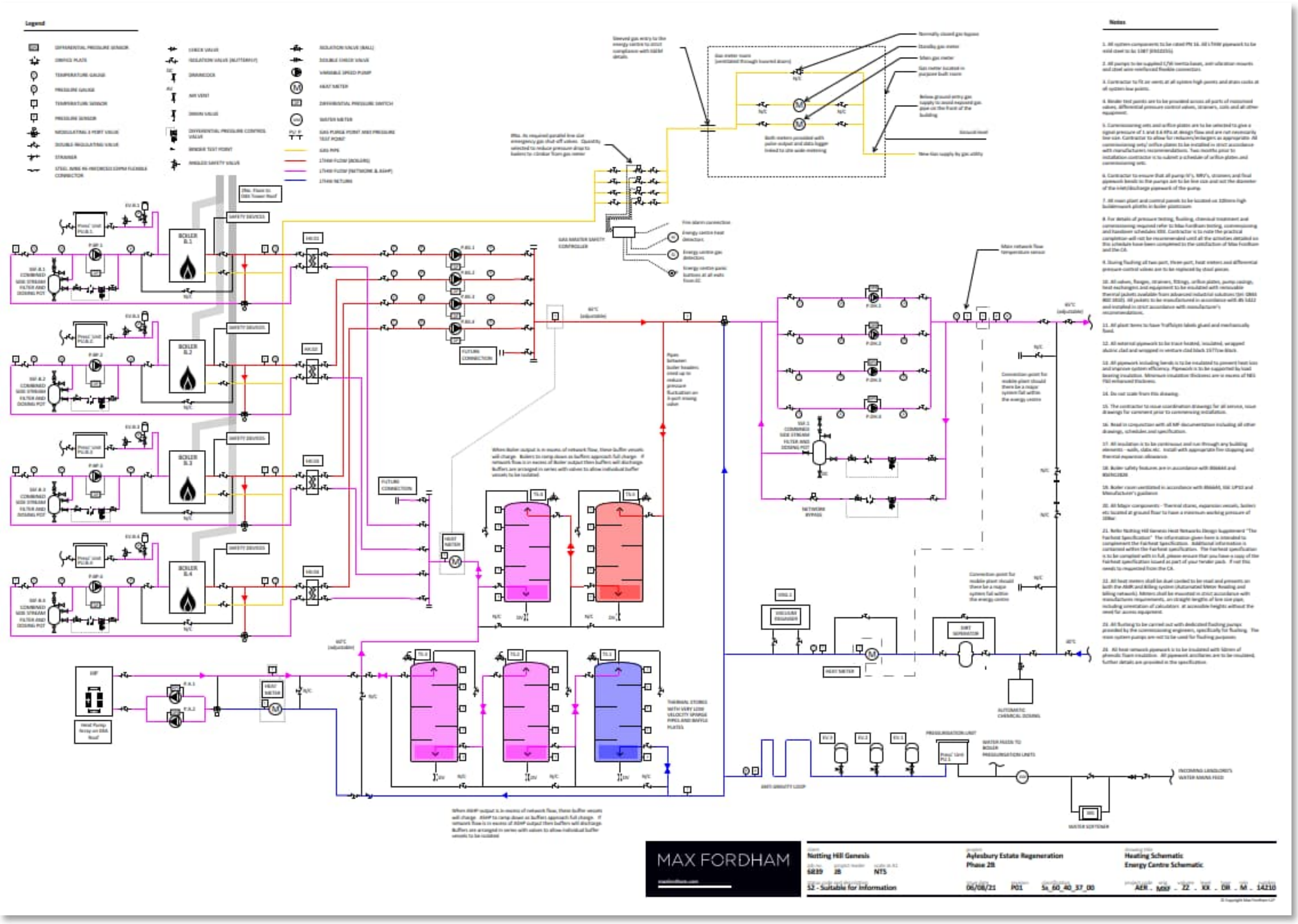
Our initial assumption is that any SSHP plant would be owned and operated by Southwark, and located either within or nearby the Aylesbury master plan accordingly. Therefore, the capital cost would be borne by Southwark. The cost to the Aylesbury project would therefore be limited to the connection cost quoted above. Similarly, there will be no additional ongoing operational costs to the Aylesbury project other than the fixed charge or heat price quoted above. However, we have seen previous SSHP projects of a similar size to the Aylesbury Phase 2B (the area we are currently focussing on) that have an equipment capital cost of around £1.75m with the Civils cost being at least the same amount again (**total >£3.5m**). This figure is far in excess of the £50/kW quoted above. Hence why we'd like confirmation on the likely costs involved to feed into our option study.

