HOARE LEA

Richmond Royal Hospital.
London.
UKI Richmond Ltd.

SUSTAINABILITY
ENERGY STRATEGY

REVISION D – 22 NOVEMBER 2018

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
A	01/08/2018	Draft revision for team comments	S. Carlsson	A. Duckworth	A. Duckworth
B	17/08/2018	Draft revision, based on updated drawings, for team comments	S. Carlsson	A. Duckworth	A. Duckworth
C	31/08/2018	Updated for planning	S. Carlsson	A. Duckworth	A. Duckworth
D	22/11/2018	Updated for planning	S. Carlsson	A. Duckworth	A. Duckworth

Project number: 23/23114
Document reference: REP-2323114-5A-SC-20180725-Energy_Strategy-Rev D

Contents.

1. Executive Summary

The Application
This Energy Strategy has been prepared by Hoare Lea on behalf of UKI Richmond Ltd ('the Applicant') in support of the planning permission and listed building consent for the applications for the conversion ('the Proposed Development') of the Richmond Royal Hospital within the London Borough of Richmond Upon Thames ('LBR').

Richmond Royal Hospital is located within the Kew Foot Road Conservation Area 36. It is bounded by Kew Foot Road to the west, Shaftesbury Road to the south and Evelyn Road to the north.

The proposed development will see refurbishment of the building fabric on the existing floors and improvements to the windows. The Proposed Development will provide homes (including affordable homes) and a healthcare facility.

Policies & Drivers
This document summarises the pertinent policies and requirements applicable to the Proposed Development. Of these, the principal target is to achieve 'zero carbon' for the new build residential aspects, corresponding to a 100% reduction in regulated CO_2 emissions beyond the requirements of the Building Regulations Part L (2013), as set out in the London Plan (2016) and set out in the LBR Local Plan (2018). The change of use aspects (healthcare to residential) are required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible).

Approach
A sample of dwellings of the Proposed Development have been assessed using Part L1A 2013 approved SAP v9.92 (2012) methodology for the new builds, and the change of use to residential elements have been assessed using Reduced Data SAP v9.92 (2012). Non-residential spaces have been modelled using Part L compliant software to present the existing building ('Existing baseline') and improvement in carbon terms of the refurbishment. This has provided the basis for the analysis of the designed building and services and the consideration of all applicable passive design, energy efficiency and Low or Zero Carbon (LZC) technologies.

The assessment makes use of the Mayor of London's Energy Hierarchy and the cooling hierarchy from the London Plan (2016).

1.1 Be Lean – Passive Design & Energy Efficient Measures
Passive design measures to be implemented at the Proposed Development include:

- Where feasible, efficient new building fabric (floor and roof) minimising heat losses and heat gains
- Optimise glazing performance and rationalise to ensure good daylight to the space whilst minimising risks of high internal gain.
- Efficient space heating systems with zonal, programmable and thermostatic controls, with separate programmer for hot water.
- Efficient low-energy lighting throughout all dwellings. External and communal lighting will be coupled to daylight and presence detection sensors to minimise unnecessary use.
- Efficient mechanical ventilation with heat recovery which will limit the need for space heating in winter months, aid the mitigation of high internal temperatures in summer months (where openable windows cannot be used due to ambient acoustic conditions), and maintain good indoor air quality.
- Appropriately insulated pipework and ductwork (and air sealing to ductwork) to minimise losses and gains.
- Variable speed pumps and fans to minimise energy consumption for distribution of services

1.2 Be Clean – Infrastructure & Low-Carbon Supply of Energy
The "Be Clean" stage encourages developments to supply energy as cleanly as possible. An assessment of the energy networks in the area has been undertaken but has shown there are no networks in close vicinity to the Proposed Development. The approach taken is to propose an onsite CHP unit capable of providing 60% of the dwelling thermal load.

1.3 Be Green – On-site Renewable Energy Generation
The inclusion of on-site renewable energy generation has been assessed. Given the location of the development in a conservation area and including a listed building, roof mounted renewables (photovoltaics, solar thermal and wind turbine) are not considered to be suitable for the site.

The healthcare unit is being developed as shell & core. It is anticipated to require cooling which would be designed and installed as part of the shell fit out. The modelling results and analysis presented in this report assume a typical cooling system appropriate for the scale of development.

1.4 Overall Carbon Dioxide Emissions Reduction
The development, as proposed, will deliver buildings which are significantly more energy efficient than at present, resulting in a reduction in energy and carbon consumed by the site. It will target improvements over what is required by the Building Regulations.

Given the refurbished and new build nature of the Proposed Development, the CO_2 emissions reductions are presented separately, as outlined in section 9 of the GLA guidance on preparing energy assessments. Table 1 summarises the performance of the refurbishment dwellings (change of use) and Table 2 outlines the performance of the refurbished healthcare elements. Note the listed building (Building C) is exempt from CO_2 emissions reductions.

1.5 Change of Use (Dwellings)

Refurbished Dwellings	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Existing Baseline	209	-
Reduction from Be Lean	105	50.4%
Reduction from Be Clean	32	15.5%
Reduction from Be Green	-	-
Total Reduction	137	66.9%

Table 1: Refurbished Dwellings Improvements from existing baseline.

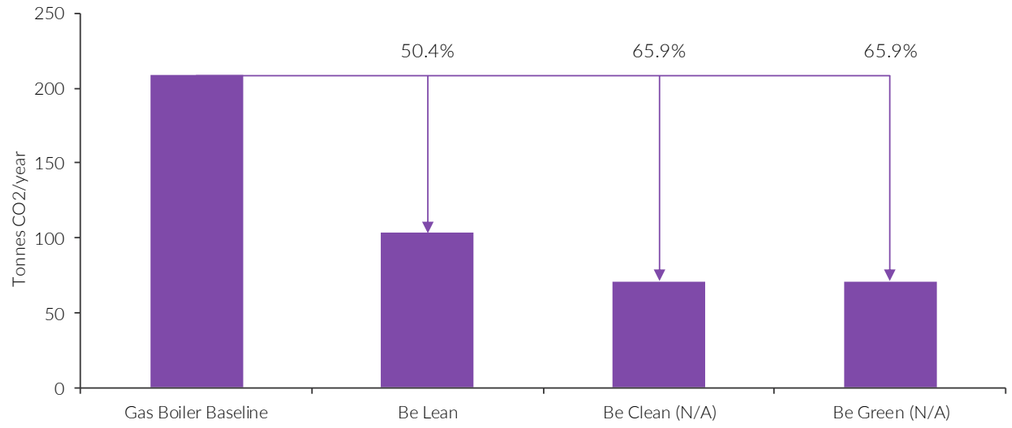


Figure 1: Change of Use to Dwellings regulated carbon emissions saving from existing buildings.

1.6 Refurbished Healthcare

Refurbished Healthcare	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Existing Baseline	28	-
Reduction from Be Lean	22	20.1%
Reduction from Be Clean	22	-
Reduction from Be Green	17	40.0%
Total Reduction	11	65.2%

Table 2: Refurbished Healthcare Improvements from existing baseline.

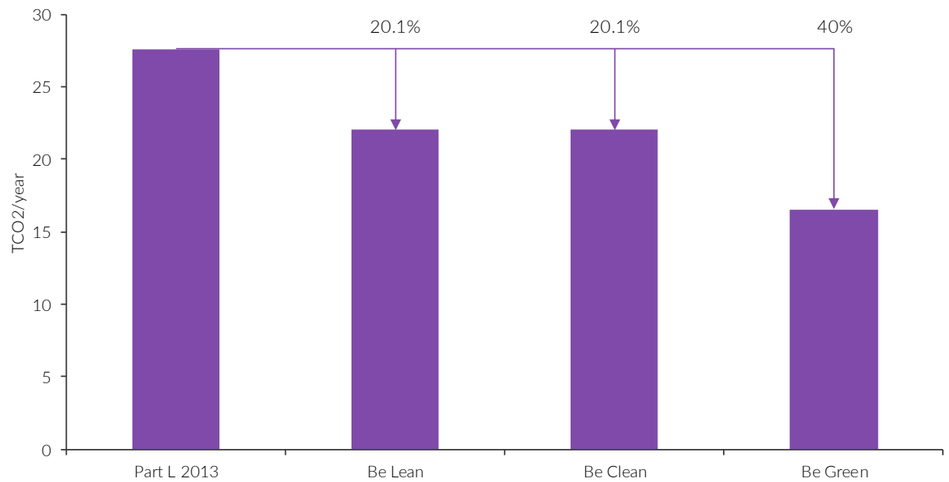


Figure 2: Refurbished Healthcare regulated carbon emissions saving from existing building.

