

Kensington Forum

QUEENSGATE
INVESTMENTS

Rockwell

Kensington Forum Hotel – London

ENERGY STRATEGY | JUNE 2018



KENSINGTON FORUM

Cromwell Road
SW7 4DN

ENERGY STATEMENT

For Planning

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1. Introduction

- 1.1 PSH have been appointed by Rockwell to undertake an Energy Efficiency Statement to accompany a planning application for the proposed multi use residential and Hotel scheme at Cromwell Road, Kensington, London, SW7 4DN
- 1.2 The scheme proposed consists of the demolition of the existing Hotel and the construction of a 749 bed hotel, 350 serviced apartments and 48 residential units. The scheme spans from Basement 2 to level 29 and has a GIA of 76,708 sq m
- 1.3 The scheme is subject to Kensington & Chelsea's Local Consolidated Local Plan Strategic Policies July 2015. Policy CE1 states:
 - a) New Residential developments should be Code Level 4 and none residential schemes should meet BREEAM Very good with 60% of unweighted credits available in energy.
 - b) Refurbishments meet BREEAM Excellent (Residential) and BREEAM Very Good (Non Residential)
 - c) Carbon emissions are reduced in accordance with the energy hierarchy, that being to consider energy efficient design and passive solutions first, secondly to consider decentralized heating, cooling and energy supplies are considered (CHP/ CCHP) and thirdly, to consider on site renewable and low carbon energy sources are considered.
 - d) To provide CHP or CCHP of a suitable size to service the development and contribute to local district heat and energy network.
 - e) Require all CHP or CCHP plant to connect to or be able to connect to other existing or planned CCHP plant or similar from a district heat network
 - f) Require development to connect into existing district heat network where accessible
 - g) Incorporate measures that will contribute to on site sustainable food production
 - h) Require the development to further reduce carbon dioxide emissions through financial contributions.
- 1.4 As a "major" application the scheme should meet London Plan Policy 5.2 to 5.9, which requires the scheme to achieve a 35% carbon reduction for both domestic and non-domestic aspects of the scheme.
- 1.5 This energy statement is set out as per the requirements of a full 'London Plan Energy Statement' report using the required format as set out in the GLA guidance. It sets out how the proposed Kensington Forum scheme meets the requirements of the

- London Plan Policy 5.2
- Provides provision to meet policy CE1 (decentralized heat and energy networks)
- Incorporate on site renewable energy generation

It will also summarise the results of the BREEAM assessor with respect to the BREEAM energy requirement and make reference to the BREEAM Assessors report.

- 1.6 London Plan Policy 5.2B sets a 'zero carbon' target for residential developments. This requires the remaining carbon emissions (after 35% reduction set out in 1.4 above) to be offset through a cash in lieu contribution to the relevant borough. As such, site carbon emissions are calculated in Tonnes per annum and are shown in table 2. It is assumed that this meets CE1 requirement h, listed above
- 1.7 Appendix A-L sets out all of the SAP and SBEM calculations

2. Executive summary

- 2.1 This document forms the Energy Statement for the Kensington Forum scheme and is written in the structure and format required by the London Plan document 'GLA guidance on preparing energy statements'. The policy sets a carbon reduction target of at least 35% beyond Part L 2013 for on-site regulated emissions.
- 2.2 To assess the level of emissions, SAP and SBEM calculations have been carried out on a representative sample of residential units using the Elmhurst Design SAP 2012 (4.03 r08) and IESVE 2017 compliance software to gain the regulated emissions. A licensed and OCDEA accredited SAP Assessor and Level 5 Energy Assessor has carried out the calculations.
- 2.3 The design process and energy assessment has determined the following key measures and CO2 reductions for each stage of the energy hierarchy:

BE LEAN – Demand Reduction

High efficiency fabric including:

- Triple Glazing Yielding a U value of 1.2 or better
- Wall U value of 0.15
- Roof U value of 0.15
- Floor U value of 0.15
- All thermal bridges designed to accredited construction details
- Air permeability of 3

Considered design to adapt to climate change and reduce the requirement for cooling, including:

- Very little south facing glazing, thus reducing daytime solar gains
- West Facing apartments have glazed facades orientated to the North West to minimize peak afternoon solar gains
- Balconies and other external façade treatments offering substantial solar shade
- Fully opening balcony doors to help reduce the risk of overheating
- Inclusion of Blinds to reduce solar gains.