Is it possible for you or a representative from ARUP to confirm our understanding above and respond? We'd be happy to arrange a meeting if that would be easier.

Best wishes,

Josh

Appendix 8 - Proposed layout of the EC(A) and the schematic drawing of the communal heat network



Appendix 9 – Heat network details

At the planning stage the energy strategy is based on an expected equipment selection from a named equipment manufacturer and their specific equipment data. The detailed equipment selection will be confirmed during RIBA Stage 4 - Technical Design and the exact unit may change from those selected at this stage.

The SCOP figure used for the ASHP installation is provided from the manufacturer's data sheets and calculation tool. These are reproduced below, along with details of the inputs to this tool.

Peak Load Calculations

The following figures are the peak plant load sizing figures from the CP1 methodology. These figures have been used for plant sizing purposes.

Domestic Hot Water	591	kW
Space Heating @ -4 deg C	849	kW
Network Losses @65W/HIU	40	kW

Solid Energy calculation inputs
The SCOP calculation from Solid Energy requires the Domestic Hot Water load to be spread over 1hr to calculate the energy loads properly, rather than a peak figure as presented above.

The tool also uses -10 degrees as a base figure so whilst the weather file does not go below -4 degrees, this figure is required to be input into the tool and so is extrapolated to give the correct peak figure at -4 degrees.

Annual DHW load per dwelling	2500	kWh/annum	
No. dwellings	614		
total DHW load	1,535,000	kWh/annum	
	8760	hrs/annum	
average DHW load (1hr)	175	kW	
Base load independent of T_{ext}	215	kW	A (Peak DHW load spread evenly to give the same energy usage, plus network loss figure)
Total peak heat load @ -4 deg C	1064	kW	B (Peak Space Heating @-4 + DHW over 1hr + network losses)
equivalent load @ -10 deg C	1319	kW	C (for input into manufacturer's tool)

Version 1,1 2021

SCOP according to EN14511/EN14825 calculation methodology.

På EN12900 producent kompressor data

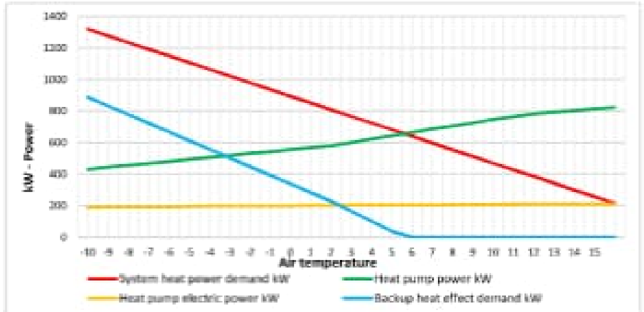
Enter dimensioning heat output in heating system