1.7 New Build Dwellings

Table 3 outlines the anticipated CO_2 emissions reductions and carbon offset payment. The new build elements fall short of the on-site renewable target of 35% reduction in CO_2 emissions. The combined on-site and zero carbon target shortfall is used to calculate a total carbon offset payment of £37,000.

New Build Dwellings	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Baseline: Part L 2013 Building Regulations	30	-
Reduction from Be Lean	3	8.7%
Reduction from Be Clean	7	23.6%
Reduction from Be Green	-	-
Total Reduction	10	32.3%
Total Target Reduction	30	100%
Annual Surplus / Shortfall	-21	67.5%
Dwellings offset Payment Rate (£/tCO_2)	£1,800	
Total Offset Payment	£37,000	

Table 3: New Build Dwellings Summary of regulated carbon emissions saving and carbon offset payment.

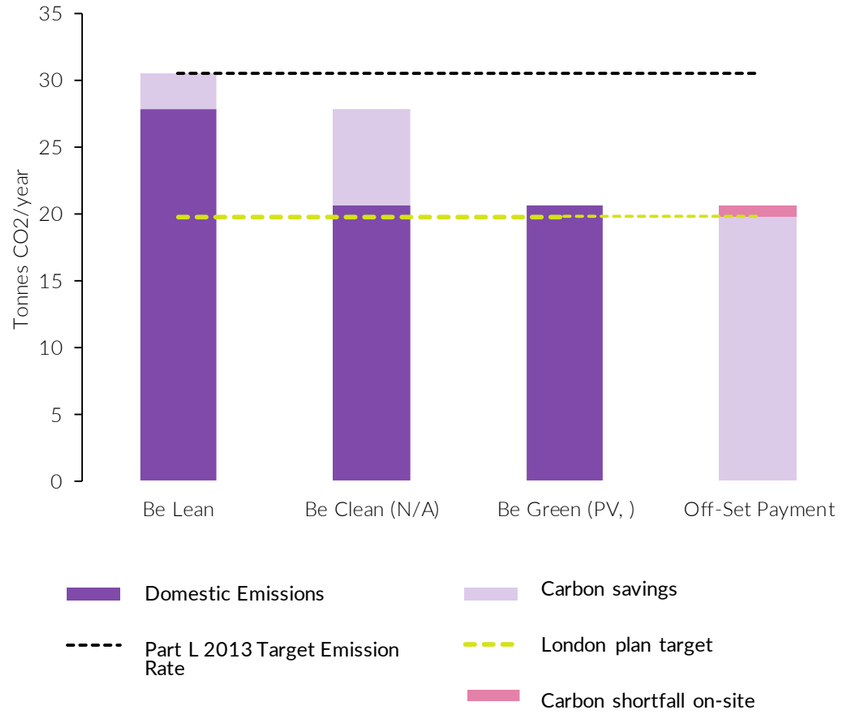


Figure 3: New Build Dwellings comparison of regulated carbon emissions saving and carbon offset payment.

1.8 Environmental Assessment Methods

In line with LBR Local Plan (2018) Policy 22, proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment (DR) 'Excellent' standard (where feasible). It is the intention of the design team to meet the minimum standards for 'Excellent' however given that the Proposed Development is in a Conservation Area (Kew Foot Road Conservation Area 36) and Building C is Grad II listed, the change of use to dwellings, assessed under BREEAM DR can be treated using the 'historic dwellings' criteria. Therefore, exemptions to the minimum standards may be required. This will be confirmed during detailed design. The dwellings in the Grade II listed building are not anticipated to achieve a BREEAM 'Excellent' rating. This is as a result of limited fabric upgrades.

2. Introduction

2.1 The Application

This document is submitted in support of an application for planning permission and listed building consent concerning the Proposed Development of Richmond Royal Hospital.

2.2 Development Description and Site Context

Richmond Royal Hospital is located within the Kew Foot Road Conservation Area 36. Bounded by Kew Foot Road to the west, Shaftesbury Road to the south and Evelyn Road to the north.

The proposed development is to convert the building to residential along with retention of a health care use.

The aim of this statement is to outline the approach of the design team to minimise the carbon footprint of the proposed development. It will discuss the improvements that will be made to the building which will result in a more energy efficient building.

2.3 Approach

This Energy Strategy follows the Mayor's energy hierarchy: 'Be Lean, Be Clean, Be Green'. This hierarchy shall be the guiding ethos behind decisions regarding the energy performance of the building.

The Proposed Development is assessed as follows:

- Change of use healthcare to residential - Building Regulations Part L1B 2013: Conservation of Fuel and Power in Existing Dwellings. These elements have been modelled using SAP v9.92 Reduced Data (RD) methodology, comparing the refurbished dwellings against the existing building.
- New Build Residential - Building Regulations Part L1A 2013: Conservation of Fuel and Power in New Dwellings. These elements have been modelled using SAP v9.92 methodology.
- Refurbished healthcare - Building Regulations Part L2B 2013: Conservation of Fuel and Power in Existing Buildings other than Dwellings. Baseline presented here using the GLA methodology of presenting the improvement beyond pre-existing buildings. Area assessed under Part L2B as there has been limited change to the footprint of this building (e.g. it is not an extension) and there are elements of the façade that are being retained which would make it challenging for the building to comply with Part L2A.

Figure 4 Site Location.

3. Regulatory and Policy Context

3.1 The Building Regulations

Building Regulations Part L2A 2013, incorporating 2010, 2011, 2013 and 2016 amendments

Part L2A applies to new buildings other than dwellings.

The regulations have their requirements:

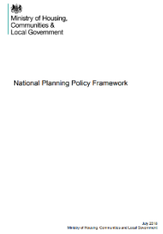
Criterion One of the Building Regulations Part L (2013) requires that the building as designed is not anticipated to generate CO_2 emissions in excess of that set by a Target Emission Rate (TER) calculated in accordance with the approved National Calculation Methodology (NCM) for non-dwellings.

Criterion Two places upper limits on the efficiency of controlled fittings and services for example, an upper limit to an external wall U-value of 0.35W/m^2.K (new non-domestic buildings).

Criterion Three requires that non-dwellings are not subject to excessive solar gains. This is demonstrated using the procedure given in the National Calculation Methodology for non-dwellings.

3.2 Planning Policy

National Planning Policy Framework, July 2018



The Revised NPPF came into force in July 2018, and replaces the previous NPPF. It sets out the government's strategy on the delivery of sustainable development through the planning system. It places responsibility for policy making with the Local Authority, who shall communicate their policies through local core strategy documents and other supplementary planning guidance documents. Updates focus on:

- Promoting high quality design of new homes and places
- Stronger protection for the environment
- Building the right number of homes in the right places
- Greater responsibility and accountability for housing delivery from councils and developers.

The NPPF states a presumption in favour of sustainable development, defined as:

"Plans should positively seek opportunities to meet the development needs of their area, and be sufficiently flexible to adapt to rapid change and strategic policies should, as a minimum provide for objectively assessed needs for housing and other uses, as well as any needs that cannot be met within neighbouring areas."

London Borough Richmond upon Thames Local Plan, July 2018

The LBR Local Plan details local policies which are applicable to the proposed development.

Policy LP 22 states:

- "Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
- Proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible).
- All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy."