BE CLEAN – Supply Energy Efficiently:

Considered design of the services to generate heat and power on site and retain energy, including:

- A community Heating network is proposed utilizing high efficiency gas condensing boilers in conjunction with a CHP unit. The system has been designed to deliver 65% of the estimated annual space heating and domestic hot water requirement.
- proposed community heating network provides opportunity to connect

into a district heating system should one become available in the future.

- High efficiency Mechanical Ventilation with Heat Recovery and summer time bypass to the residential units.
- Decentralized Ventilation for the hotel and residential units to increase diversity and eliminate unnecessary distribution loss's
- High Efficiency Chillers
- Low Energy Lighting with efficiency of 85 luminair lumens per CW or better.
- Daylight linking where practical
- Occupancy linked light control where practical

BE GREEN – On Site Energy Generation

The proposed CHP system generates on site electricity more efficiently than centralized power stations. The principle reason being that the heat, which is usually wasted by power stations, can be used on site. In this case, for domestic hot water and space heating. The contribution from CHP is outlined above in the 'Be clean' scenario

Further electricity will be generated on site via solar Panels. A solar PV array is proposed to generate circa 55,000 kWh per annum, connected to the landlords supply. 15,000 kWh of which is apportioned to the apartments (circa 300kWh per apartment per annum), reducing residential emissions by a further 14%. The remaining 40,000 kWh per annum generated is apportioned to the hotel, which reduces hotel emissions by a further 1%

2.4 The residential carbon reduction at each step of the energy hierarchy is demonstrated in tables 1 and 2 below

	CO ₂ Emissions - (Tonnes per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 (TER)	62	2
Proposed Development (DER)	55	2
After Decentralised & CHP Feasibility	37	2
After Renewable Energy	29	2

Table 1: Residential - carbon dioxide emissions after each stage of the energy hierarchy

	CO ₂ Emissions - (Tonnes per Annum)	
	(Tonnes CO ₂ per Annum)	%
Savings From Demand Reduction	7	
Savings from CHP/ Heat network	18	11
Savings from Renewables	8	40
Cumulative on site savings	33	54
Annual Savings from off-set payment	29	

Table 2: Residential - regulated carbon dioxide savings from each stage of the energy hierarchy

- 2.5 The non domestic carbon reduction at each step of the energy hierarchy is demonstrated in tables 1 and 2 below

	CO ₂ Emissions - (Tonnes per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 (TER)	4348	2691
Proposed Development (DER)	3912	2691
After Decentralised & CHP Feasibility	2632	2691
After Renewable Energy	2625	2691

Table 3: Carbon dioxide emissions after each stage of the energy hierarchy for non domestic buildings

	CO ₂ Emissions - (Tonnes per Annum)	
	(Tonnes CO ₂ per Annum)	%
Savings From Demand Reduction	437	10
Savings from CHP/ Heat network	1279	29
Savings from Renewables	8	1
Cumulative on site savings	1724	40
Annual Savings from off-set payment	n/a	n/a

Table 4: regulated carbon dioxide savings from each stage of the energy hierarchy for non domestic buildings

- 2.6 The Site Wide regulated carbon dioxide emissions and savings are set out in the following table 5 and 6.

	CO ₂ Emissions - (Tonnes per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 (TER)	4410	2693
Proposed Development (DER)	3967	2693
After Decentralised & CHP Feasibility	2669	2693
After Renewable Energy	2653	2693

Table 5: Site wide carbon dioxide emissions after each stage of the energy hierarchy

	CO ₂ Emissions - (Tonnes per Annum)	
	(Tonnes CO ₂ per Annum)	%
Savings From Demand Reduction	443	10
Savings from CHP/ Heat network	1298	29
Savings from Renewables	16	1
Cumulative on site savings	1757	40
Annual Savings from off-set payment	29	

