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**Reserved Matters
Energy Statement**

St William Homes LLP

Clarendon Gas Works Phase 4 & 5

Final

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We are able to advise at all stages of projects from planning applications to handover.

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Executive Summary

The purpose of this Energy Statement is to address Condition 11 and 53 of the hybrid planning consent (HGY/2017/3117) for Phases 4 & 5 of the Clarendon Gas Works development in the London Borough of Haringey.

Condition 53 requires an updated Energy Strategy to be submitted prior to any Reserved Matters applications. This Energy Statement will provide the updated energy strategy to clear Condition 11 and 53 and 11 of planning consent HG/2017/3117 for Phases 4 & 5.

As per Condition 53 this energy strategy has been formulated following the London Plan (2016) Policy 5.2 and therefore the Energy Hierarchy: **Be Lean**, **Be Clean** and **Be Green**. The objective in the formulation of the strategy is to maximise the reductions in CO₂ emissions through the application of this Hierarchy with a cost-effective approach that is technically appropriate. In line with GLA Guidance this Energy Statement will demonstrate constancy with the Outline Consent and accompanying Energy Strategy; In addition to energy efficiency measures, this provided for a gas CHP led heat network.

This Energy Statement considers a portion of the development within the Outline Consent; Phases 4 & 5. This is comprised of 682 new dwellings, and 2,100m² of new non-domestic developments. Phase 4 consists of 375 dwellings across Blocks H1-3 and 1,771m² of non-domestic area (Café and Office space). Phase 5, consisting of Blocks F1, G1, G2, J1, and J2 is anticipated to have 399 dwellings and 5,991m² non-domestic area (Café and Office space).

The development has been assessed under Approved Document Part L1A (2013) and Part L2A (2013) for continuity with the Outline consent target. Due to the likely Part L (2021) version to be registered to each Phase has also been shown to comply with the most recent version of SAP (10.2) methodology which is expected to ensure compliance with Approved Document Part L Volume 1 (2022). Publication of the adopted SAP 10 methodology with Part L (2022) approved amendments are yet to be properly integrated into current approved software. However, it is known that SAP 10.2 methodology will be broadly in line with the adopted SAP 10.

London Plan (2016) Policy 5.2 requires the equivalent of a reduction in Regulated CO₂ emissions by 35% beyond a determined 2013 baseline case on site. The Energy Statement consented under the 2017 hybrid application aligns with this 35% over Part L1A (2013) target.

A range of **Be Lean** energy efficiency measures are currently proposed for the dwellings. This is in line with the London Plan Energy Hierarchy. They enable the currently proposed elements to meet or exceed the baseline cases through energy efficiency alone.

In accordance with the Energy Hierarchy, the feasibility of decentralised energy production as a **Be Clean** measure has also been carefully examined. In line with the Outline Consent Phase 4 and 5 will connect into the consented site wide heat network, which has the plant room in existing Phases.

In accordance with the Energy Hierarchy, the relevant **Be Green** renewable energy generating technologies have been evaluated. Given that the required energy reduction has been provided through the use of a site wide heating network, no further technologies were required to be applied with the exception of Heat Pump use for the non-domestic elements. This aligns with the outline Consent.

The current proposal for the development will enable it to reduce its CO₂ emissions in line with the conditioned targets of the London Plan (2016) requirements (35%) over the overall Part L1A (2013) baseline case. This represents a high level of sustainable design.

The Tables below demonstrates the reduction in Regulated and Total CO₂ reductions after each stage of the Energy Hierarchy showing energy policy requirements have been achieved.

PHASE 4 Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L1A 2013 Compliant Development	373	453
After <i>Be Lean</i> Measures	356	453
After <i>Be Clean</i> Measures	187	453
After <i>Be Green</i> Measures	187	453
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	17	5%
Savings from <i>Be Clean</i> Measures	169	45%
Savings from <i>Be Green</i> Measures	0	0%
Cumulative On-Site Savings	186	50%

PHASE 4 Non-Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 Compliant Development	105	93
After <i>Be Lean</i> Measures	100	93
After <i>Be Clean</i> Measures	80	93
After <i>Be Green</i> Measures	59	93
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	5	5%
Savings from <i>Be Clean</i> Measures	19	18%
Savings from <i>Be Green</i> Measures	22	21%
Cumulative On-Site Savings	46	44%

PHASE 4 Phase Wide Carbon Dioxide Emissions and Cumulative Savings			
	Regulated Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	Regulated Carbon Dioxide Savings	
		Tonnes CO ₂ per Annum	Percentage
Baseline: Part L 2013 Compliant Development	478	-	-
After <i>Be Lean</i> Measures	456	22	5%
After <i>Be Clean</i> Measures	267	189	40%
After <i>Be Green</i> Measures	245	22	9%
Cumulative On-Site Savings		232	49%

PHASE 5 Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L1A 2013 Compliant Development	394	484
After <i>Be Lean</i> Measures	376	484
After <i>Be Clean</i> Measures	198	484
After <i>Be Green</i> Measures	198	484
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	18	5%
Savings from <i>Be Clean</i> Measures	178	45%
Savings from <i>Be Green</i> Measures	0	0%
Cumulative On-Site Savings	196	50%

PHASE 5 Non-Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 Compliant Development	298	267
After <i>Be Lean</i> Measures	284	267
After <i>Be Clean</i> Measures	229	267
After <i>Be Green</i> Measures	168	267
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	14	5%
Savings from <i>Be Clean</i> Measures	55	18%
Savings from <i>Be Green</i> Measures	62	21%
Cumulative On-Site Savings	131	44%

PHASE 5			
Phase Wide Carbon Dioxide Emissions and Cumulative Savings			
	Regulated Carbon Dioxide Emissions (Tonnes CO₂ per Annum)	Regulated Carbon Dioxide Savings	
		Tonnes CO₂ per Annum	Percentage
Baseline: Part L 2013 Compliant Development	692	-	-
After <i>Be Lean</i> Measures	660	32	5%
After <i>Be Clean</i> Measures	427	233	34%
After <i>Be Green</i> Measures	365	62	17%
Cumulative On-Site Savings		327	47%

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1. INTRODUCTION

- 1.1** This Energy Statement has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by St William Homes LLP. This statement is to demonstrate that Phases 4 & 5 at Clarendon Gas Works, in the London Borough of Haringey, can achieve the requirements in Condition 11 and 53 of the Planning Permission as well as Building Regulations Part L requirements.
- 1.2** This Energy Statement applies to Phase 4 and 5. Phase 4 consists of 283 new dwellings, and 1,852 m² of new non-domestic area within Blocks H1-H3. Phase 5 consists of 399 new dwellings, and 5,991m² of new non-domestic area within Blocks F1, G1, G2, J1, and J2.
- 1.3** The formulation of the energy statement is on the basis that it targets a viable reduction in carbon dioxide (CO₂) emissions through the application of the London Plan Energy Hierarchy with an affordable, deliverable and technically appropriate strategy and conforms to the outline consent Conditions.
- 1.4** This statement establishes a baseline assessment of the energy demands and associated CO₂ emissions for Clarendon Gas Works Phases 4 and 5. It reflects the Approved Document Part L 1A (2013) and Part L 2A (2013) baseline for new build dwellings and non-domestic construction respectively. Compliance with the forthcoming Part L of the Building regulations has also been shown via the most up-to-date SAP 10 calculation methodology which is to be used on projects registered under Part L (2021).
- 1.5** The report will then follow The London Plan Energy Hierarchy approach of **Be Lean, Be Clean** and **Be Green** to enable the maximum viable reductions in Regulated and Total CO₂ emissions over these baselines.