The London Plan, March 2015 (subsequent minor updates in 2016)

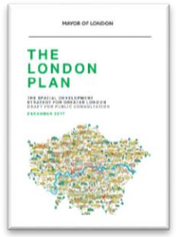
The London Plan is the overall strategic plan for London, and it sets out a fully integrated economic, environmental, transport and social framework for the development of the capital to 2031. It forms part of the development plan for Greater London. The first London Plan was published in 2004 with the latest version published in March 2015. One of the main objectives of the London Plan is to improve the environment and reduce climate change by reducing CO_2 emissions and heat loss from new developments

Policy 5.4 on retrofitting states:

"The environmental impact of existing urban areas should be reduced through policies and programmes that bring existing buildings up to the Mayor's standards on sustainable design and construction. In particular, programmes should reduce carbon dioxide emissions, improve the efficiency of resource use (such as water) and minimise the generation of pollution and waste from existing building stock"

Policy 5.2 Minimising carbon dioxide emissions sets a 'Zero Carbon' target reduction in CO_2 emissions for new build 'Residential Buildings'. The energy assessment SPG defines 'Zero Carbon' homes as those where the residential element of the application achieves at least 35% CO_2 emissions reduction on-site, with the remainder achieved by a combination of off-site measures and a cash in lieu payment (currently set at £1,800 per tonne of CO2 of remaining emissions to achieve a total reduction of 100%).

The London Plan – Draft for consultation, December 2017



A draft of the proposed new London Plan has been published for consultation. The policies are yet to be adopted, and as such have not been incorporated into the proposals laid out within this document. The notable policy carbon emission changes include non-residential target will be uplifted to 'zero carbon' – i.e. 100% reduction in CO_2 emissions for regulated energy uses. Of this target, 35% reduction should be achieved from on-site measures, and 15% from passive design and energy efficiency measures. Any shortfall is still expected to be made up by a cash-in-lieu payment. The plan also sets targets and policies for further sustainability measures such as:

- Improving Air Quality
- Energy infrastructure
- Managing heat risk
- Water infrastructure
- Reducing waste
- Aggregates.

4. Part L Approach and Methodology

4.1 Definitions and Limitations

Definitions
The following definitions should be understood throughout this statement:

- Energy demand – the 'room-side' amount of energy which must be inputted to a space to achieve comfortable conditions. In the context of space heating for example, this is the amount of heat which is emitted by a radiator, or other heat delivery mechanism.
- Energy requirement – the 'system-side' requirement for energy (fuel). In the context of a space heating system using a gas boiler, this is the amount of energy combusted (e.g. gas) to generate useful heat (i.e. to meet the energy demand).
- Regulated CO_2 emissions – the CO_2 emissions resulting from the combustion of fuel, or 'consumption' of electricity from the grid, associated with regulated energy uses (those covered by Part L of the Building Regulations).

4.2 Limitations

The appraisals within this strategy are based on Part L calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise. Occupants may operate their systems differently, and / or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements.

4.3 Approach

This strategy outlines how the Proposed Development could have a reduced effect on climate change by reducing CO_2 emissions associated with energy use in buildings.

Figure 5 outlines the route followed by the Proposed Development when reducing CO_2 emissions and defines the structure of this statement.

Figure 5 The Energy Hierarchy

The strategic approach to the design of the proposed development has been to maximise the energy efficiency of the development through the incorporation of passive design led solutions during the construction process, with the integration of low carbon technology to maximise reduction of carbon emissions from the development.

Further reductions are ensured through the specification of high-efficiency building services to limit losses in energy supply, storage and distribution.

After the inclusion of passive design and energy efficiency measures, various options have been investigated to reduce CO_2 emissions associated with energy supply. The feasibility of LZC technologies has been investigated in line with the policy aspirations.

4.4 Methodology

The areas outlined in Table 4 have been used to undertake the appraisals described within this strategy. Please note that these areas refer to conditioned spaces only and exclude the basement car park, energy centres and other non-conditioned spaces that are subject to the CO_2 emissions calculations of Part L of the building regulations.

Use	Gross Internal Area (m^2)
Residential (Change of Use)	2,993
Residential (New Build)	2,081
Healthcare (Refurbished)	500

Table 4: Anticipated Area Schedule.

Calculations demonstrating the energy requirements and associated CO_2 emissions have been modelled as follows:

- Change of use healthcare to residential - Building Regulations Part L1B 2013: Conservation of Fuel and Power in Existing Dwellings. A sample of dwellings have been modelled using SAP v9.92 Reduced Data (RD) methodology, comparing the refurbished dwellings against the existing building.
- New Build Residential - Building Regulations Part L1A 2013: Conservation of Fuel and Power in New Dwellings. A sample of dwellings have been modelled using SAP v9.92 methodology.
- Refurbished healthcare - Building Regulations Part L2B 2013: Conservation of Fuel and Power in Existing Buildings other than Dwellings. Baseline presented here using the GLA methodology of presenting the improvement beyond pre-existing buildings.

Note assumptions regarding floor to ceiling heights and window heights have been made where drawings or elevations were not available.

The following Part L 2013 compliant carbon factors were used to convert the energy consumption figures into CO_2 emissions for the Proposed Development.

Fuel	Emissions Factor ($kgCO_2/kWh$)
Gas	0.216
Electricity	0.519

Table 5 Building Regulations Part L 2013 CO_2 Emission Factors.

5. Energy Strategy

The following sections outline considerations of the passive design and energy efficiency measures that have been proposed at Richmond Royal Hospital. The measures are described as follows:

- Listed; refers to measures that are applicable to the Listed Building (Building C)
- Refurbished; refers to the buildings to be retained – Building B, D and most of Building A and E.
- New Build; refers to Building F which is a completely new building, as well as new build elements of Building A and E.

Figure 6 The Proposed Development at Richmond Royal Hospital.

5.1 Be Lean – Passive Design Strategy

Passive design measures are those which reduce the demand for energy within buildings, without consuming energy in the process.

These are the most effective and robust measures for reducing CO_2 emissions as the performance of the solutions, for example wall insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners.

The following passive design measures will be incorporated in the proposed development design:

Thermal Insulation

Listed & Refurbished
The external appearance of the listed building (Building C) and the buildings noted as having townscape merit (Building B and D) and Shaftesbury Road (Building A and B) make positive contributions to the conservation areas. As such are deemed exempt from any external changes in this respect.

Where feasible the floor and roof will be insulated.

New Build
To minimise the demand for space heating, where new build elements are incorporated these will target an improvement upon the Part L1A 2013 minimum standards.

Fabric Air Permeability

Fabric air permeability is a measure of the volume of air that can penetrate through the fabric of a building, leading to ventilation heat loss and gain. High air permeability can lead to uncomfortable drafts and increase the demand for space heating in winter, and space cooling in summer, when the air-flow works in reverse i.e. cool air escaping from the building.

Listed & Refurbished
As the façade is not proposed to change, and owing to the listed building and conservation area location of the Proposed Development, it is unlikely that the fabric air permeability will be improved.

New Build
The new build dwellings will target an air permeability rate of $3m^3/h.m^2$ at 50Pa. This is a 70% reduction beyond that required by Building Regulations Part L 2013.

Glazing - Energy & Light Transmittance

Listed
The listed building is exempt from passive upgrades that would alter the external appearance.

Refurbished
The façades have a glazing ratio of approximately 15 – 30% of the floor area, which largely optimises the beneficial solar gains in the winter months, whilst limiting the risk of high internal gains in summer. Where feasible, secondary glazing will be incorporated into the design. This will be reviewed with the heritage consultant at the next stage of design.

New Build
The new build dwellings will have glazing which will be high specification, following a glazing ratio which aligns with the retained facades. Solar gains are beneficial in winter months as a means of reducing the need for active heating to maintain comfortable internal temperatures. However, in summer months excessive solar gains can, if not properly managed, lead to overheating and increased cooling load.

5.2 Be Lean - Limiting the Effect of Heat Gains in Summer Months

Cooling Hierarchy

The London Plan Policy 5.9 (Overheating and Cooling) requests that developments should reduce potential overheating risks and reliance on air conditioning systems. A 'cooling hierarchy' is provided and the Proposed Development will seek to follow this hierarchy. This is in line with LBR Local Plan LP 20.