Table 6: Site wide regulated carbon dioxide emissions and savings

- 2.7 The 'clean' scheme results in 9 credits being achieved under BREEAM issue Ene 01: Reduction of energy use and carbon emissions. (please refer to BREEAM assessment report by XCO2

3. London plan methodology

- 3.0 The methodology for calculating regulated and unregulated carbon emission improvements for the development has been detailed within the London Plan.
- 3.1 A Baseline energy assessment sets the emission level by which improvements are measured. The baseline emission rate is the regulated CO2 emissions assuming the development complies with Part L 2013 of the building regulations. This is calculated using SAP 2012 (the Standard Assessment Procedure) for the residential dwellings and SBEM for non domestic schemes. This gives the estimated site wide carbon emissions from Regulated energy. An estimation of the carbon emissions from unregulated energy use will also be included.
- 3.2 The same buildings will then be benchmarked/ thermally modelled with the inclusion of the energy hierarchy:
- Be Lean Demand Reduction
 - Be Clean Heating Infrastructure including CHP
 - Be Green Renewable Energy
- 3.3 At each stage a percentage reduction in carbon emissions can be estimated and compared to the baseline to ensure the planning policy targets are achieved.
- 3.4 The development must be provided with energy savings through the use of thermal improvements to fabric (a 'fabric first' approach), followed by other clean energy solutions (energy efficiency improvements, consideration of district heating etc) and finally the use of renewable energy technologies, where practical. This hierarchy complements the integrated approach to the sustainable energy objectives of the London Plan and Kensington & Chelsea Council and reflects the aspirations of the regional and national policies.
- 3.5 Sections 4 to 7 of this report set out the carbon emissions associated with the baseline, lean, clean and green scenarios
- 3.6 The development must also provide a response to the requirement to adapt to climate change with respect to thermal comfort and mitigation of the potential increase in the requirement to provide cooling. This is discussed in the 'lean' scenario, section 5, from 5.9 onwards.

4. Baseline energy assessment

- 4.1 The baseline energy calculation is based upon the dynamic thermal model of the hotel and landlord areas (using IESVE compliance software), and a representative SAP model of the residential units using Elmhurst software. The whole of the hotel and landlord circulation has been modelled and in respect of the residential units, one of each apartment type (each type has a unique area, heat loss perimeter, façade treatment and orientation) has been assessed and multiplied as required to represent the total 49 apartments. In total, 20 apartments types were identified and modelled.
- 4.2 In line with the London Plan energy assessment guidance document, the baseline energy assessment is calculated on the basis that the scheme is heated by a similar gas fired LTHW system to that proposed.
- 4.3 Based upon the figures as set out in the SAP and SBEM assessments, the development has a baseline (Part L 2013 TER) regulated production of 4410 tonnes CO₂/year.

	CO ₂ Emissions - (Tonnes per Annum)	
	Regulated	Reduction (%)
Baseline: Part L 2013 (TER)	4410	
LEAN		
CLEAN		
GREEN		

Table 7: Site wide Baseline Carbon Dioxide Emissions

5. Be Lean – Demand reduction

- 5.1 Construction Details have been selected to ensure that all fabric U-values exceed the requirements of Part L of the Building Regulations (2013) by more than 50% in some instances. The proposed construction details for the residential element and envelope are as follow:

Elements	U Value/ Service Detail	Further Information / Comment
External Walls	0.16 w/m2/k	0.16 W/m2K to the Landlord and Hotel
Party Walls Between Dwellings and from dwelling to common areas	0.0 w/m2/k	Party walls to be fully filled with insulation and sealed in-line with MIMA guidance. Adjacent common areas assumed to be heated for the purposes of SAP
Roof	0.15 w/m2/k	
Windows	1.2 w/m2/k residential 1.6 w/m2/k Hotel	Shading coefficient between 0.3 and 0.6 depending on location
Doors	1.6 w/m2/k	
Air permeability	3m³/hm²@50Pa 3m³/hm²@50Pa	Apartments - all plots to be air tested Hotel
Ventilation	System 1 – WHMV with HR System 2 – AHU with HR	Apartments and hotel rooms (SFP = 0.2 W/l/s, HR = 75%) Hotel communal spaces (SFP = 1.6 W/l/s, HR = 75%)
Heating plant	Fuel: Gas Fired Central Plant	LTHW fan coil units (SFP = 0.6 W/l/s) and heat interface units to apartments
Cooling plant	High efficiency chillers	Chilled water to fan coil units
Controls	Programmer and appliance thermostat	Time and Temperature Zone Control
DHW	Central Plant via gas fired boilers	Heat Interface Units to apartments
Thermal Bridging	ACDs	Accredited Construction Details to be achieved throughout
Low Energy Lighting	100% to apartments	LED Lighting throughout
Lighting	>85 luminaire lumens per cW to Hotel	PIR and Daylight linking where practical