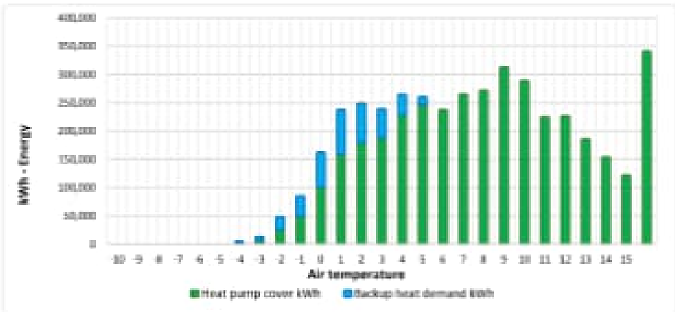
Heat power at -10 degrees air temp.	C 1319	kW at - 10 °C air	
Summer degree days independent heat power	A 215	kW	44.8%

Language: English
Area: London

Heat coverage distribution and SCOP result:

System annual heating demand	4,201,503	kWh		
Heat pump covers annual heat	3,820,746	kWh	90.9	% of heat demand
Heat pump electricity consumption	1,138,928	kWh	27.1	% of heat demand
Boiler backup heat	380,757	kWh	9.1	% of heat demand
SCOP	3.35			





Outdoor air	London	Heat pump power	COP	System heat power demand	Heat pump effect coverage	Heat pump electric power	Backup heat effect demand	System heat demand	Heat pump cover	Heat pump electric consumption	Backup heat demand	Heat pump full load hours
°C	Hours	kW		kW	kW	kW	kW	kWh	kWh	kWh	kWh	Hours
-10	0	431	2.27	1319	431	190	888	0	0	0	0	0
-9	0	444	2.32	1277	444	192	833	0	0	0	0	0
-8	0	456	2.37	1234	456	193	778	0	0	0	0	0
-7	0	**469**	**2.42**	1192	469	194	723	0	0	0	0	0
-6	0	481	2.47	1149	481	195	668	0	0	0	0	0
-5	0	494	2.52	B 1107	494	196	613	0	0	0	0	0
-4	5	506	2.57	1064	506	197	558	5,321	2,531	985	2,790	5
-3	13	519	2.62	1022	519	198	503	13,283	6,743	2,573	6,540	13
-2	49	531	2.67	979	531	199	448	47,986	26,028	9,744	21,958	49
-1	91	544	2.72	937	544	200	393	85,253	49,476	18,177	35,777	91
0	182	556	2.77	894	556	201	338	162,778	101,229	36,510	61,549	182
1	279	569	2.82	852	569	201	283	237,687	158,672	56,200	79,015	279
2	308	**581**	**2.87**	809	581	202	228	249,314	179,018	62,287	70,297	308
3	312	602	2.96	767	602	203	165	239,304	187,911	63,381	51,393	312
4	366	623	3.06	725	623	204	101	265,181	228,140	74,666	37,041	366
5	382	644	3.15	682	644	205	38	260,553	246,156	78,240	14,397	382
6	372	665	3.24	640	640	206	0	237,937	237,937	73,508	0	358
7	445	**686**	**3.33**	597	597	206	0	265,733	265,733	79,858	0	387
8	491	706	3.41	555	555	207	0	272,354	272,354	79,919	0	386
9	612	725	3.49	512	512	208	0	313,485	313,485	89,871	0	432
10	615	744	3.57	470	470	209	0	288,908	288,908	80,961	0	388
11	528	764	3.65	427	427	209	0	225,618	225,618	61,834	0	295
12	589	**783**	**3.73**	385	385	210	0	226,674	226,674	60,786	0	290
13	544	793	3.77	342	342	210	0	186,257	186,257	49,415	0	235
14	514	802	3.81	300	300	211	0	154,160	154,160	40,468	0	192
15	475	812	3.85	257	257	211	0	122,294	122,294	31,769	0	151
Rest	1588	821	3.89	215	215	211	0	341,420	341,420	87,776	0	416
Sum	8760							4,201,503	3,820,746	1,138,928	380,757	5516