The London Plan cooling hierarchy has been followed to limit the effects of heat gains in summer, prior to the incorporation of active cooling:

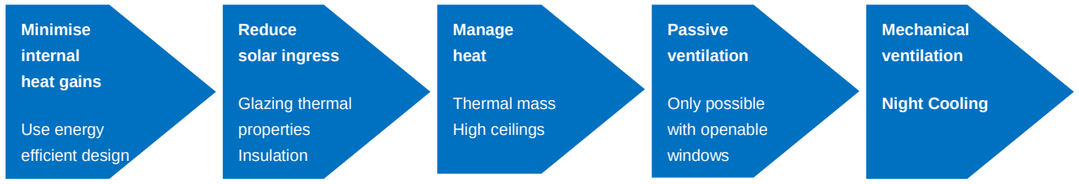


Figure 7 Cooling Hierarchy

Summary of Mitigation Measures

The following mitigation methods will be implemented at the Proposed Development.

Reduction of internal heat gains

Internal heat gains will be reduced by energy efficient design measures such as:

- Use of energy efficient lighting (such as LED or compact fluorescent) with low heat output.
- Pipework design and insulation to minimise circulation heat loss
- New Build - high levels of insulation and low fabric air permeability which will retain cool air during the summer months

Reduction of solar ingress

Glazing g-value is linked to light transmittance. For lower g-values, it is likely that the visible light transmittance of the glass is reduced, due to the inclusion of reflective outer surfaces or tints to control solar energy transmittance.

New Build

The g-values for the new windows will be set based on a combination of aesthetic properties and overall building performance.

Mechanical ventilation

All areas of the Proposed Development will be equipped with mechanical ventilation with heat recovery units. This greatly reduces the energy consumption required to heat up or cool down incoming ventilation air to the building. To reduce the likelihood of the end-user choosing between excessive internal gains and acoustic noise, it is also recommended that additional ventilation fans are provided to increase ventilation to the apartments in line with Building Regulations Part F.

5.3 Be Lean - Energy Efficiency Measures

Energy efficiency measures are those which seek to service the demand for energy (i.e. the remaining demand after implementation of passive design measures) in the most efficient way.

All areas (listed, refurbished and new build) will be conditioned using the same central system.

Heating

Heating of the Proposed Development will be served by high efficiency gas boilers of at least 90% efficiency.

The dwellings within each building would connect to the central energy centre via Heat Interface Units (HIU) (Figure 8).

Figure 8: Typical Heat Interface Unit.

HIUs would be insulated in accordance with the guidelines in the Building Regulations and the Mayor of London's District Heating Manual for London (2013). This would maximise system efficiency by reducing as far as practically possible the heat loss from the pipework.

A means to connect the heat networks for each area and to connect to a wider district heat network would also be provided to allow for future connection should this be technically, economically and legally viable to do so.

All Low Temperature Hot Water (LTHW) network and primary pipework would be insulated to maximise system efficiency and guard against excessive distribution heat loss.

Whilst capped connections to the energy centre will be provided, the fit-out of the healthcare facility would be the responsibility of the NHS. The NHS would be required to implement highly efficient systems and in line with the standards outlined in the Non-Domestic Building Services Compliance Guide (2013). Sufficient plant space would be provided for each tenant to install their own plant (at roof or basement level as appropriate).

Hot Water

60% of the heating & hot water load for the dwellings will be delivered via an onsite (CHP) Combined Heat and Power generator as described in Section 5.3.1.

Capped connections to the energy centre will be provided to the healthcare unit. It is anticipated that point of use electric water heaters are more likely and these have been modelled as such. The point of use system will minimise the heat losses in distribution pipework. It also means that, storage losses will be minimal compared with large stored volumes of water at high temperatures.

The Proposed Development will feature water efficient fixtures and fittings including WC's with low flush volume and flow reducers in the taps of wash hand basins and on showers and as a minimum, meet the optional performance stipulations within the Building Regulations Part G (2013), as required by LBR Local Plan Policy LP 22, which requires all dwellings to achieve maximum water consumption of 110 litres per person per day (including allowances of 5 litres or less per day for external water consumption).

Space Cooling
Space cooling is not currently proposed at the Proposed Development. It is anticipated that the fit-out of the healthcare unit would incorporate cooling and has been modelled as such. However this would be an NHS design specification.

Lighting
High-efficiency lighting systems will be installed wherever possible, and as a minimum meet the performance stipulations within the Non-Domestic Building Services Compliance Guide (2013). In addition, the use of lighting controls such as occupancy detection shall be installed in communal areas where possible, to further reduce the use of electric lighting.

The implementation of efficient lighting will not only reduce energy requirement and CO_2 emissions associated with lighting, but will also aid in minimising the energy requirement associated with cooling.

Ventilation
The Proposed Development will be provided with high-efficiency localised mechanical ventilation with heat recovery. Mechanical ventilation is an important addition to the building services to maintain good indoor air quality by providing fresh air to all spaces, and extracting stale air. Coupled to a heat exchanger, the warmth in extracted air can be recovered and delivered to the supply air. In this mode, the ventilation system reduces space heating and cooling demand.

To reduce the electrical energy associated with fans, for areas in the Proposed Development with supply and extract, low specific fan powers will be targeted. It is recommended that boosted ventilation and summer bypass will also be incorporated.

Pipework & Ductwork Insulation
All distribution pipework will be insulated in accordance with the requirements of the Building Regulations, as a minimum.

This will serve to minimise heat gains and losses to / from distribution pipework, and maximise system efficiency. Careful attention will be paid to insulating joints, valves and knuckles to minimise standing heat losses. Ductwork will also be insulated to minimise heat gains and losses, and will be of suitable construction to minimise air leakage. Rigid duct work will be used as preference, to avoid inefficiencies from convoluted flexible duct runs.

Operation & Maintenance Manuals
In accordance with the requirements of the Building Regulations detailed Operation and Maintenance (O&M) manuals will be provided to managers of the Proposed Development.

The guides will provide both an overview of the systems and their intended operation, and relevant engineering details of the installations.

Unregulated Energy
Unregulated energy includes small power electricity use (computers, plug in devices, washing machines, refrigeration) and catering energy consumption.

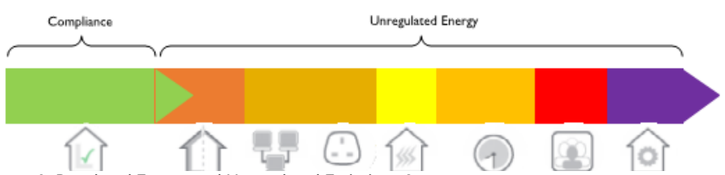


Figure 9: Regulated Energy and Unregulated Emissions Summary.

It is anticipated that the proportion of unregulated energy would gain in significance when compared to regulated energy as each revision of Building Regulations Part L comes into force and regulated energy is reduced.

It is therefore foreseeable that energy efficiency and the rising cost of energy would play an increasing role when future building users are deciding which appliances to purchase and the frequency of their use. However, it is not possible at present to quantify the extent of this potential reduction.

Given the uncertainty, measures to educate the future building users on how they can reduce their equipment energy use would be encouraged. This can be provided in the form of building user guides and tenant fit-out guides. The guidance measures detailed within these types of documents would consider:

- Use of A / A+ rated white goods;
- Energy star rated computers and flat screen monitors;
- Energy efficient lifts; and
- Voltage optimization and power factor correction.

Summary of Passive Design & Energy Efficiency Measures

Table 6 summarises the passive design and energy efficiency measures for the Proposed Development. As the healthcare unit is being developed to shell & core, the inputs in Table 6 are minimum requirements and should be improved upon where feasible by the tenant.