- 5.2 The scheme has excellent Daylight levels throughout, benefitting from twin aspect glazing and are supplemented with low energy light bulbs.
- 5.3 West facing elevations have a 'saw tooth' arrangement which angle the façade to the North West. This orientation of the windows reduces peak solar gain while ensuring optimum levels of daylight.
- 5.4 The proposed air permeability is a 70% improvement over building regulations.
- 5.5 The proposed building services are all high efficiency.
- 5.6 The proposed lighting efficiency for the purpose of this analysis is high efficiency at 85 luminar lumens per circuit Watt. However, it is likely that the final design efficiency could exceed 100 Imnr Imns / cW

- 5.7 The emissions of improve upon the Part L 2013 Baseline TER emission rate by 10% which equates to 443 tonnes CO₂/year.

	CO ₂ Emissions - (Tonnes per Annum)	
	Regulated	Reduction (%)
Baseline: Part L 2013 (TER)	4410	
LEAN	3967	10
CLEAN		
GREEN		

Table 8: Site wide Baseline Carbon Dioxide Emissions

- 5.8 The LEAN energy assessment carbon emissions are 443 Tonnes CO₂/yr.

ADAPTION TO CLIMATE CHANGE

- 5.9 The Development has been designed to adapt to these potential changes in climate, in line with the cooling hierarchy with respect to overheating and cooling.
- 5.10 The accredited energy calculations (SAP) carried out on a selection of dwelling types confirm that the dwellings do not have a propensity to overheat in line with ADL1A 2013 criteria 3 – “Limiting the effects of solar gains in summer”. Similarly, the criteria 3 table on the BRUKL documents indicates that 99% of rooms are well within the solar gains check, following a dynamic simulation using IESVE2017.
- 5.11 To minimize the risk of overheating, the following measures have been incorporated into the design and specification:
- Very little south facing glazing on the apartments reduce daytime solar gains
 - West Facing apartments have glazed facades orientated to the North West to minimize peak afternoon solar gains
 - Balconies and other external façade treatments offering substantial solar shade
 - Fully opening balcony doors to help reduce the risk of overheating
 - Inclusion of light colored roller blinds or similar to reduce solar gains
 - South Facing hotel rooms have a G value of 0.3 or better
- 5.12 It can be seen in the BRUKL output document (fig 1.0 Below) that the ‘actual’ base line design has a cooling demand that is lower than the notional building.

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Fan coil systems, [H] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	22.9	39.1	8.2	2.5	21.3	0.77	4.39	0.97	5.46
Notional	37.9	50.8	12.2	3.7	29.1	0.86	3.79	----	----

Energy Consumption by End Use [kWh/m ²]		
	Actual	Notional
Heating	4.95	7.41
Cooling	5.07	5.19

Figure 1.0 Actual v's Notional (Target) cooling demand and Energy Consumption

6. Be Clean Supply energy efficiently

- 6.1 The GLA's energy policy reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.
- 6.2 One of GLA's top priorities for reducing London's CO2 emissions is to reduce the capital's reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de- centralised energy systems.
- 6.3 Decentralised plant generally means any heating and hot water and/or electricity generation provided on a site or district wide basis. District heating is generally provided from Combined Heat and Power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.
- 6.4 The Kensington & Chelsea Policy CE1 requires that new schemes provide CHP or CCHP of a suitable size to service the development and contribute to local district heat and energy network.
- 6.5 The policy requires applications for major developments in areas where future network opportunities are identified, development proposals should be designed to connect to these networks.
- 6.6 The London Heat Map does not indicate any existing District Heat networks in the SW7 4DN Area or indeed within a 1 mile radius of the scheme (see fig 1.2 below).