Heat Pump Data Sheet

AW200SP

Heat system temperature					EN 14825 data		
Type	Air °C	RH %	Tflow °C	Treturn °C	Heat kW	COP	Elect. kW
AW200SP	-7	80	60	30	468.6	2.42	193.8
AW200SP	2	80	60	30	581.2	2.87	202.2
AW200SP	7	80	60	30	686.5	3.33	206.3
AW200SP	12	80	60	30	782.9	3.73	209.9

Air flow m3/h	196,542	No. Sec.	10	Speed	475	
Cooling kW	Vent kW	De ice kW	dT K	Sound:	free fielsd soft ground	
296.9	4.34	8.8	6.2	SWL 1 fan	60.5	W/m2
414.0	4.34	21.2	7.7	SPL total	42.5	N/m2 at 10 meters
494.1	4.34	0.0	8.4	SPL total	28.5	N/m2 at 50 meters
587.1	4.34	0.0	8.9	SPL total	22.5	N/m2 at 100 meters

Dimensioning data:		
Current	334.7	Amp
Heat flow	22.4	m3/h

Aircoler lenght each section:	1.3

Plus 1 meter each unit

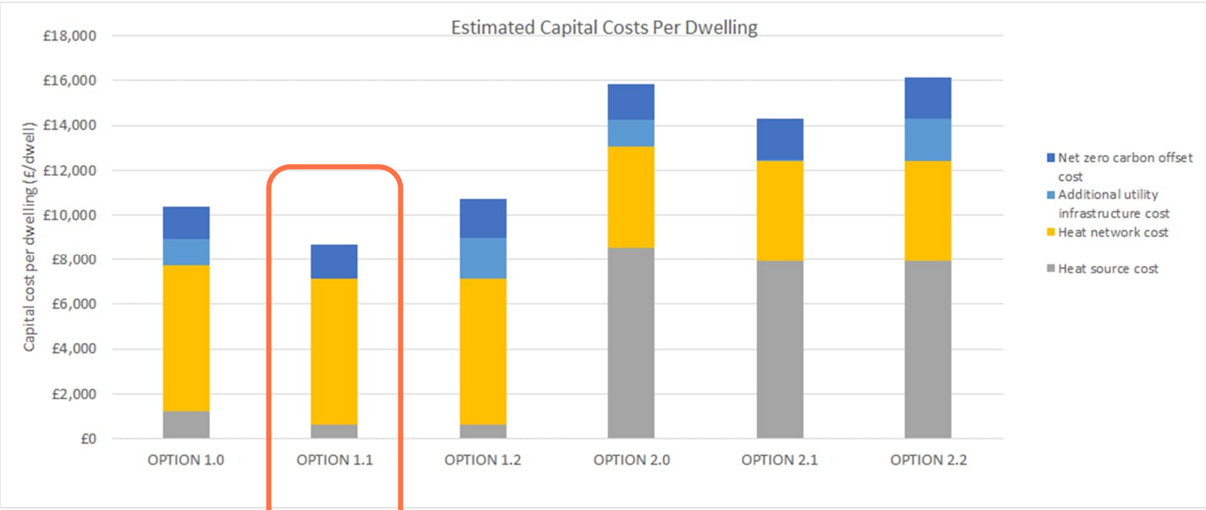
Compressor unit size			1 pcs.
L x W x H	3.3	1.5	2.8