	Parameter	Refurbished Dwellings	New Build Dwellings	Healthcare
Passive Design	Roof U-value ($W/m^2.K$)	-	0.16	-
	External Wall U-value ($W/m^2.K$)	1.7	0.15	Existing – 1.7 New – 0.28
	Floor U-value ($W/m^2.K$)	0.25	0.13	0.22
	Party Wall U-value ($W/m^2.K$)	0.00 (fully filled cavity with effective edge sealing)		-
	Sheltered Wall U-value ($W/m^2.K$)	0.2		N/A
	Window U-value ($W/m^2.K$)	2.4 (secondary glazing)	1.40	Existing – 4.8 New – 1.4
	Glazing g-value	0.7	0.5	Existing – 0.7 New – 0.5
	Fabric Air Permeability ($(m^3/m^2.h)$ at 50 Pa)	15	3.00	25
	Thermal Bridging	Default	Approved	-
Energy Efficiency	Space Heating	DEN fuelled by CHP and high-efficiency condensing gas boilers (92% efficiency) with Heat Interface Units (HIU) per dwelling coupled to hot water systems and fan coil units / underfloor heating.		Variable Refrigerant Flow (VRF) system with COP =3
	Hot Water	Water efficient fixtures and fittings to minimise water demand. HIU with minimal heat loss		Electric point of use 10% distribution losses.
	Space Cooling	No cooling.		SEER 5.0
	Lighting	High efficiency lighting. Daylight and presence detection in common areas.		Target efficacy of >60 luminaire lumens per circuit Watt. Display Lighting is 22 lamp lumens per circuit Watt.
	Ventilation	MVHR with specific fan power 0.4-0.53 with Heat Recovery of 91-94%		Target SFP of 1.8W/l/s and HR of 75%
	Metering & Controls	Zonal, programmable thermostatic controls for heating. Separate programmable control for hot water. Electricity meter and heat meter with potential link to energy display device.		To be provided in accordance with the requirements of the Building Regulations.
	Pipework & Ductwork Insulation	To be provided in accordance with the requirements of the Building Regulations.		To be provided in accordance with the requirements of the Building Regulations.
	Variable Speed Pumping	To be provided.		To be provided.
	O&M Manuals	Systems overview and detailed descriptions in plain and clear English, in line with BREEAM Domestic Refurbishment Home User Guide.		To be provided in accordance with the requirements of the Building Regulations.

Table 6: Summer of Passive Design & Energy Efficiency Measures.

5.3.1 Be Lean - Energy Requirement & CO_2 Emissions appraisal

The following is an appraisal of the anticipated energy requirements and resultant CO_2 emissions that could arise as a result of the Proposed Development, after the inclusion of the passive design and energy efficiency measures described above.

The appraisal has been based on approved calculation methodology and should not be understood as a predictive assessment as occupants may operate their systems differently, and / or the weather may be different from the assumptions made within the calculations.

Regulated sources of energy requirement are those controlled by the Building Regulations, as follows:

- space heating
- hot water
- space cooling
- lighting
- auxiliary (combining fans, pumps and controls)

Refurb Areas – Dwellings

The results presented below are the comparison between the pre-refurbished, existing building, and the proposed change of use to dwellings. This follows the Building Regulations Part L1B 2013: Conservation of Fuel and Power in Existing Dwellings. A sample of dwellings have been modelled using SAP v9.92 Reduced Data (RD) methodology, comparing the refurbished dwellings against the existing building.

The results demonstrate that for the refurbished elements, based on the measures listed in section 4.3 above, before the implementation of 'be clean' or 'be green' measures, the annual regulated energy requirement of the refurbished dwellings of the Proposed Development is anticipated to be approximately 445 MWh with associated regulated CO_2 emissions of 103 tonnes, summarised in Table 7.

Parameters	Energy Consumption		Regulated CO_2 Emissions	
	MWh/yr	% Reduction	tCO_2/yr	% Reduction
Existing 'Baseline'	898	-	209	-
Refurbished Dwellings 'Be Lean'	445	-50.4%	103	-50.7%

Table 7: Summary of Be Lean Regulated Energy Requirements and Associated CO_2 Emissions – Refurbed Dwellings.

As outlined in Figure 10 the majority of the regulated energy requirement, approximately 86%, is as a result of thermal energy requirements (domestic hot water and space heating), of which hot water is the most significant contributor.

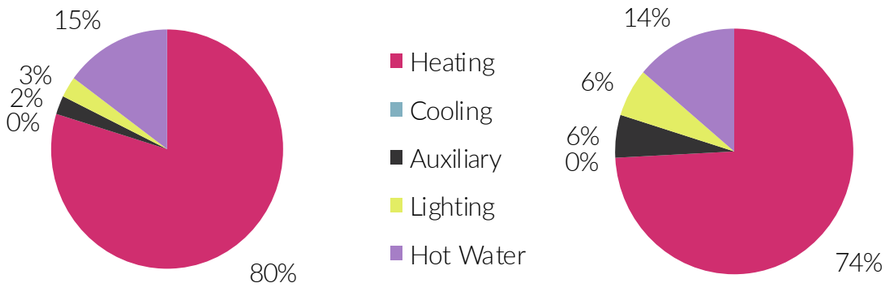


Figure 10: A breakdown of the anticipated annual regulated energy requirement (left) and CO_2 emissions (right) by service and space use for the Refurbished Dwellings.

Refurbished Areas - Healthcare

The results presented below are based on Building Regulations Part L2B 2013: Conservation of Fuel and Power in Existing Buildings other than Dwellings. Baseline presented here using the GLA methodology of presenting the improvement beyond pre-existing buildings.

The results demonstrate that for the retained healthcare facility, based on the measures listed in section 4.3 above, before the implementation of 'be clean' or 'be green' measures, the annual regulated energy requirement of the new build elements of the Proposed Development is anticipated to be approximately **92 MWh** with associated regulated CO_2 emissions of **22 tonnes**, summarised in Table 8.

Parameters	Energy Consumption		Regulated CO_2 Emissions	
	MWh/yr	% Reduction	tCO_2/yr	% Reduction
Existing 'Baseline'	166	-	28	-
Retained healthcare 'Be Lean'	92	-44%	22	-21.4%

Table 8: Summary of Be Lean Regulated Energy Requirements and Associated CO_2 Emissions – Healthcare.

New Build

The results presented below are based on Building Regulations Part L1A 2013 compliance modelling carried out on a sample of new build dwellings. The results have been applied to all the new build residential areas of the Proposed Development on an area weighted basis. The calculations demonstrating the energy requirements and associated CO_2 emissions for dwellings have been carried out using Building Regulations Part L1A approved SAP 2012 v9.92 methodology.

The results demonstrate that for the new build elements, based on the measures listed in section 4.3 above, before the implementation of 'be clean' or 'be green' measures, the annual regulated energy requirement of the new build elements of the Proposed Development is anticipated to be approximately **108 MWh** with associated regulated CO_2 emissions of **28 tonnes**, summarised in Table 9.

Parameters	Energy Consumption		Regulated CO_2 Emissions	
	MWh/yr	% Reduction	tCO_2/yr	% Reduction
New Build Part L 2013 'Baseline'	119	-	30	-
New Build 'Be Lean'	108	-9.2%	28	-8.7%

Table 9: Summary of Be Lean Regulated Energy Requirements and Associated CO_2 Emissions – New Build.

As outlined in

Figure 11 the majority of the regulated energy requirement, approximately 87%, is as a result of thermal energy requirements (domestic hot water and space heating), of which hot water is the most significant contributor.

Therefore, the Proposed Development achieves Part L 2013 compliance via Be Lean measures, i.e. prior to the consideration of any LZC technologies.

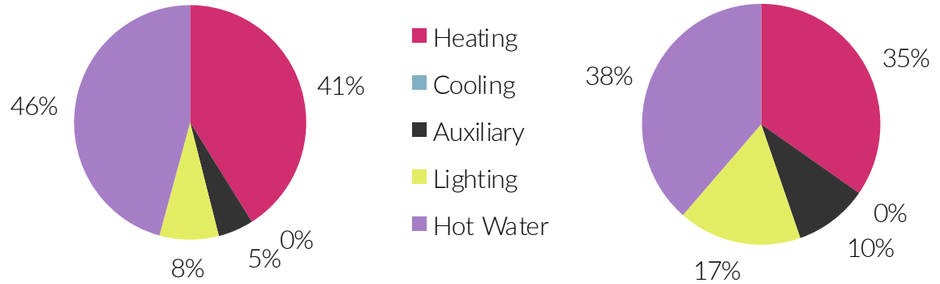


Figure 11: A breakdown of the anticipated annual regulated energy requirement (left) and CO_2 emissions (right) by service and space use for the New Build Elements.