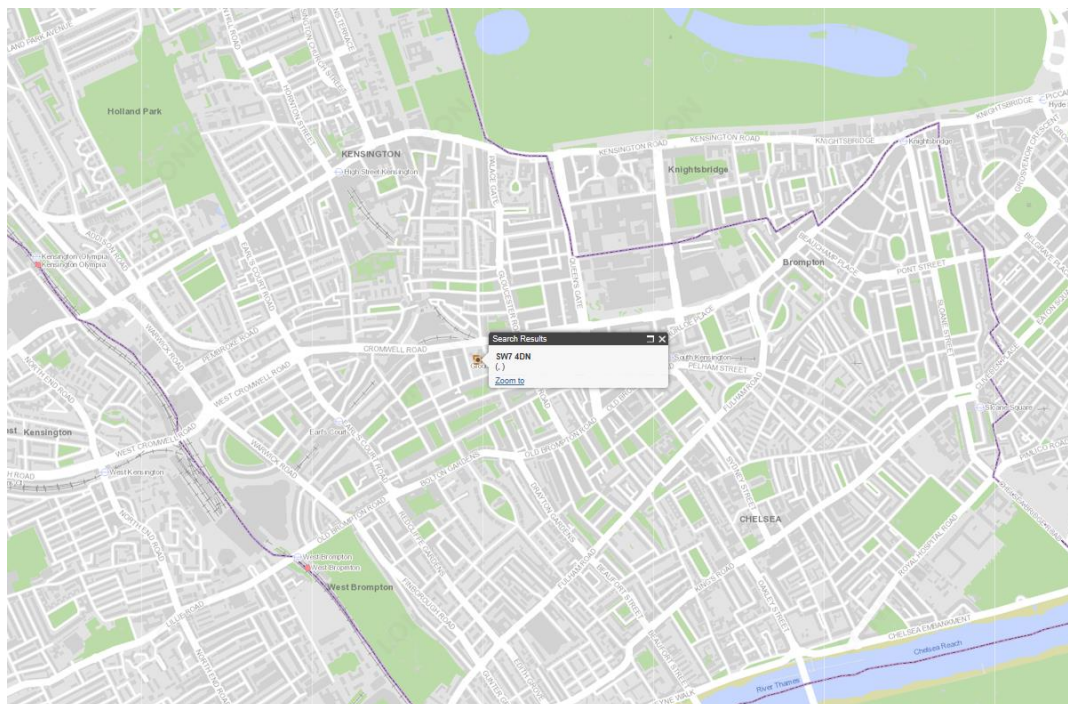


Fig 1.2 – London Heat Map 1 miles of SW7 4DN

- 6.7 The diagram below is the current heat map and analysis existing district heating networks in the SW7 4DN area. The Kensington Forum development is located over 2 miles from the 'Pimlico District Heating Undertaking' (PDHU) in Pimlico, south of Victoria Station and adjacent to the river Thames as indicated by the yellow lines in the blue box below. Due to the infrastructure required to meet this scheme and the practical heat loss incurred over such a large distance, it is not deemed practicable to connect to such a scheme.