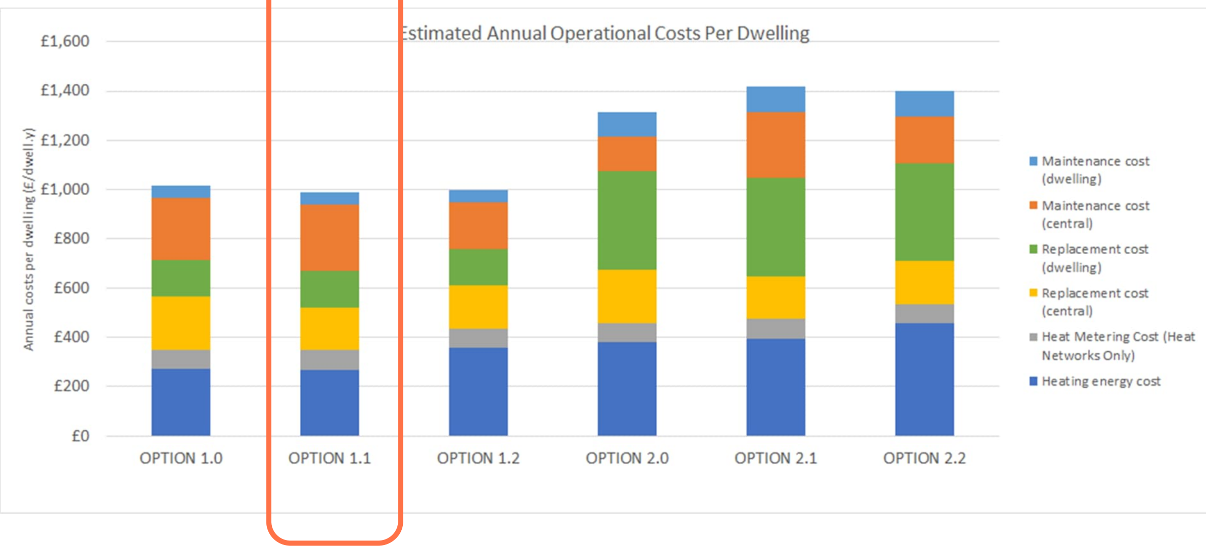
Compressor unit size Compact model:			1 pcs.
L x W x H	3.8	2.3	2.8

Estimated Heating Costs for occupants

The relative capital and running costs of different heating options were considered. The option selected (option 1.1) had the lowest capital and running costs.

At this stage it is not known exactly how the district heating costs would be proportioned so these figures should be taken as relative comparisons only, rather than predictions of absolute costs to occupants. The fuel cost is shown as the dark blue part of the bar – whilst this may change, the option selected has the lowest fuel cost to the occupants.





Distribution loss calculations

See separate file

Appendix 10 - **DER worksheets for dwellings after** Be Green measures

See separate file

Appendix 11 - BER worksheets for commercial spaces after Be Green measures

See separate file

Appendix 12 – GLA Consultation Feedback

The team has received feedback from the GLA during the course of the application and is incorporating this into the final application.

GREATER**LONDON**AUTHORITY

	Updated GLA energy comments v2 (07/12/21) are outlined in green text.	MF Comments
1	London Plan: The Mayor has published his London Plan 2021 which includes new carbon, energy and heat risk policies (See Policies SI 2, SI 3 and SI 4) which applicants are expected to follow. This can be found here: https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/london-plan-2021	noted
2	Guidance: Applicants should follow the GLA Energy Assessment Guidance 2020 ((https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_april_2020.pdf) which sets out the information that should be provided within the energy assessment to be submitted at Stage 1.	noted
3	The following comments summarise key points for you to be aware of in progressing your energy strategy, but you should refer to the guidance for full details.	noted
Net zero carbon target		
4	The Mayor's London Plan 2021 requires all major developments (residential and non-residential) to meet his net-zero carbon target. This should be met with a minimum on-site 35% reduction in carbon emissions beyond Part L of 2013 Building Regulations with any carbon shortfall to net zero being paid into the relevant borough's carbon offset fund using the GLA's recommended carbon offset price (£95/tonne) or, where a local price has been set, the borough's carbon offset price .	noted
5	Applicants should submit a completed Carbon Emissions Reporting spreadsheet (https://www.london.gov.uk/what-we-do/planning/planning-applications-and-decisions/pre-planning-application-meeting-service-0) alongside their Stage 1 application to confirm the anticipated carbon performance of the development and should clearly set out the carbon emission factors they are proposing to use in their energy assessment. Although results for both sets of carbon emission factors should be submitted, applicants are encouraged to use the SAP 10.0 carbon emission factors for referable applications when estimating CO_2 emission performance against London Plan policies. However, for developments in Heat Network Priority Areas with the potential to connect to a planned or existing district heating network (DHN) the SAP 2012 emission factors may be used provided that the heat network operator has developed, or is in the process of developing, a strategy to decarbonise the network which has been agreed with the GLA.	noted