5.4 Be Clean

The following sections detail considerations of the infrastructure and low-carbon energy supply measures that have been considered.

Decentralised Energy Networks (DEN)

The Proposed Development is not within an 'Opportunity Area' for the implementation of a decentralised energy network and within an area of moderate to high heat density, as identified by the London Heat Map (http://www.londonheatmap.org.uk). The nearest "Potential Network" (red line) is a significant distance away, and so is not thought to represent a viable energy source for this refurbishment scheme.

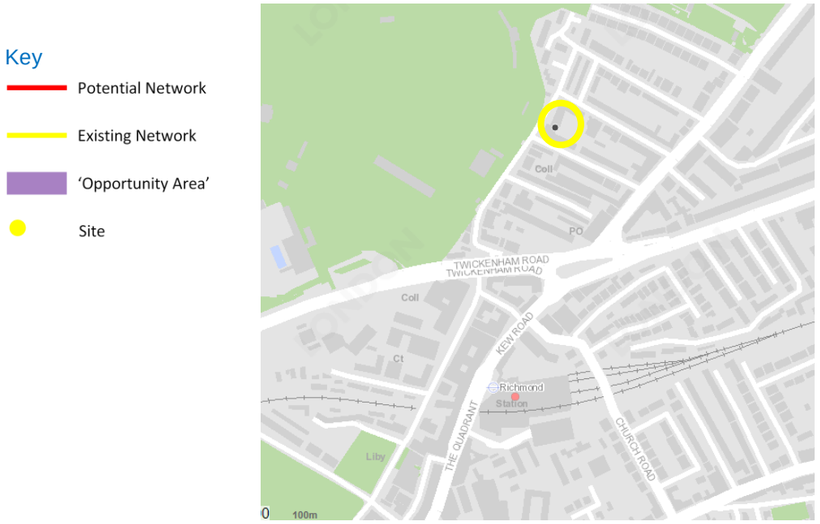


Figure 12 Extract from London Heat Map

Technology Appraisal

This section considers the relative merits of providing a stand-alone on-site DEN served by a dedicated energy centre with a Combined Heat and Power (CHP).

The figures demonstrate that these systems can work more efficiently than their traditional counterparts, i.e. grid electricity and gas boilers. Where thermal demand is adequate, CHP can achieve significant reductions in primary energy demand relative to traditional sources.

Such plant can be more efficient than deriving electricity from the grid as the heat generated in the process of creating the electricity can be used on-site, and the electricity does not have to travel great distances over the national grid before use, thus minimising transmissive losses.

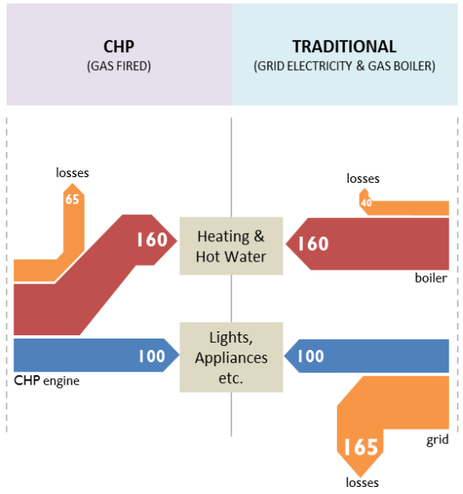


Figure 13 CHP Efficiency

Combined Heat and Power (CHP)

CHP is a strategy suited to buildings with a good thermal baseload present throughout the year, typically residential schemes. This is because to run efficiently, CHP engines need to run an average of 16-17 hours per day. If these running hours cannot be met, the technology becomes economically much less viable as sufficient energy costs are not offset to deliver reasonable payback on the original capital investment. They are also an on-site source of pollutants which may adversely affect the local air quality.

As the Proposed Development is residential development, the thermal loads present on the site are relatively high.

5.4.1 Be Clean - Energy Requirement & CO_2 Emissions appraisal

Potential savings arising from a CHP system have been evaluated. It has been assumed that in total, 60% of the dwelling space heating and hot water used, could be produced by CHP with the remainder provided by gas fired boilers.

Refurbished Dwellings

For the refurbished dwellings it is estimated that a decentralised CHP and gas-fired boiler system could provide an approximate saving of 15% beyond the existing building Baseline.

Refurbished Healthcare

It is not proposed that the healthcare is connected to the CHP. However capped connection will be provided should the future tenants wish to connect in future.

New Build Dwellings

For the new build dwellings it is estimated that a decentralised CHP and gas-fired boiler system could provide an approximate saving of 24% beyond the Part L 2013 Baseline.

5.5 Be Green

The following sections outline considerations of the renewable energy generation measures that have been considered, and those which will be implemented at the Proposed Development.

Renewable Technology Appraisal

Renewable technologies harness energy from the environment and convert this to a useful form. Many renewable technologies are available. However, not all these are commercially viable, suitable for conservation areas or appropriate for the Proposed Development.

Technologies considered for the Proposed Development include:

- Photovoltaics
- Solar thermal panels
- Biomass boilers
- Heat pumps (closed and open loop ground-source / water source open loop/air-source)
- Wind turbines

Where calculations are provided, these are representative of improvements over the new building dwellings only.

Photovoltaic (PVs) Panels

The potential areas suitable for PVs are limited given the location of the development in a conservation area.

However, an appraisal of roof space available for PV has been undertaken, taking into consideration the following:

- Conservation area
- view from surrounding buildings
- area required for access

Considering the roof space available, as shown in Figure 14, a 50m^2 PV panel area could be incorporated on Building F of the Proposed Development.

Based on the solar irradiance data for London, an array of this size would generate approximately 7,420kWh of electricity per annum, reducing CO_2 emissions by 3,850 tonnes per annum. This is equivalent to a reduction in regulated CO_2 emissions of 1.0% beyond the GLA Gas boiler 'baseline'.

However, given the limited roof space, and the location of the Proposed Development in a conservation area, and including a listed building, PVs are not considered suitable for the site.

Figure 14: Third floor plan demonstrating potential roof area for PV on building F.

Solar Thermal Panels

Solar thermal panels operate by capturing solar energy and transferring this via a fluid (e.g. glycol) to a thermal store to generate hot water. These systems can operate at efficiencies up to ~75% thus a high yield of energy can be derived from small collector areas.

The appraisal of solar thermal panels has been undertaken with the same approach as for PV.

Considering the available roof space, and allowing for access and maintenance requirements, a total solar thermal system size of 24kW could be installed at the Proposed Development.

Based on the solar irradiance data for London, an array of this size would generate approximately 1,140kWh of heat per annum. This level of thermal generation is equivalent to 36% of the annual hot water demand, reducing CO_2 emissions by 5.5tonnes per annum.

This is equivalent to a reduction in regulated CO_2 emissions of 1.4% beyond the Building Regulations Part L (2013) 'baseline'.

However, in providing solar thermal panels, a portion of the hot water baseload (21%) would be offset, meaning a CHP engine would generate less heat and electricity. As a result, CO_2 emissions reductions associated with a CHP would be reduced.

The reduction in use of a CHP engine would lead to an overall increase in net CO_2 emissions from the Proposed Development owing to the high carbon content of grid electricity (0.519kgCO_2/kWh compared with 0.216kgCO_2/kWh for gas).

As such, the use of solar thermal panels is not suitable where CHP is included and would not be implemented at the Proposed Development.

Biomass Boilers

Biomass boilers burn wood fuel or other bio-fuel sources to generate heat. These boilers can operate at high efficiencies, comparable to condensing gas boilers.

However, they require a large fuel store to maintain continuous operation during the winter months. Spatially this would be very difficult to accommodate at the Proposed Development.