2. DEVELOPMENT OVERVIEW

- 2.1 The development of Phase 4 and 5 of Clarendon Gas Works is to take place within the London Borough of Haringey.

Outline Consent Development description

- 2.2 Phases 4 and 5 benefit from an Outline Consent and sits within the wider Clarendon Gas Works site, which is consented to provide:

“103,150sqm Class C3 Residential; 7,168sqm to 7,500sqm Class B1 Business Use; 1,500sqm to 3,950sqm Class A1-A4; and up to 2,500sqm Class D2 Leisure Use; Buildings up to 103.90m AOD; associated cycle and car parking provision; new basement level; energy centre; new public square, public realm works and landscaping; vehicular access and new servicing arrangements; associated highway works; and facilitating works.”

- 2.3 Figure 1 illustrates the site location, and the developments layout.



Figure 1: Clarendon Gas Works site location (Panter Hudspith architects, © OpenStreetMap Contributors)

Development description

- 2.4 The Development of Phase 4 and 5, Blocks F, H, G and J, for which this Energy Strategy is based upon consist of c.774 Domestic units and 8,091m² of non-domestic space (e.g. office space and café space)

Masterplan Consented Energy Strategy

2.5 A summary of the approved Energy Strategy for the Outline consent is as follows:

- > Meet Part L (2013) through energy efficiency;
- > Connection to the sitewide gas-CHP led district heating network to achieve a 35% CO₂ reduction (or connection to DEN2);
- > No provision of renewable energy technologies or carbon offset payments;
- > Provision of DEN2 'box' to Haringey Council for development into an Energy Centre of the Wood Green Heat Network;
- > Subject to the requirements of the S106, potential connection to the Wood Green Heat Network.

3. PLANNING REQUIREMENTS

Condition 11

- 3.1 Condition 11 of Planning Permission (HGY/2017/3117) states:

*“COMPLIANCE – Development in Conformity with Energy Statement
Unless otherwise agreed by the Local Planning Authority, the development hereby approved shall be constructed and delivered to the U-values and other standards set out in the document Energy Statement prepared by Hodkinson dated October 2017 and any energy strategy document thereafter approved.”*

Condition 53

- 3.2 Condition 53 of Planning Permission (HGY/2017/3117) states:

*“PRIOR TO SUBMISSION OF RMA – Updated Energy Strategy
Notwithstanding the submitted details and prior to the submission of any reserved matters, excluding demolition and site preparation works, an updated energy strategy shall be submitted to and approved in writing by the local planning authority. The Energy Strategy shall, unless otherwise agreed by the local planning authority, be based on connection of all residential and non-residential buildings to a district energy and heating network. Details of the site wide heating and hot water facilities, the phasing of delivery, and associated network infrastructure will be submitted for approval to the Council. The strategy shall explore all reasonable options for improving the energy efficiency of the building and reducing carbon dioxide emissions in accordance with the energy hierarchy set out in London Plan policy 5.2 ‘Minimising carbon dioxide emissions’. The Strategy will comply with the targets and measures set out in London Plan (2016) Policy 5.2 and will be submitted using the format set out in the GLA guidance on Energy Strategies. The development shall be carried out strictly in accordance with the details approved.”*

- 3.3 The Condition cites the London Plan (2016) Policy 5.2. This, additional relevant London Plan Policy and GLA guidance on preparing energy statements are iterated below for clarity.

The London Plan (2016)

- 3.4 It is noted that as Condition 53 specifically references the London Plan (2016), the New London Plan does not apply in this instance.

- 3.5** The following outlines key policies set out in the current London Plan which are relevant to the current proposed development and this Energy Statement.
- 3.6** **Policy 5.2 – Minimising Carbon Dioxide Emissions** requires that all residential and non-residential major developments to achieve a specific improvement. The London Plan Sustainable Design and Construction SPG (2014) updates this target stating that the Mayor will adopt an onsite carbon dioxide improvement target beyond Part L 2013 of 35%.
- 3.7** **Policy 5.3 – Sustainable Design and Construction** states that the highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments. Major development should meet the minimum standards outlined in the London Plan Supplementary Planning Guidance and this should be clearly demonstrated.
- 3.8** **Policy 5.6 – Decentralised Energy** requires that all developments should evaluate the feasibility of Combined Heat and Power (CHP) systems and examine the opportunities to extend the system beyond the site boundary to adjacent sites.
- 3.9** **Policy 5.7 – Renewable Energy** states that within the framework of the Energy Hierarchy, major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.
- 3.10** **Policy 5.8 – Innovative Energy Technologies** encourages the more widespread use of innovative energy technologies to reduce use of fossil fuels and carbon dioxide emissions.
- 3.11** **Policy 5.9 – Overheating and cooling** encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.
- 3.12** It is to be noted that Condition 49 of the Outline consent requires the overheating assessment to be submitted prior to above ground works being undertaken. This document is not therefore not presented in this Energy Statement.

GLA Energy Assessment Guidance (April 2020)

- 3.13** The Greater London Authority's (GLA's) guidance on preparing energy assessments details what should be included within an energy assessment.
- 3.14** Within the document it states energy assessments:

“...should demonstrate consistency with the Outline strategy.”

Summary of Project Requirements

3.15 The following are the energy related project requirements:

- > To follow the Outline consent Energy Strategy which used the **Energy Hierarchy**, '**Be lean**' (energy efficiency, '**Be Clean**' (heating infrastructure), and '**Be Green**' (renewable energy technologies);
- > To meet the requirements of Part L (2013) through energy efficiency alone ('**Be Lean**');
- > To meet a 35% Regulated CO₂ reduction over Part L (2013), achieved through connection to the gas-CHP led Clarendon Gas Works Heat Network ('**Be Clean**');

3.16 This Energy Strategy covers the overall specification for Phases 4 and 5. It provides a compliant energy strategy for both phases. Compliance with future regulations has also been tested.