6	The carbon emission figures should be reported against a Part L 2013 baseline. Sample SAP full calculation worksheets (both DER and TER sheets) and BRUKL sheets for all stages of the energy hierarchy should be provided to support the savings claimed.	A sample of the SAP calculations have been provided in appendices 2,3,10 & 11.
Be Lean Demand Reduction		
7	Applicants are expected to meet the London Plan 2021 energy efficiency targets: • Residential – at least a 10% improvement on 2013 Building Regulations from energy efficiency • Non-residential – at least a 15% improvement on 2013 Building Regulations from energy efficiency The applicant proposes to meet the energy efficiency targets. This is welcomed.	See section 6.0 of this report
8	Applicants are expected to design buildings to be able to meet all energy policy areas. They should consider how building form is contributing to the meeting of energy policy targets. Applicant are required to consider the suitability of other design areas which may be negatively impacting the energy consumption and overheating risk of the proposed development.	See section 6.0 of this report
9	Applicants will be expected to consider and minimise the estimated energy costs to occupants and outline how they are committed to protecting the consumer from high prices. See the guidance for further detail.	See section 6.0 of this report for passive measures taken to reduce the energy demand. See appendix 8 for estimate heating costs.
Energy flexibility		
10	Applicants will be expected to investigate the potential for energy flexibility in new developments, include proposals to reduce the amount of capacity required for each site and to reduce peak demand. The measures followed to achieve this should be set out in their energy assessment. See the 2020 guidance for further details.	See section 11 .0 of this report
Cooling and Overheating		
11	The Good Homes Alliance (GHA) Early Stage Overheating Risk Tool (https://goodhomes.org.uk/wp-content/uploads/2019/07/GHA-Overheating-in-New-Homes-Tool-and-Guidance-Tool-only.pdf) should be submitted to the GLA alongside the Stage 1 application, if this was not submitted at pre-application stage, to identify potential overheating risk and passive responses early in the design process. They have completed the Good Homes Alliance Overheating Checklist; this is welcomed.	See appendix 6 for the Early Stage Overheating Risk Tool

12	Evidence should be provided on how the demand for cooling and the overheating risk will be minimised through passive design in line with the cooling hierarchy. Dynamic overheating modelling in line with CIBSE Guidance should be carried out (TM59 for residential and TM52 for non-residential) for all TM49 weather scenarios. The applicant proposes to undertake CIBSE TM59 assessment, and they have considered measures to reduce the overheating risk such as limiting the glazing area and including a large proportion of dual aspect units; this is welcomed. They suggest there may be noise issues for some units, but they will seek to address these through passive measures such as attenutated ventilators and avoid the provision of active cooling; This is welcomed. They should ensure the assumptions align with the noise and air pollution assessments. If windows must be assumed closed, they should present one iteration with windows closed and one with windows opened. They suggest that all units will comply against the DSY1 weather file. They should ensure that compliance against the DSY2 and DSY3 weather files are maximised and further measures (e.g. occupancy-related) are considered to address this.	See appendix 5 for the Overheating Risk Analysis Report
13	The area weighted average (MJ/m^2) and total (MJ/year) cooling demand for the actual and notional building should be provided and the applicant should demonstrate that the actual building's cooling demand is lower than the notional.	See section 7.3 of this report
Be Clean Heating Infrastructure		
14	The applicant has investigated opportunities for connection to nearby existing or planned district heating networks (DHNs) including SELCHP. It is understood that the site is within potential longer term range of SELCHP and that there are wider developments occuring in the area. They have consulted with SELCHP who have confirmed that no opportunity for district heating connection. The applicant should also consult with the borough to identify any opportunities for wider off-site connections now and in the future, and they should ensure that the on-site proposals are future-proofed for connection to such opportunities. Evidence of this investigation should be provided including evidence of active two-way communication with the network operator, the local authority and other relevant parties. This should include information on connection timescales and confirmation that the network has available capacity. See the guidance for full details on the information that should be provided.	See Section 8.2 of this report for a description of the approach to the district heating network, plus Appendix 7 for details of consultation with SELCHP and Southwark LCB
15	The original outline consent included the provision of a site-wide heat network served by CHP, which would serve the wider masterplan site. The applicant now proposes an on-site electric approach, citing reduced CO2 emissions. This change in strategy is much welcomed.	noted