High numbers of fuel deliveries are required to keep the fuel store topped up during the peak heating season. The carbon associated with the delivery vehicles and their journeys reduces the net carbon saving gained from using a renewable fuel.

The reasons listed above alongside high maintenance implications and air quality implications mean that biomass boilers are not considered a suitable technology for the scheme.

Air / Water / Ground Source Heat Pumps

Ground Source systems work to extract heat or cooling energy from the ground. They are generally more efficient than air source systems, as the ground temperature is more stable over the course of the year relative to air temperature. There are four common varieties of ground source systems:

- Vertical, open loop, direct cooling (i.e. without heat pump)
- Vertical, open loop, with heat pump
- Horizontal, closed loop, with heat pump
- Vertical, closed loop, with heat pump

Regardless of the type of ground source heat loop used, all would require new below ground works to bury and install the system on site. As the Proposed Development is an existing building with limited external area at ground floor, ground source heat pumps are not considered a viable technology for use on site.

Water source heat pumps use bodies of water, such as rivers, lakes or oceans to provide heating or cooling energy to a building. However, there are no such bodies of water local to site, therefore this technology could not be used.

Air source heat pumps use thermodynamic principles to convert heat from the air into useable heat within the building. Unlike some other sources of renewable energy, heat pumps do require energy (typically electricity or gas) to pump and compress refrigerant through the system. However, under the Renewable Energy Directive 2009/28/EC they are classified as renewable technologies provided that the final energy output significantly exceeds the primary energy input required to drive the heat pump.

To accommodate the demands of the dwellings, at the Proposed Development, large external condenser units would be required. Given that the Proposed Development is in a conservation area, these would need to be accommodated sensitively to minimise the visual impact on-site, and would be a source of noise that would possibly require attenuation to prevent nuisance. Therefore, this LZC is not proposed for the residential units.

The healthcare unit is being developed as shell & core. It is anticipated to require cooling which would be designed and installed as part of the shell fit out. The modelling results and analysis presented in this report assume a typical cooling system appropriate for the scale of development, which includes an air source heat pump. The air source heat pump will be required to be designed and attenuated in line with the acoustic requirements. This system delivers both the heating and cooling requirements and can deliver high energy efficiencies. Therefore, this is proposed, only to serve the healthcare unit.

Micro Wind Turbines

For efficient operation and to yield high energy output, wind turbines require a smooth laminar flow of air. The Proposed Development is located a conservation area and therefore deemed unsuitable for micro wind turbines.

Moreover, mounting wind turbines on the roof of the building could result in unacceptable vibration and resonance being felt within occupied spaces. The turbines are also likely to generate noise which may be a nuisance to neighbouring residential properties. This scenario is likely to result in the turbines being switched off.

Therefore, given the complexities of installing this technology, the use of micro wind turbines is not proposed at the Proposed Development.

5.6 Summary

Preferred Strategy for Implementation
Table 10 provides a summary of the technologies assessed above.

	Pros	Cons	Suitability
Solar Photovoltaic Panels (PV)	Generates electricity from solar energy	Not well suited to conservation areas.	✗
Solar Thermal Panels	Generates hot water from solar energy	Roof space has been allocated however given the location of the Proposed Development in a conservation area PV may not be deemed suitable. If CHP route is selected, baseload will be reduced and CHP will run less efficiently.	✗
Wood Pellet Biomass Boiler	Uses a renewable fuel source to generate hot water	Large fuel stores required High number of fuel deliveries required High maintenance required Negative impacts on local air quality	✗
Ground Source Heat Pumps	Uses heat/coolth from the ground to provide usable heating or cooling to the building	Requires an auxiliary energy source to drive system No space available on site to dig the required bore holes to feed system	✗
Air Source Heat Pumps	Uses heat/coolth from the air to provide usable heating or cooling to the building. Same technology can deliver the heating and cooling requirements of the building. Use of the refrigerant cycle delivers very high energy efficiencies	Large demand for heating in the residential units would require large outdoor condenser not suitable to a conservation area. Requires an energy source to drive system.	✗ (For Resi) ✓ (Healthcare only)
Micro Wind Turbines	Generates electricity from wind energy	Unsuitable for conservation areas. Potential noise and vibration impacts on the proposed development and neighbouring properties	✗

Table 10: Renewable Technologies Appraisal.

6. Summary of Results

The following tables demonstrate the relative carbon emission savings of the Proposed Development, compared to Part L 2013 baseline for the Be Lean, Be Clean and Be Green stages of the Mayor's energy hierarchy.

In line with GLA Energy Strategy guidelines, the results are presented separately for the refurbished and new build. Only the new build elements are subject to the carbon offset payment required for falling short of the zero carbon reduction target set by the GLA.

6.1 Change of Use to Dwellings

Refurbished Dwellings (With CHP)	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Existing Baseline	209	-
Reduction from Be Lean	105	50.4%
Reduction from Be Clean	32	15.5%
Reduction from Be Green	-	-
Total Reduction	137	66.9%

Table 11: Refurbished Dwellings Improvements from existing baseline.

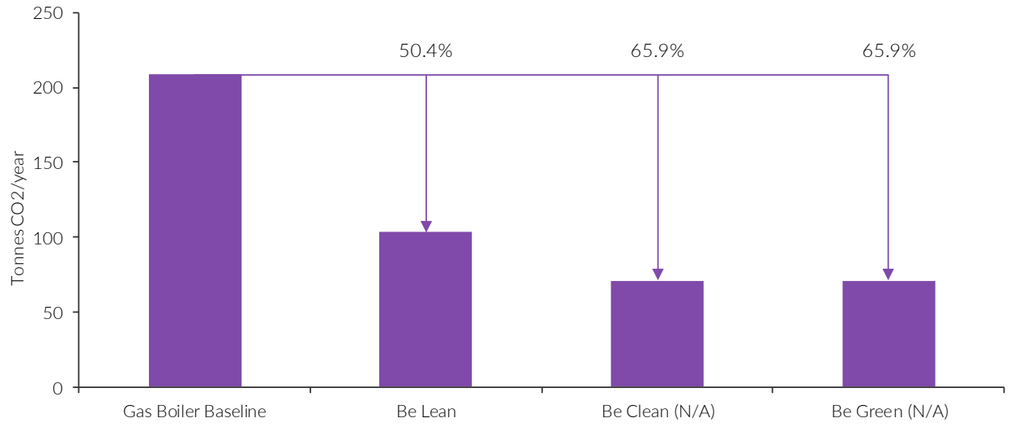


Figure 15: Change of Use to Dwellings regulated carbon emissions saving from existing buildings.

6.2 Refurbished Healthcare

Refurbished Healthcare	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Existing Baseline	28	-
Reduction from Be Lean	22	20.1%
Reduction from Be Clean	22	-
Reduction from Be Green	17	40.0%
Total Reduction	11	65.2%

Table 12: Refurbished Healthcare Improvements from existing baseline.

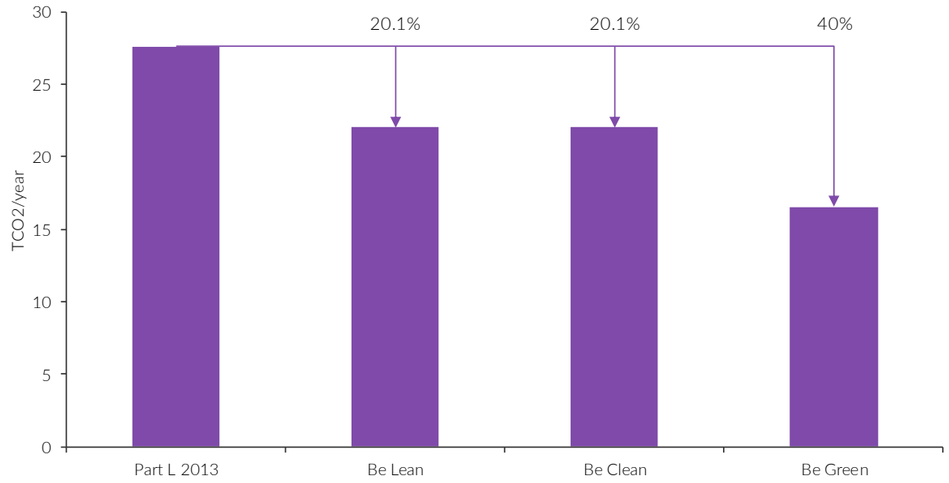


Figure 16: Refurbished Healthcare regulated carbon emissions saving from existing building.