4. BASELINE EMISSIONS ASSESSMENT

Methodology

- 4.1 This statement first establishes a baseline assessment of the energy demands and associated CO₂ emissions for the build types.
- 4.2 The report will then follow The London Plan (2016) Energy Hierarchy approach of **Be Lean, Be Clean** and **Be Green**, to enable the maximum viable reductions in Regulated and Total CO₂ emissions over the baselines.
- 4.3 The estimated annual energy demand for the Development has been calculated using Standard Assessment Procedure (SAP 2012) and Simplified Building Energy Model (SBEM 2013) methodology. Use of SAP2012 is in accordance with GLA 2020 energy statement guidance for developments connecting to an existing CHP-led heat network, which is the case here.
- 4.4 SAP calculates the domestic Regulated energy demands associated with hot water, space heating and fixed electrical items. The unregulated dwelling energy demands for appliances and cooking are taken from calculation procedures within SAP chapter 16. SBEM calculates the non-domestic Regulated energy demands associated with hot water, space heating and fixed electrical items. The unregulated non-domestic energy demands are taken from additional SBEM output (BRUKL) documents.
- 4.5 In addition to showing planning compliance through use of SAP2012, it is currently expected that Phase 4 will be delivered to Part L 2021 and Phase 5 potentially to Part L 2025 (the Future Homes Standard). Additional calculations have therefore been undertaken to provide comfort that the design & specification of the phases is sufficient to achieve these. Currently there is no SAP software that correctly calculates performance against Part L 2021 due to changes between the consultation and the adopted Part L. Compliance is therefore shown through:
- > Use of Elmhurst SAP beta software for compliance with the 2021 Fabric Energy Efficiency (FEE) requirements;
 - > Manual calculation via excel (using the SAP10.2 manual) to show that the CHP-led heat network meets the notional building requirements (carbon & primary energy) for heat network performance.
- 4.6 Due to how SAP10.2 & Part L 2021 are designed to treat CHP heat networks, the above should enable compliance with Part L 2021.

- 4.7** Seven representative studios, 1 and 2 bed dwellings have been modelled which include a heat loss floor, mid floor, and top floor apartments all with a range of orientations.
- 4.8** Representative areas and use types have been used for the non-domestic energy assessment. It should be noted that the non-domestic components will be delivered by St William to shell and core only.

CO₂ Baselines for Building Types

- 4.9** Table 1 shows the Regulated and Total CO₂ baseline cases. Summary CO₂ baselines and Dwelling Target Emission Rate (TER) Worksheets and can be found in Appendices B and C respectively.

Table 1: Regulated CO₂ Baseline Cases

Carbon dioxide emissions TCO _{2,a}						
	Domestic		Non-domestic		Total	
	Regulated	Unregulated	Regulated	Unregulated	Regulated	Unregulated
Phase 4 Baseline	373	453	105	93	478	547
Phase 5 Baseline	394	484	298	267	692	751

5. 'BE LEAN': ENERGY EFFICIENCY MEASURES

- 5.1 In line with the London Plan Energy Hierarchy, the following '**Be Lean**' measures (energy efficiency) are currently proposed to achieve the calculated baseline.
- 5.2 The Outline Consent requires Part L (2013) to be achieved through '**Be Lean**' measures. The specification must also be sufficient to achieve the Part L 2021 FEE requirements.
- 5.3 This Chapter and following chapters will provide an indicative route to compliance

Domestic

Insulation Standards

- 5.4 Due to the increased improvements on Fabric Energy Efficiency in forthcoming and Future Part L Regulations, the insulation values have been improved over those stated within the Outline Application Energy Strategy detailed in the submitted October 2017 Energy Statement. These values are intended to ensure compliance with the standards set within future Regulation.
- 5.5 Condition 11 requires the development to follow the U-values set out in the Energy Statement of October 2017, these are shown for comparison against the currently proposed U-values in Table 2 below.

Table 2: Comparison of Energy Statement (Oct 2017) and currently proposed U-values

Fabric Element	Energy Statement October 2017	Proposed Strategy
	U-value (W/m ² K)	U-value (W/m ² K)
External wall	0.15	0.24
Windows	1.40	0.90
Average Façade with 30% glazing	0.53	0.44
Ground floor	0.10	0.10
Exposed floor (e.g. above unheated space)	0.15	0.12
Roof	0.12 (Terraces 0.15)	0.14
Party walls and corridor walls	0.00 (fully filled and sealed), considering the corridor as heated.	0.00 (fully filled and sealed), considering the corridor as heated.

- 5.6** The external façade (walls and windows) U-value is expected to be a 17% reduction in overall U-value when compared to the Outline Application Energy Strategy due to significantly better window performance. These values represent a good level of sustainable design and construction which surpasses the notional building. The wall u-value has been increased due to the need to avoid rigid insulation so as to minimise flammability risk.

Air Tightness and Ventilation

- 5.7** Air tightness standards will conform to, and exceed, Approved Document Part L1A (2013) and Part L Volume 1 (2022) requirements. By reducing air leakage loss and convective bypass of insulation, an improvement of design air permeability rate from $10\text{m}^3/\text{hm}^2$ to less than $4\text{m}^3/\text{hm}^2$ will further reduce space heating requirements.
- 5.8** It is proposed that the dwellings will utilise a Part L & F compliant Continuous Mechanical Ventilation system (Part F System 3 or 4). Currently proposed is a Mechanical Ventilation with Heat Recovery (MVHR) system (Part F System 4). This system extracts stale air or pollutants (such as moisture) continuously, fresh air is then drawn into the dwelling through controlled background ventilators. These mechanisms are illustrated in Figure 2.