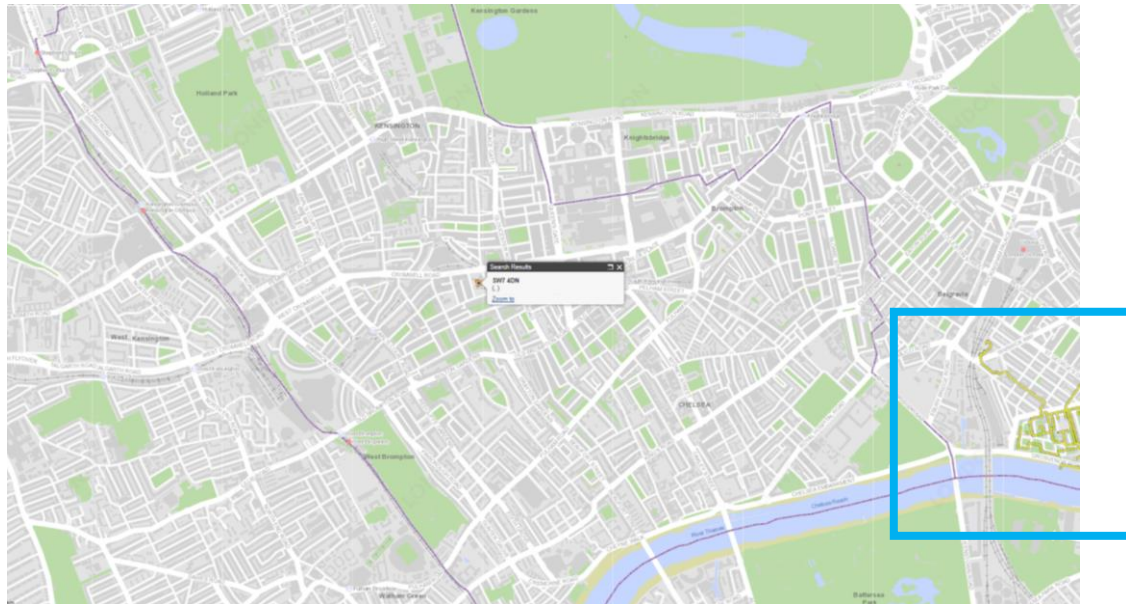


Fig 1.3 – London Heat Map 3 miles of SW7 4DN

- 6.8 The London Heat Map does not indicate that there are any **potential** heat networks available within the vicinity. However, it does indicate that location of the scheme is within an area of 'Decentralised Energy Potential', as indicated by the map below:

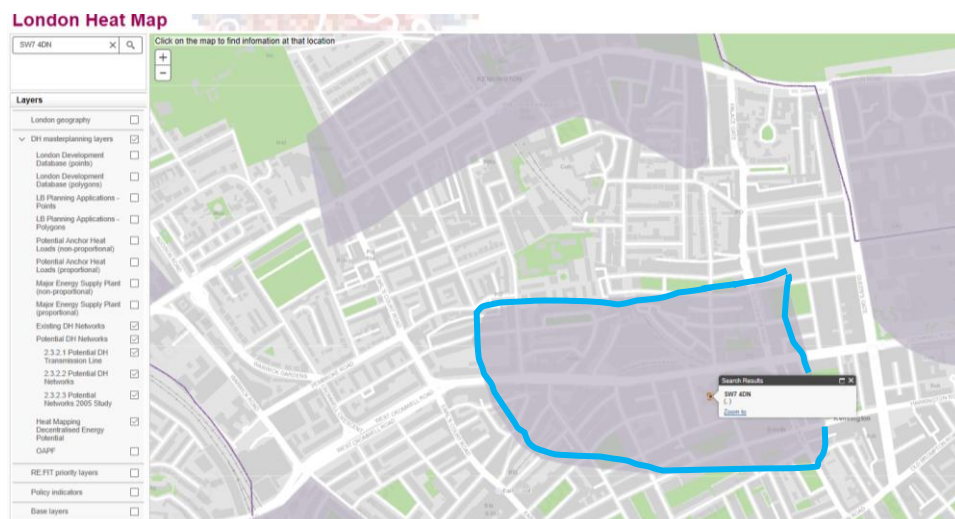


Fig 1.4 – London Heat Map 1/2 mile of SW7 4DN

- 6.9 Due to the lack of local district heating schemes or proposed district heating schemes in the immediate vicinity, it is not proposed to connect the scheme to any district heat networks at this time.