16	The applicant is proposing a site-wide network to serve the site with the energy centre in Plot 4A. This is welcomed. They propose network temperatures of 65/40C and HIUs, and are seeking to minimise the number of heat exchangers on the network to enable the heating system to work more efficiently. This may require a PN16 pressure regime. They have updated this from the block-by-block heating approach previously proposed. They have suggested that connections to existing buildings on the wider site (e.g. AFP, plot 18) may not be suitable due to the different temperature and pressure requirements. They should seek to maximise the heat loads served by the heat network and should submit evidence to demonstrate any constraints to connections that are not proposed. The site should be provided with a single point of connection where all buildings/uses on site will be connected in the event of future connection to district heating.. Engagement with the developer / design team for other phases of the masterplan should be undertaken in order to develop a holistic approach. Relevant drawings/schematics demonstrating the above should be provided. Any constraints should be robustly demonstrated.	Connections will be provided for other buildings to connect to the district heat network, however these buildings have heating systems that work on higher temperatures than our heat network will be running at, so will require either changes to their heating system to suit the heat network temperatures and pressures or a heat pump to bring the LTHW up to higher temperatures.
17	The applicant should provide evidence confirming that the development is future proofed for connection to wider district networks now or in the future, where an immediate connection is not available.	Capped-off connections for future expansion will be provided.
18	Where a DHN connection is not available, either now or in the future, applicants should follow the London Plan 2021 heating hierarchy to identify a suitable communal heating system for the site.	noted
19	The London Plan 2021 limits the role of CHP to low-emission CHP and only in instances where it can support the delivery of an area-wide heat network at large, strategic sites. Applicants proposing to use low-emission CHP will be asked to provide sufficient information to justify its use and strategic role while ensuring that the carbon and air quality impact is minimised.	noted
Be Green Renewable Energy		
20	All major development proposals should maximise opportunities for renewable energy generation by producing, using and storing renewable energy on-site. This is regardless of whether the 35% on-site target has already been met through earlier stages of the energy hierarchy.	noted
21	Solar PV is proposed; this should be maximised. The applicant suggests that there are likely to be constraints to PV such as the need to provide urban greening and amenity space. Where green roofs are proposed, they should consider the potential for biosolar roofs and propose them where feasible. Opportunities to integrate PV into amenity space should be considered. Applicants should submit the total PV system output (kWp) and a plan showing that the proposed installation has been maximised for the available roof area and clearly outlining any constraints to further PV.	noted. See section 9.3 for further details on the PV provision.