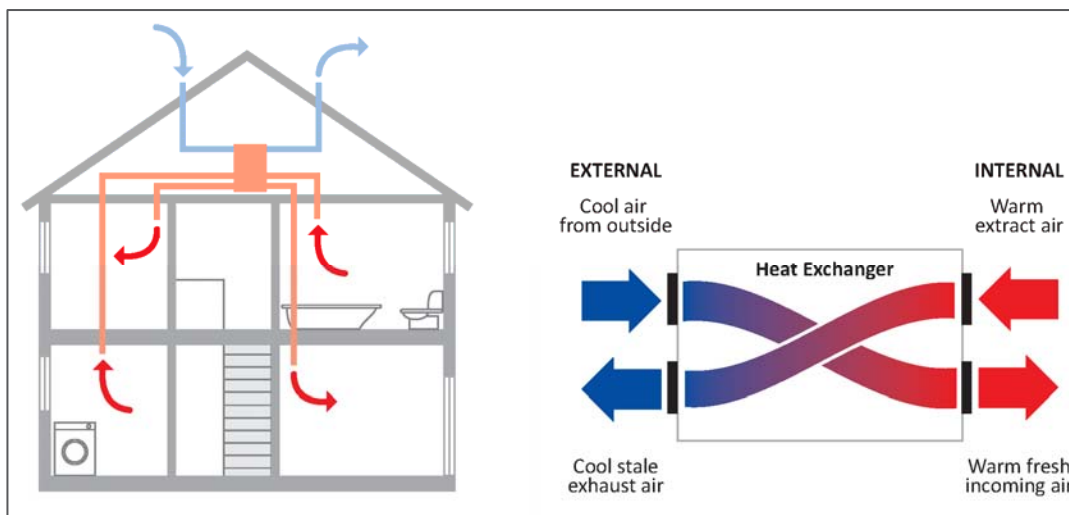


Figure 2: Mechanical Ventilation with Heat Recovery

- 5.9** The selected MVHR units will typically have low Specific Fan Powers (SFP) and high heat recovery efficiency.
- 5.10** Additionally, all dwellings, where safe, will have openable windows and therefore the ability to naturally ventilate should the occupant desire. Convective ventilation and night purging of heat will therefore be facilitated.

Thermal Bridging

- 5.11** In well insulated buildings, as much as 30% of heat loss can occur through thermal bridges, which occur when highly conductive elements (e.g. metal studs) in the wall construction enable a low resistance escape route for heat.
- 5.12** Outgoing and forthcoming Part L versions place increased importance on addressing heat losses through thermal bridging. As such, the Applicant is committed to developing a building fabric where these are minimised as far as practicable.
- 5.13** It is currently proposed that for this development based on a concrete frame and steel walls that a mix of default and bespoke thermal bridges would be targeted. This is based on our experience and availability to alter constructions accordingly.
- 5.14** Significant and prevalent thermal bridges will be reduced through good design. Where bespoke thermal bridge heat loss values (psi-values) are used, they will be assessed to allow the psi-value to be used within the SAP calculations.
- 5.15** With the outgoing of the Accredited Constructions Details (ACDs) scheme, common such as dwelling corners and window surrounds, will be required to be bespoke psi-value calculations where they may not have needed to before. Additional care should be taken to enable low psi-values equivalent to those previously claimed via ACDs.
- 5.16** The following thermal bridge junctions between various elements have been assumed to be bespoke on the basis they can economically and technically be targeted. These go beyond standard practice and help to ensure a lean building design. These include between:
- > E2: Lintels, 0.10 W/m.K;
 - > E7: Party floor between dwellings, 0.10W/m.K;
 - > E15: Flat roof with parapet, 0.35W/m.K
 - > E23: Balconies, 0.20W/m.K;
 - > P4: Party wall to roof (flat) insulation, 0.05W/m.K
- 5.17** The targeted thermal bridge psi values will be fully determined during detail design.

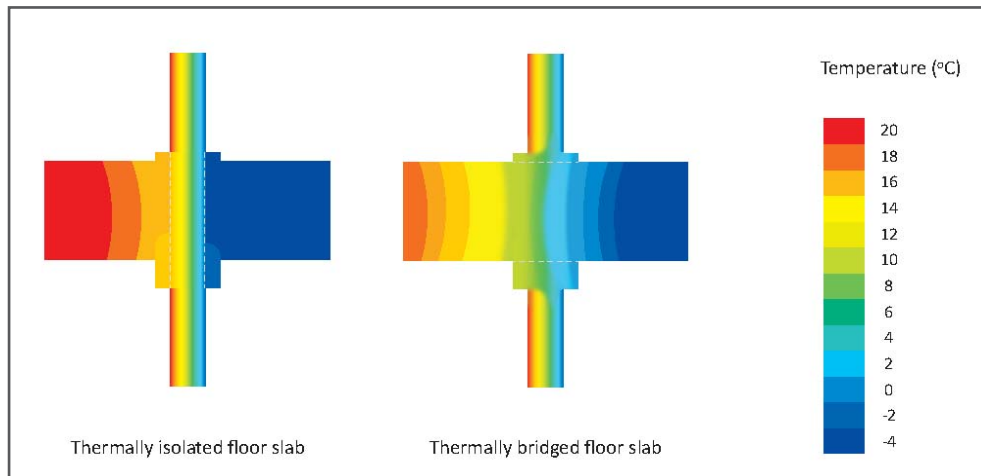


Figure 3: Thermal Bridging (SCI P380 2012)

- 5.18** Figure 3 illustrates the benefits of reducing thermal bridges; reducing heat loss and ensuring higher internal surface temperatures.

Space Heating & Hot Water

- 5.19** The space heating requirement of all build elements will be reduced by the fabric, air tightness and ventilation measures detailed above.
- 5.20** The combination of the above measures will create highly energy efficient homes.
- 5.21** The strategy will make use of communal heating utilising, among other technologies, conventional gas boilers. Therefore, in line with GLA guidance on Preparing Energy Statements the end energy strategy boiler efficiency has been used at the **Be Lean** Stage.
- 5.22** The boiler gross seasonal efficiency for the energy centre has been assessed to have an efficiency of 95.7%. This forms part of the current DEN1 plantroom design which is within areas of the development that already benefit from Detailed Planning Consent.
- 5.23** The space heating systems will include time and zoning controls where appropriate and low loss dwelling metered heat interface units. This will allow the occupants to have a flexible and efficient way of controlling heating throughout the dwelling.

Limiting the Risk of Summer Overheating

- 5.24** Minimising the risk of summer overheating is important to ensure that homes are adapted to climate change and remain comfortable to occupy in the future. As required by the planning consent, an overheating mitigation report will be submitted against condition 52 prior to above ground works.

Initial work has been undertaken to ensure that the energy strategy is coordinated with both the overheating strategy from the hybrid consent and with Approved Document Part O (2021).

- 5.25** In line with the Cooling Hierarchy within London Plan Policy 5.9, it is currently proposed to reduce the need for active cooling as far as possible and will not require the installation of mechanical cooling. All dwellings will therefore be subject to measures to minimise the risk of summer overheating to an acceptable level.
- 5.26** This will be done through the specification of passive measures such as low fabric U-values and ventilation systems capable of maintaining airflow through the dwelling, and solar control glazing which reduces the passage of solar radiation and therefore heat gains in peak summer months. The amount of glazing and the amount to which it is openable will be designed to facilitate overheating compliance.
- 5.27** A g-factor of 0.40 has been used for the glazing for the dwelling and an ability to achieve a 1.5 ACH rate through the MVHR system rate for all units (see submitted Dynamic Overheating Assessment by Hodkinson Consultancy, October 2017).
- 5.28** Some units benefit from inset balconies which provide partial window shading. These act effectively in mitigating any overheating risk.
- 5.29** Open-able windows will be used across the development and will enable convective-ventilation and night purging. These concepts are illustrated in Figure 4.