- 6.10 However, it is proposed to have a localized community heating system served by a high efficiency centralized boiler system and CHP unit to serve space heating and domestic hot Water to the dwellings and Hotel.
- 6.11 The proposed decentralized strategy would enable the scheme to be connected to any future district heating networks as and when they become available.
- 6.12 It is proposed to use a high efficiency CHP unit and sufficient thermal store to generate up to 65% of the annual heating and DHW requirement for the residential scheme. The proposed CHP efficiency is 55% heat and 35% electrical efficiency.
- 6.13 Current proposals are for an Ene-G E230 CHP unit as the lead boiler followed in series by Hamworthy Wessex Modumax Mk3 boilers.
- 6.14 The CLEAN energy assessment carbon emissions are 1298 Tonnes CO2/yr.

	CO ₂ Emissions - (Tonnes per Annum)	
	Regulated	Reduction (%)
Baseline: Part L 2013 (TER)	4410	
LEAN	3967	10
CLEAN	2669	39
GREEN		

Table 9: Site wide Baseline Carbon Dioxide Emissions

7. Be Green – Feasibility of renewable energy

- 7.1 A review of low and zero carbon energy generation technology has been carried out for the scheme. Section 6 considered the suitability of district heating and a local heat network incorporating on site CHP. As such, this section will not consider CHP.
- 7.2 **PV panels** are feasible for this project. The limiting factor will be the available space on the roof. However, the roofs are flat and thus provide an ideal opportunity to locate PV panels at a favorable orientation and gradient.
- 7.3 **Solar Thermal Collectors** are also feasible for the development. However, the yield of renewable energy in terms of Carbon Reduction is less than PV can provide for the same available roof space. Further, a domestic hot water cylinder would be required which would increase the space requirement and lead to standing losses which would offset some of the benefits of the solar thermal panels. The DHW provision as proposed is a central plant scheme with CHP which is one of the most efficient methods of providing domestic hot water. Solar thermal can impact negatively on the efficient running of CHP units. For these reasons, solar thermal panels are not proposed to maximize the potential of PV.
- 7.4 **Wind power** is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power. Most small wind turbines generate Direct Current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity. There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of houses
- Mast mounted – Which are free standing

Important issues to consider when using wind turbines are:

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.

Generally speaking the ideal site is a smooth hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, houses or other buildings. Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical where the local annual average wind speed is 6 m/s or more where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence

As this development is in an urban area there will be obstacles which reduce wind speed. The average wind speed in this area is 2.3 m/s which is much less than the 6 m/s required. Therefore, micro wind is not a viable technology for this development.

7.5 **Biomass** is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets
- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in communal heating systems. Centralised gas boilers are therefore still required to support the biomass boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.

Air quality issues are also an important factor when looking to install biomass.

The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation. The cost of wood pellets is currently a little more expensive than mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up.

Biomass CHP is still relatively new to the UK market and is more suitable to large developments where energy demand does not require significant modulation. There are technical issues with small scale Biomass CHP and until these can be resolved and proven the take up of these systems in the UK and Europe has been slow.

Overall carbon savings of 40%+ are achievable with biomass technology.

Biomass is more suited to a communal heating system, there is insufficient space to accommodate the equipment and fuel storage to facilitate a biomass boiler. Furthermore, there are noise and air quality issues associated with this type of technology. For this reason biomass is discounted.

7.6 **Be Green proposal**

It is proposed that the most effective LZC technology for the scheme, to complement the proposed community heating proposal is a substantial array of Photovoltaic panels.

7.7 The large proportion of the roof will be covered in PV panels and it is estimated that circa 55,000 kWh can be generated. 15 kWh has been apportioned to apartments (300kWh per annum per apt) and the remaining 40,000 kWh to the hotel.

7.8 The PV array provides a carbon reduction of 14% for the residential units and 1% for the scheme as a whole.

7.9 The GREEN energy assessment carbon emissions are 2653 Tonnes CO2/yr.

	CO2 Emissions - (Tonnes per Annum)	
	Regulated	Reduction (%)
Baseline: Part L 2013 (TER)	4410	
LEAN	3967	10
CLEAN	2669	39
GREEN	2653	40