	The applicant is proposing an on-site air source heat pump solution, and considering typical communal heat pumps (with flow and return temperatures to the HIU of 60/30), propane based communal heat pumps and an ambient loop heat pump approach. They also note that sewer heat recovery from Earl's Sluice sewer could potentially be a feasible option in for later phases, but that this is unlikely to be feasible currently. Utilising waste heat from the sewer would be GLA's preference; further information should be provided in the submission to clarify why this is not feasible at present and outline the possible future opportunity. They suggest that a hybrid approach may be required involving top-up from gas boilers or potentially electric boilers, but that heat pumps would provide 85% of the heat load. They should seek to minimise CO2 emissions, energy bills and fossil fuel use and to maximise the use of renewable heat. The applicant suggests they looked at electrical boilers but the substation is not local and the.cost of bringing in additional capacity is high; evidence should be submitted to demonstrate this. Should heat pumps be proposed, applicants will be expected to demonstrate a high specification of energy efficiency measures under be lean, a thorough performance analysis of the heat pump system and, where there are opportunities for DHN connection, that the system is compatible. The detail submitted on heat pumps should include: a. An estimate of the heating and/or cooling energy (MWh/annum) the heat pumps would provide to the development and the percentage of contribution to the site's heat loads. The applicant will be required to demonstrate how the heat fraction from heat pump technologies will be maximised. b. Details of how the Seasonal Coefficient of Performance (SCOP) and Seasonal Energy Efficiency ratio (SEER) has been calculated for the energy modelling. This should be based on a dynamic calculation of the system boundaries over the course of a year i.e. incorporating variations in source temperatures and the design sink temperatures (for space heat and hot water). c. The expected heat source temperature and the heat distribution system temperature with an explanation of how the difference will be minimised to ensure the system runs efficiently. The distribution loss factor should be calculated based on the above information and used for calculation purposes.	See appendix 7.0 for correspondence with London Borough of Southwark relating to the feasibility of the Earls Sluice Heat Pump See section 8.1 for details of the required electrical infrastructure upgrades for installing electric boilers. See appendix 9.0 for details of the heat pumps.
22		
23	Should an ambient loop heat network be proposed, the applicant will be required to engage with local DHN stakeholders and demonstrate that proposals will be compatible and commercially viable for future connection to district heating.	n/a
Carbon Offsetting		
24	Applicants should maximise carbon emission reductions on-site. Where it is clearly demonstrated that no further carbon savings can be achieved, but the site falls short of the net-zero carbon reduction targets, applicants are required to make a cash-in-lieu contribution to the relevant borough's carbon offset fund using	noted

	the GLA's recommended carbon offset price (£95/tonne) or, where a local price has been set, the borough's carbon offset price.	
25	Energy strategies should provide a calculation of the shortfall in carbon emissions and the offset payment that will be made to the borough.	noted
Whole Life-Cycle Carbon Assessment		
26	Applicants will be expected to calculate and reduce whole life-cycle carbon emissions to fully capture the development's carbon footprint. Applicants should submit a whole life-cycle carbon assessment to the GLA as part of the Stage 1 application submission, following the Whole Life-Cycle Carbon Assessment Guidance and using the GLA's reporting template (https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/planning-guidance/whole-life-cycle-carbon-assessments-guidance-pre-consultation-draft). Applicants will also be conditioned to submit a post-construction assessment to report on the development's actual WLC emissions. The applicant proposes to submit a WLC assessment. This is welcomed.	See the separate Whole Life-Cycle Carbon Assessment document within this application.
Be Seen' Energy Monitoring		
27	Applicants will be expected to monitor on their development's energy performance and report on it through the GLA's online monitoring portal. Applicants should review the 'Be seen' energy monitoring guidance to ensure that they are fully aware of the relevant requirements to comply with the 'be seen' policy (https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/planning-guidance/be-seen-energy-monitoring-guidance-pre-consultation-draft). A commitment should be provided that the development will be designed to enable post construction monitoring and that the information set out in the 'be seen' guidance is submitted to the GLA's portal at the appropriate reporting stages. This will be secured through suitable legal wording. The first submission of the planning stage data should be provided to the GLA through the be seen planning stage webform (https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/london-plan-guidance-and-spgs/be-seen-energy-monitoring-guidance) at the planning submission stage, alongside the energy statement. The be seen reporting spreadsheet has been developed to enable development teams to capture all data offline before this is submitted via the webform. The applicant proposes to submit a Be Seen submission. This is welcomed.	Noted