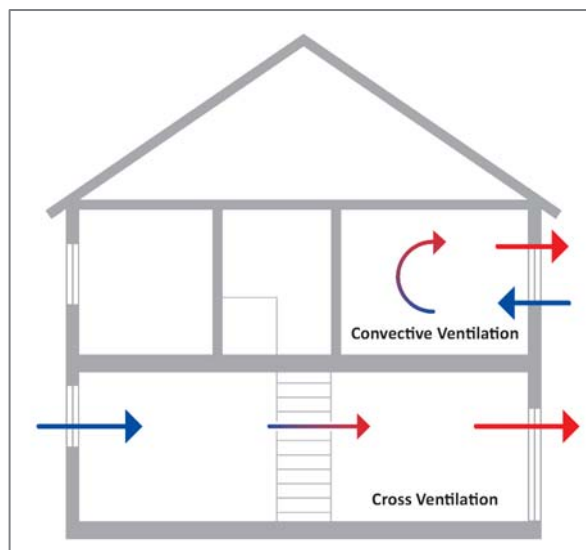


Figure 4: Natural Ventilation

- 5.30** The design of the development will aim that no dwelling will have a high risk of summer overheating and will adopt appropriate measures to ensure this is delivered.

Lighting and Appliances

- 5.31** It is very challenging to design and construct living spaces to reduce the unregulated electricity demands, because this is almost entirely dependent on the occupant of a home and can vary substantially. However, the Applicant is committed to ensuring that all efforts are made to enable the residents to minimise their unregulated electricity consumption and will ensure all appliances supplied to the apartments are of a high standard of energy efficiency.
- 5.32** Low energy lighting, with an efficacy of 100 lm/W is expected to be used throughout the dwellings as it now assessed under SAP 10.

Non-Domestic

Insulation Standards

- 5.33** For the non-domestic areas U-values will be improved beyond the limiting U-values detailed in Part L2B. Example targeted values for all Non-Domestic areas are:
- > External wall U-values of 0.24 W/m²K;
 - > Ground and exposed floors (e.g. above unheated spaces) U-values of 0.14 W/m²K;
 - > Flat roof U-values of 0.14 W/m²K;
 - > Whole window and glazed door U-value of 1.40 W/m²K;

Air Tightness and Ventilation

- 5.34** Non-domestic areas are considered as shells for this application. We have considered that they can reasonably be provided with a balanced supply and extract mechanical ventilation system with a heat exchanger. This system would have a central air handling unit which would require a specific fan power (SFP) of 1.50 W/l/s and a heat recovery efficiency of at least 85%, any terminal units such as fan coil units would be expected to have a specific fan power of 0.3 W/l/s.
- 5.35** Air tightness standards will conform to, and exceed, Approved Document Part L requirements. By reducing air leakage loss and convective bypass of insulation, an improvement of design air permeability rate from 10m³/hm² to less than 5m³/hm² will further reduce space heating requirements.

Space Heating and Hot Water

- 5.36** All non-domestic development will have connection points to heat from an energy centre. This is discussed further with relation to decentralised energy in **Be Clean**.

Cooling and Limiting the Risk of Summer Overheating

- 5.37** The specification of passive measures such as low fabric U-values and ventilation systems capable of maintaining airflow reduces the demand on the mechanical cooling systems.
- 5.38** Low g-factors will reduce unwanted solar heat gains in peak summer months.

Cooling

- 5.39** Cooling is only considered for the non-domestic areas where there is a significant need as a result of the space use. However, cooling will be designed to maximise natural cooling before using energy therefore peak shaving. Table 3 shows the cooling demand calculated using the NCM.

Table 3: Cooling Demands

	Notional (MJ/m ²)	Actual (MJ/m ²)
Café	466.2	325.7
Office	117.6	78.6

- 5.40** To allow the occupant to efficiently use the systems a central time control with local temperature control should be installed. Sub-metering with alarm for out of range values for the HVAC and Lighting should also be considered.
- 5.41** The Non-Domestic areas are shell only, therefore the proposed cooling strategy is an indicative route to compliance. The occupier, providing the fit-out, may follow the proposed strategy or they may provide an alternative option to meet equivalent performance or compliance.

Lighting

- 5.42** Energy efficient lighting is anticipated to be installed on the site during fit-out. This will help reduce the occupant's electrical energy bills. The lighting will be well designed and utilise luminaires which are LED or equivalently efficient.
- 5.43** It would be expected that non-domestic lighting will be provided with energy efficient lighting design, with a lamp efficacy greater than 100lm/W (can be lower for display lighting). This will also be accompanied with various automatic, manual and photoelectric dimming lighting controls, with a low parasitic power. These will help to reduce the energy consumption associated with lighting.
- 5.44** Zoning of lighting circuits also allows greater benefit to be made of natural daylight in the areas where it is available, without compromising light levels further away from windows.
- 5.45** The Non-Domestic areas are shell only, therefore the proposed lighting strategy is an indicative route to compliance. The occupier, providing the fit-out, may follow the proposed strategy or they may provide an alternative option to meet equivalent performance or compliance.

CO₂ Emissions Following *Be Lean* Measures

5.46 Table 4 describes the energy demand for the development, based on the Building Regulations methodology.

Table 4: Energy demand for development after demand reduction measures

Energy demand for site by building use				
Energy demand use	Phase 4		Phase 5	
	Domestic	Non-Domestic	Domestic	Non-Domestic
	kWh/yr	kWh/yr	kWh/yr	kWh/yr
Space heating	717,000	7	746,000	7
Hot water	590,000	129	624,000	129
Lighting	102,000	42	107,000	42
Auxiliary	14,000	16	15,000	16
Cooling	-	63		63
Unregulated electricity	877,000	171	937,000	171
Unregulated gas	-	-	-	-

5.47 In achieving energy efficiency savings, the dwellings in the development also demonstrate compliance with the Target Fabric Energy Efficiency (TFEE). This is a mandatory requirement to demonstrate compliance with Approved Document Part L 1A and is demonstrated in Table 5 below.

Table 5: Summary table reporting on Fabric Energy Efficiency for dwellings

Summary report on Part L1A (2013) FEE			
	Target Fabric Energy Efficiency (TFEE)	Design Fabric Energy Efficiency (DFEE)	Improvement
	kWh/yr	kWh/yr	%
Phase 4 FEE - Area Weighted	40.8	34.0	16.6%
Phase 5 FEE - Area Weighted	39.9	33.4	16.3%

5.48 The more stringent TFEE required by Part L Volume 1 (2021) currently within SAP 10.2 methodology results in a different TFEE and DFEE calculation as the reference values for the notional dwelling have been significantly reduced. The sample dwellings are still compliant with the new standard (see Table 6 below).