Table 10: Site wide Baseline Carbon Dioxide Emissions

8. Conclusion

- 8.1 In line with The London Plan (2014) and Kensington & Chelsea Local Policies, this Energy Statement has been written and produced to set out the energy efficiency and renewables energy strategy for the proposed development and to illustrate savings in terms of CO₂ emissions.
- 8.2 The scheme benefits from building fabric efficiencies that improve on the Energy efficiency Standards set out in the building regulations.
- 8.3 High efficiency fabric, community heating with CHP and Photo Voltaic Panels are proposed to exceed the required reduction in regulated CO₂ emissions of 35% and actually reduce emissions by an estimated 38.5%
- 8.4 The baseline emissions for the development have been assessed in accordance with Part L 2013 of the Building Regulations for the emissions at 4410 tonnes CO₂/year.
- 8.5 Taking into proposed construction details and U-Values to all thermal elements, high levels of energy efficient lighting and a low air permeability rating, the CO₂ savings from energy efficiency measures equate to an 10% decrease in CO₂ emissions over the Part L 2013 baseline, or 443 tonnes CO₂/year
- 8.6 Through efficient heating and DHW delivery and the use of CHP, the measures equate to a further 29% decrease in CO₂ emissions over the Part L 2013 baseline, or 1298 tonnes CO₂/year
- 8.7 Through on-site technologies (PV) a reduction of 16 tonnes CO₂/year has been achieved. This is a further reduction of 1% off the total baseline.
- 8.8 Total carbon reduction is 1757 Tonnes CO₂ per annum or 40%.
- 8.9 The residential carbon reduction at each step of the energy hierarchy is demonstrated in tables 1 and 2 below

	CO ₂ Emissions - (Tonnes per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 (TER)	62	2
Proposed Development (DER)	55	2
After Decentralised & CHP Feasibility	37	2
After Renewable Energy	29	2

Table 11: Residential - carbon dioxide emissions after each stage of the energy hierarchy

	CO ₂ Emissions - (Tonnes per Annum)	
	(Tonnes CO ₂ per Annum)	%
Savings From Demand Reduction	7	
Savings from CHP/ Heat network	18	11
Savings from Renewables	8	40
Cumulative on site savings	33	54
Annual Savings from off-set payment	29	

Table 12: Residential - regulated carbon dioxide savings from each stage of the energy hierarchy

- 8.10 The non domestic carbon reduction at each step of the energy hierarchy is demonstrated in tables 1 and 2 below

	CO ₂ Emissions - (Tonnes per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 (TER)	4348	2691
Proposed Development (DER)	3912	2691
After Decentralised & CHP Feasibility	2632	2691
After Renewable Energy	2625	2691

Table 13: Carbon dioxide emissions after each stage of the energy hierarchy for non domestic buildings

	CO ₂ Emissions - (Tonnes per Annum)	
	(Tonnes CO ₂ per Annum)	%
Savings From Demand Reduction	437	10
Savings from CHP/ Heat network	1279	29
Savings from Renewables	8	1
Cumulative on site savings	1724	40
Annual Savings from off-set payment	n/a	n/a

Table 14: regulated carbon dioxide savings from each stage of the energy hierarchy for non domestic buildings

- 8.11 The Site Wide regulated carbon dioxide emissions and savings are set out in the following table 5 and 6.

	CO ₂ Emissions - (Tonnes per Annum)	
	Regulated	Unregulated
Baseline: Part L 2013 (TER)	4410	2693
Proposed Development (DER)	3967	2693
After Decentralised & CHP Feasibility	2669	2693
After Renewable Energy	2653	2693

Table 15: Site wide carbon dioxide emissions after each stage of the energy hierarchy

	CO ₂ Emissions - (Tonnes per Annum)	
	(Tonnes CO ₂ per Annum)	%
Savings From Demand Reduction	443	10
Savings from CHP/ Heat network	1298	29
Savings from Renewables	16	1
Cumulative on site savings	1757	40
Annual Savings from off-set payment	29	

Table 16: Site wide regulated carbon dioxide emissions and savings

- 8.12 The 'clean' scheme results in 9 credits being achieved under BREEAM issue Ene 01: Reduction of energy use and carbon emissions. (please refer to BREEAM assessment report by XCO2

Appendix A SAP block compliance – Be lean

Appendix B SAP block compliance – Be clean

Appendix C SAP block compliance – Be green

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