Table 6: Summary table reporting on Fabric Energy Efficiency for dwellings

Summary report on Part L (2021) FEE			
	Target Fabric Energy Efficiency (TFEE)	Design Fabric Energy Efficiency (DFEE)	Improvement
	kWh/yr	kWh/yr	%
Phase 4 FEE - Area Weighted	29.6	29.3	0.9%
Phase 5 FEE - Area Weighted	28.8	28.6	0.6%

5.49 Table 7 below outlines the reduction in CO₂ emissions following the inclusion of all the above energy efficiency measures for each of the energy strategies. All build types achieve or exceed the baseline assessment through **Be Lean** measures alone.

Table 7: CO₂ reductions following Be Lean measures

Carbon dioxide emissions (TCO _{2,a})			
Phase 4	Domestic Regulated	Non-domestic Regulated	Total
Phase 4 - New Builds – Baseline	373	105	478
Phase 4 - After Be Lean	356	100	456
Phase 4 - Development cumulative Total Reduction over Base case	4.5%	4.7%	4.6%
Phase 5	Domestic Regulated	Non-domestic Regulated	Total
Phase 5 - New Builds – Baseline	394	298	692
Phase 5 - After Be Lean	376	284	660
Phase 5 - Development cumulative Total Reduction over Base case	4.7%	4.7%	4.7%

5.50 Summary CO₂ calculations, **Be Lean** SBEM outputs (BRUKLs), and **Be Lean** Dwelling Emission Rate (DER) Worksheets and can be found in Appendix B, D and E respectively.

6. BE CLEAN: DECENTRALISED ENERGY

6.1 In line with Policy 5.6 of the London Plan, the feasibility of decentralised heating networks as a **Be Clean** measure has been evaluated. This is the next step in the Energy Hierarchy after **Be Lean**. The London Plan outlines the following order of preference: -

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

6.2 Condition 53 requires the energy strategy of the development to be based on connection of all residential and non-residential buildings to a district energy and heating network.

Connection to Existing Heat Network

6.3 An existing Heat Network to service the Clarendon Gas Works development is operational, currently servicing Phases 1 & 2. An example of the Networks Layout is shown in Figure 5. Phases 4 & 5 will connect to this heat network.

6.4 The heat network and DEN1 are consented under the detailed component of the hybrid masterplan consent. Alteration to the heat network strategy (e.g. type of plant) is not therefore within the scope of this Energy Statement or subsequent Reserved Matters Applications.

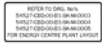


Figure 5: Clarendon Gas Works indicative District Heating Distribution Layout (Chapman BDSP)

- 6.5** For Phase 4, 100% of heat will come from the Heat Network, currently this will be provided for by DEN1 in the Southern Quarter. DEN1 Energy Centre and will enable a 75% provision of low carbon heat via an optimised CHP with a Heat to Power ratio of 1.06 with an efficiency greater than 78%.
- 6.6** The calculations, using SAP10.2 methodology, that show the heat network achieves the Part L 2021 standards are shown below in Tables 8 & 9. An initial calculation of heat network losses indicates that a Distribution Loss Factor (DLF) of below 1.3 can be achieved.

Table 8: Heat Network Part L 2021 Carbon Compliance		
Heat Loss Factor	1.3	
Gas boiler efficiency	95.0%	
CHP Efficiency	78.9%	
Thermal	40.6%	
Electrical	38.3%	
HP Efficiency		
CHP Contribution	75%	
HP Contribution	0%	
Heat from CHP	0.975	kWh
Heat from HP	0	kWh
Heat from Gas Boilers	0.325	kWh
CHP Gas Required	2.401	kWh
CHP Electricity Generated	0.920	kWh
CHP Carbon Dioxide Emissions	0.218	kgCO ₂
HP Electricity Required		kWh
HP Carbon Dioxide Emissions		kgCO ₂
Gas Boiler Gas Required	0.342	kWh
Gas Boiler Carbon Dioxide Emissions	0.072	kgCO ₂
Total CO₂ emissions	0.290	kgCO₂/kWh
Pass Mark for Existing Heat Networks	< 0.35	kgCO₂/kWh

Table 9: Heat Network Part L 2021 Primary Energy Compliance		
Heat Loss Factor	1.3	
Gas boiler efficiency	95.0%	
CHP Efficiency	78.9%	
Thermal	40.6%	
Electrical	38.3%	
HP Efficiency		
CHP Contribution	75%	
HP Contribution	0%	
Heat from CHP	0.975	kWh
Heat from HP	0	kWh
Heat from Gas Boilers	0.325	kWh
CHP Gas Required	2.401	kWh
CHP Electricity Generated	0.920	kWh
CHP PE	0.776	kWh
HP Electricity Required		kWh
HP PE		kWh
Gas Boiler Gas Required	0.342	kWh
Gas Boiler PE	0.387	kWh
Total PE	1.162	kWh/kWh
Pass Mark for Existing Heat Networks	< 1.45	kWh/kWh

- 6.7** Timings & requirements for Part L 2025, which may apply to Phase 5, are currently not confirmed. Carbon requirements are expected to be enhanced over Part L 2021, but its unknown what will happen not the primary energy target. Furthermore, it is unclear how gas CHP will be treated in 2025. Due to these uncertainties, there is a risk that connection to an unmodified gas CHP-led heat network may not in itself enable compliance with Part L 2025 (if Phase 5 had to meet this standard).
- 6.8** Should Phase 5 be required to be built to Part L 2025 and if connection to the existing heat network is not itself sufficient to enable compliance, the current plan is to introduce air source heat pumps on the roof of Phase 5. Heat from these would be fed to the building connection point where the temperature would be topped up by heat from the (currently proposed) CHP site heat network. This therefore retains the provision of a site wide heat network and has the following other benefits:
- > Enables Phase 5 to achieve more onerous Part L requirements;
 - > Avoids installation of heat pumps on completed buildings (i.e. where DEN1 is located);
 - > Avoids any substantial increase to heat prices across the site.

- 6.9 Subject to the S106 agreement, the whole of Clarendon Gas Works may connect to a more extensive Heat Network via the DEN2 Box to be delivered by Haringey Council.

CO₂ Emissions Following *Be Clean* Measures

- 6.10 Table , below, outlines the total reduction in CO₂ emissions following connection to the Heat Network. The results show that for the **domestic areas** Policy 5.2 of the London Plan, over 35% improvement in carbon emissions (over the base case), have been achieved. Non-domestic areas are required to further reduce CO₂ emissions.

Table 10: Regulated CO₂ reductions showing improvements of *Be Clean* over *Be Lean* measures

Carbon dioxide emissions (TCO ₂ .a)			
	Domestic Regulated	Non-domestic Regulated	Total
Phase 4			
New Builds – Baseline	373	105	478
<i>After Be Lean</i>	356	100	456
<i>After Be Clean</i>	187	80	267
Development cumulative Total Reduction over <i>Base case</i>	50%	23%	44%
Phase 4 Total Reduction over <i>Be Lean</i> case			40%
Phase 5			
New Builds – Baseline	394	298	692
<i>After Be Lean</i>	376	284	660
<i>After Be Clean</i>	198	229	427
Development cumulative Total Reduction over <i>Base case</i>	45%	23%	38%
Phase 5 Total Reduction over <i>Be Lean</i> case			34%

- 6.11 Summary CO₂ emissions for the *Be Clean* case can be seen in Appendix G. *Be Clean* DER worksheets and SBEM BRUKLs can be seen in Appendix H and I respectively.

7. BE GREEN: RENEWABLE ENERGY TECHNOLOGIES

- 7.1 The final part of the London Plan Energy Hierarchy is **Be Green** which examines the feasibility of renewable energy technologies for Clarendon Gas Works.
- 7.2 In line with Policy 5.2, the domestic areas of the development has already achieved the required 35% reduction in carbon emissions following the stated hierarchy. Policy 5.7 highlights that renewable technologies should be considered as the third step of the energy hierarchy. As a result, renewable technologies are not required for the purposes of the energy strategy to meet policy.
- 7.3 No renewables (other than heat pumps for non-domestic areas) form part of the Outline Consent Energy Strategy.
- 7.4 This section does however provide details to demonstrates the feasibility of renewable energy technologies. For technologies to be feasible, they must be complementary for the CHP engine specified at '**Be Clean**' stage.

Biomass Boiler

- 7.5 Biomass boilers generate heat on a renewable basis as they are run on biomass fuel which can be considered virtually carbon neutral.
- 7.6 The 2016 London Plan's energy hierarchy considered CHP before any other technologies. Biomass boilers directly compete with CHP.

Heat Pumps

- 7.7 Air Source Heat Pumps (ASHP) are a more economical alternative to Ground Source Heat Pump (GSHP) as they do not require ground works. In the future heat pumps could be come a viable option for feeding low temperature heat into the heat network. However, the existing strategy and heat network is sufficient to meet the conditioned requirements.
- 7.8 For this development Heat Pumps will be more suited to non-domestic applications and have therefore been considered for the non-domestic areas.
- 7.9 To provide efficient cooling to non-domestic areas cooling equipment will be specified with high Energy Efficiency Ratios (EER) and Seasonal Energy Efficiency Ratios (SEER). These are considered in the '**Be Green**' section.
- 7.10 Given the commercial units are shell only; when they are fitted out by their subsequent owners, they may choose to install cooling. If this is the case, then it would be likely that they would utilise a

reversible heat pump solution that provides heating too. As a result, it is currently proposed that during fit out they would likely use a heat pumps with a **SEER of 6 and EER of 3.5**.

Wind Turbines

- 7.11** Urban rooftop wind turbines do not generally perform sufficiently to well to warrant their installation, due to the low and turbulent wind conditions present. They are therefore likely to remain technically unfeasible.
- 7.12** It has therefore been concluded that wind turbines are not a suitable technology for this site.

Solar Thermal Panels

- 7.13** Solar thermal panels generate heat for hot water.
- 7.14** The benefits of solar thermal panels are constrained by the seasonal variation in solar radiation. This means that solar thermal panels can only deliver a maximum of 60% of the annual hot water demand. This would still require all of the proposed conventional fuel heating infrastructure to be in place to meet times when DHW generation is not possible using this technology.
- 7.15** This technology would be in direct competition with the proposed CHP engine which supplies the hot water demand as a base load. It has therefore been concluded that solar thermal panels are not a suitable technology for this site.

Photovoltaic (PV) Panels

- 7.16** PV panels generate electricity from solar radiation. The generating potential of PV panels is not dependent on development demand, but on available roof space for installation and ensuring that they are not overshadowed.
- 7.17** As an electricity generating technology, PV panels generally operate during the day. This energy can be used on site, in the locality or sold back to the national grid. This means that the technology would directly offset the energy that would otherwise be drawn from the national grid.
- 7.18** However, it is not proposed to install any due to following of the energy hierarchy to maximise CO₂ reductions in the most appropriate manner. This reflects Policy 5.7 (B) of the London Plan which states provision of renewables is '*within the framework of the energy hierarchy*', which firmly requires energy efficiency ('**Be Lean**') and community heating ('**Be Clean**') measures to be prioritised.
- 7.19** In this instance, where the applicant has provided the DEN2 Box to the Council for their use in the Wood Green heat network, this Energy Strategy seeks to provide substantially more CO₂ reductions in the Local area at the '**Be Clean**' stage and in doing so, provide greater benefit than providing '**Be Green**' measures

- 7.20** In line with Condition 11, PV should not be required as it was not in the original energy statement (Oct 2017) strategy. In addition, given that the required CO₂ reductions required in line with Policy 5.2 have been achieved at the second stage of the energy hierarchy, application of this technology is not required to achieve a carbon reduction.

CO₂ Emissions Following *Be Green* Measures

- 7.21** It should be noted that the combination of *Be Lean* and *Be Clean* measures enable the development to meet the requirements of London Plan Policy 5.2. Table , below, demonstrates this.

Table 11: Regulated CO₂ reductions following Be Green measures over Be Lean and Clean measures

Carbon dioxide emissions (TCO ₂ .a)			
	Domestic Regulated	Non-domestic Regulated	Total
Phase 4			
New Builds – Baseline	373	105	478
After <i>Be Lean</i>	356	100	456
After <i>Be Clean</i>	187	80	267
After <i>Be Green</i>	187	59	189
Development cumulative Total Reduction over <i>Base case</i>	50%	44%	49%
Development Total Reduction over <i>Be Clean</i> case			9%
Phase 5			
New Builds – Baseline	394	298	692
After <i>Be Lean</i>	376	284	660
After <i>Be Clean</i>	198	229	427
After <i>Be Green</i>	198	168	365
Development cumulative Total Reduction over <i>Base case</i>	50%	44%	47%
Development Total Reduction over <i>Be Clean</i> case			17%

8. ZERO CARBON

- 8.1 In line with the Outline Consent and S106 Agreement, 'Zero Carbon' offset payments are not to be levied at the Clarendon Gas Works development. This is due to St. William's provision of the DEN2 Box to the Council in lieu of this.

9. SUMMARY

- 9.1 The purpose of this Energy Statement is to address Condition 11 and 53 of the hybrid planning consent (HGY/2017/3117) for Phases 4 & 5 of the Clarendon Gas Works development in the London Borough of Haringey.
- 9.2 Condition 53 requires an updated Energy Strategy to be submitted prior to any Reserved Matters applications. This Energy Statement will provide the updated energy strategy to clear Condition 11 and 53 and 11 of planning consent HGY/2017/3117 for Phases 4 & 5.
- 9.3 As per Condition 53 this energy strategy has been formulated following the London Plan (2016) Policy 5.2 and therefore the Energy Hierarchy: **Be Lean**, **Be Clean** and **Be Green**. The objective in the formulation of the strategy is to maximise the reductions in CO₂ emissions through the application of this Hierarchy with a cost-effective approach that is technically appropriate. In line with GLA Guidance this Energy Statement will demonstrate constancy with the Outline Consent and accompanying Energy Strategy; In addition to energy efficiency measures this provided for a gas CHP led heat network.
- 9.4 This Energy Statement considers a portion of the development within the Outline Consent; Phases 4 & 5. This is comprised of 682 new dwellings, and 7,762m² of new non-domestic developments. Phase 4 consists of 375 dwellings across Blocks H1-3 and 2,100m² of non-domestic area (Café and Office space). Phase 5, consisting of Blocks F1, G1, G2, J1, and J2 is anticipated to have 399 dwellings and 5,991m² non-domestic area (Café and Office space).
- 9.5 The development has been assessed under Approved Document Part L1A (2013) and Part L2A (2013) for continuity with the Outline consent target. Due to the likely Part L (2021) version to be registered to each Phase has also been shown to comply with the most recent version of SAP (10.2) methodology which is expected to ensure compliance with Approved Document Part L Volume 1 (2022). Publication of the adopted SAP 10 methodology with Part L (2022) approved amendments are yet to be properly integrated into current approved software. However, it is known that SAP 10.2 methodology will be broadly in line with the adopted SAP 10.

- 9.6** London Plan (2016) Policy 5.2 requires the equivalent of a reduction in Regulated CO₂ emissions by 35% beyond a determined 2013 baseline case on site. The Energy Statement consented under the 2017 hybrid application exceeds this 35% over Part L1A (2013) target.
- 9.7** A range of **Be Lean** energy efficiency measures are proposed for the dwellings. This is in line with the London Plan Energy Hierarchy. They enable the proposed elements to meet or exceed the baseline cases through energy efficiency alone.
- 9.8** In accordance with the Energy Hierarchy, the feasibility of decentralised energy production as a **Be Clean** measure has also been carefully examined. In line with the Outline Consent Phase 4 and 5 will connect into the consented site wide heat network, which has the plant room in existing Phases.
- 9.9** In accordance with the Energy Hierarchy, the relevant **Be Green** renewable energy generating technologies have been evaluated. Given that the required energy reduction has been provided through the use of a site wide heating network, no further technologies were required to be applied with the exception of Heat Pump use for the non-domestic elements. This aligns with the outline Consent.
- 9.10** The proposed design for the development will enable it to reduce its CO₂ emissions in line with the conditioned targets of the London Plan (2016) requirements (35%) over the overall Part L1A (2013) baseline case. This represents a high level of sustainable design.
- 9.11** The Tables below demonstrates the reduction in Regulated and Total CO₂ reductions after each stage of the Energy Hierarchy showing energy policy requirements have been achieved.

PHASE 4		
Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L1A 2013 Compliant Development	373	453
After Be Lean Measures	356	453
After Be Clean Measures	187	453
After Be Green Measures	187	453
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO₂ per Annum	Percentage
Savings from Be Lean Measures	17	5%
Savings from Be Clean Measures	169	45%
Savings from Be Green Measures	0	0%
Cumulative On-Site Savings	186	50%

PHASE 4 Non-Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 Compliant Development	105	93
After <i>Be Lean</i> Measures	100	93
After <i>Be Clean</i> Measures	80	93
After <i>Be Green</i> Measures	59	93
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	5	5%
Savings from <i>Be Clean</i> Measures	19	18%
Savings from <i>Be Green</i> Measures	22	21%
Cumulative On-Site Savings	46	44%

PHASE 4 Phase Wide Carbon Dioxide Emissions and Cumulative Savings			
	Regulated Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	Regulated Carbon Dioxide Savings	
		Tonnes CO ₂ per Annum	Percentage
Baseline: Part L 2013 Compliant Development	478	-	-
After <i>Be Lean</i> Measures	456	22	5%
After <i>Be Clean</i> Measures	267	189	40%
After <i>Be Green</i> Measures	245	22	9%
Cumulative On-Site Savings		232	49%

PHASE 5 Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L1A 2013 Compliant Development	394	484
After <i>Be Lean</i> Measures	376	484
After <i>Be Clean</i> Measures	198	484
After <i>Be Green</i> Measures	198	484
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	18	5%
Savings from <i>Be Clean</i> Measures	178	45%
Savings from <i>Be Green</i> Measures	0	0%
Cumulative On-Site Savings	196	50%

PHASE 5 Non-Domestic Carbon Dioxide Emissions and Savings after each stage of the Energy Hierarchy		
Stage	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 Compliant Development	298	267
After <i>Be Lean</i> Measures	284	267
After <i>Be Clean</i> Measures	229	267
After <i>Be Green</i> Measures	168	267
Stage	Regulated Carbon Dioxide Savings	
	Tonnes CO ₂ per Annum	Percentage
Savings from <i>Be Lean</i> Measures	14	5%
Savings from <i>Be Clean</i> Measures	55	18%
Savings from <i>Be Green</i> Measures	62	21%
Cumulative On-Site Savings	131	44%

PHASE 5			
Phase Wide Carbon Dioxide Emissions and Cumulative Savings			
	Regulated Carbon Dioxide Emissions (Tonnes CO₂ per Annum)	Regulated Carbon Dioxide Savings	
		Tonnes CO₂ per Annum	Percentage
Baseline: Part L 2013 Compliant Development	692	-	-
After <i>Be Lean</i> Measures	660	32	5%
After <i>Be Clean</i> Measures	427	233	34%
After <i>Be Green</i> Measures	365	62	17%
Cumulative On-Site Savings		327	47%

APPENDICES

Appendix A

Site Plan

Appendix B

Summary CO₂ Emissions Rates & FEE Scores – *Be Lean*

Appendix C

TER Worksheets

Appendix D

BRUKL Outputs – *Be Lean*

Appendix E

DER Worksheets – *Be Lean*

Appendix F

Indicative Heat Network Layout

Appendix G

Summary CO₂ Emissions Rates – *Be Clean*

Appendix H

DER Worksheets – *Be Clean*

Appendix I

BRUKL Outputs – *Be Clean*

Appendix J

Low Carbon and Renewable Energy Technologies Summary

Appendix K

Summary CO₂ Emissions Rates – *Be Green*

Appendix L

BRUKL Outputs – *Be Green*