6.3 New Build Dwellings

New Build Dwellings	Regulated Carbon Dioxide Emission Savings	
	(tonnes/yr)	(%)
Baseline: Part L 2013 of the Building Regulations Compliant Development	30	-
Reduction from Be Lean	3	8.7%
Reduction from Be Clean	7	23.6%
Reduction from Be Green	-	-
Total Reduction	10	32.3%
Total Target Reduction	30	100%
Annual Surplus / Shortfall	-21	67.5%
Dwellings offset Payment Rate (£/tCO_2)	£1,800	
Total Offset Payment	£37,000	

Table 13: New Build Dwellings Summary of regulated carbon emissions saving and carbon offset payment.

Figure 17: New Build Dwellings comparison of regulated carbon emissions saving and carbon offset payment.

7. Conclusion

This report has shown that the Proposed Development will result in a building considerably more energy efficient than the existing building. New, high efficiency servicing equipment and improved façade will minimise the energy usage of the building. Using the Mayor's energy hierarchy, the strategy has been developed to ensure that the proposed development is efficient and economical.

The regulated energy carbon emissions of the new build dwellings of the development have been compared with the GLA London Plan emissions saving target and found to marginally fall short. A carbon offset payment made to the local authority will be required. The estimated offset payment is shown in Table 13.

In line with LBR Local Plan (2018) Policy 22, proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment (DR) 'Excellent' standard (where feasible). It is the intention of the design team to meet the minimum standards for 'Excellent' however given that the Proposed Development is in a Conservation Area (Kew Foot Road Conservation Area 36) and Building C is Grad II listed, the change of use to dwellings, assessed under BREEAM DR can be treated using the 'historic dwellings' criteria. Therefore, exemptions to the minimum standards may be required. This will be confirmed during detailed design. The dwellings in the Grade II listed building are not anticipated to achieve a BREEAM 'Excellent' rating. This is as a result of limited fabric upgrades.

Appendix A: Regulatory & Policy Context

The following outlines the regulatory and planning policy requirements applicable to the Proposed Development.

National Policy

Current Policy Framework

The Proposed Development is not considered to be preferable to the Mayor of London. The policies considered when preparing this strategy are contained in the London Plan (GLA, 2016) and the Local Development Plan of LBR (2018). The Supplementary Planning Guidance (SPG) has also been reviewed and taken into consideration in the Energy Strategy.

Building Regulations Part L 2013

Approved Document Part L

Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO_2 emissions from new buildings.

Current Requirements: Part L 2013

Part L has five key criteria which must be satisfied as follows:

a. Criterion 1 - Achieving the Target Emission Rate (TER)
b. Criterion 2 - Limits on design flexibility
c. Criterion 3 - Limiting the effects of solar gains in summer
d. Criterion 4 - Building performance consistent with the Dwelling Emission Rate (DER)
e. Criterion 5 - Provision for energy efficient operation of the dwelling

Criteria one, two and three are addressed within this strategy.

Criterion one requires that the building as designed is not predicted to generate CO_2 emissions in excess of that set by the Target Emission Rate (TER) calculated in accordance with the approved Standard Assessment Procedure (SAP) 2012. Part L (2013) requires the following reductions:

a. A 6% aggregate reduction in CO_2 emissions beyond the requirements of Part L 2010 for dwellings; and
b. A 9% aggregate reduction in CO_2 emissions beyond the requirements of Part L 2010 for non-domestic buildings.

Criterion two places upper limits on the efficiency of controlled fittings and services for example, an upper limit to an external wall U-value of 0.30W/m^2.K (dwellings).

A Fabric Energy Efficiency Standard (FEES) has been introduced for new dwellings although no definitive targets have been set in this regard. Part L 2013 requires the following Fabric Energy Efficiency performance targets to be met:

a. Target Fabric Energy Efficiency (TFEE). The TFEE is calculated independently for each dwelling, based upon an elemental recipe of efficiency parameters, applied to the geometry of the dwelling in question. This would generate a notional value which would then be relaxed by 15% to generate the TFEE

Criterion three requires that dwellings are not at 'high' likelihood of high internal temperatures in summer months (June, July & August) and that zones in commercial buildings are not subject to excessive solar gains. This is demonstrated using the procedure given in SAP 2012 Appendix P for dwellings, and Simplified Building Energy Model (SBEM) or Dynamic Simulation Method (DSM) for non-residential buildings.

GLA Planning Policy

The London Plan (March 2016) Consolidated with Alterations Since 2011

The regional policies of the GLA are contained within the London Plan (2016), and the relevant SPGs.

The latest version of the consolidated London Plan (2016) was published and adopted in March 2016 and is current for any Stage 1 submissions to the GLA. This constitutes the London Plan 2011 consolidated with:

- Revised Early Minor Alterations to the London Plan (October 2013)
- Further Alterations to the London Plan (March 2015)
- Housing Standards Minor Alterations to the London Plan (March 2016)
- Parking Standards Minor Alterations to the London Plan (March 2016)

The target reduction in CO_2 emissions for Residential Buildings is to achieve 'zero carbon homes' for Stage 1 applications. The definition of this is clarified in the GLA's publication G*uidance on Preparing Energy Assessments*. The target for 'Non-Domestic Buildings' is to achieve 35% reduction in CO_2 emissions.

Energy Planning - Greater London Authority guidance on preparing energy assessments (March 2016)

This document was produced by the GLA to provide further detail on how to prepare an energy assessment to accompany strategic planning applications. Within this, the definition of 'zero carbon homes' is made as follows:

'Zero carbon' homes are homes forming part of major development applications where the residential element of the application achieves at least a 35 per cent reduction in regulated carbon dioxide emissions (beyond Part L 2013) on-site. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere (in line with policy 5.2E).

The cash in lieu payment is currently set at £1,800 per tonne of CO_2 (equivalent to £60 per tonne per year over 30 year period).

Use Type	CO_2 Reduction Target (beyond Part L 2013)	
	2013 – 2016	2016 – 2019 (1st October 2016)
Residential Buildings	35%	'Zero Carbon'
Non-Domestic Buildings	35%	35%

Table A1: Uplift in CO_2 emissions targets

London Plan Policy

Development within LBRuT is subject to the policy requirements of the London Plan 2016. The following policies of the London Plan (2016) have informed this strategy.

Policy 5.2: Minimising CO_2 Emissions

Policy 5.2 sets out the target CO_2 emission reductions as described above.

Policy 5.6: Decentralised Energy in Development Proposals

Policy 5.6 requires development proposals to evaluate the feasibility of Combined Heat & Power (CHP) systems and where a new CHP system is appropriate, examine opportunities to extend the system beyond the Site boundary. Developments should select energy systems on the following hierarchy:

a. connection to existing heating or cooling networks
b. site wide CHP network
c. communal heating and cooling

Where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7: Renewable Energy

Policy 5.7 requires that developments should provide a reduction in expected CO_2 emissions through the use of on-site renewable energy generation, where feasible.

Policy 5.9: Overheating and Cooling

The GLA have produced a 'Domestic Overheating Checklist' (Appendix 5 of the 'Energy Planning' guidance) for use early in the design process to identify potential overheating risks and to trigger the incorporation of passive measures within the building envelope. The 'Energy Planning' guidance document also includes an update to the guidance on compliance with overheating policy that design teams should be aware of when undertaking risk analysis and thermal comfort modelling for dwellings.

It is the GLA's expectation that dynamic thermal modelling should be undertaken to determine overheating risk and demonstrate compliance with London Plan Policy 5.9. This should be in addition to the Building Regulations 'Criterion 3' assessment of heat gains in summer months.

The GLA has set out that dynamic modelling should be carried out in accordance with the guidance and data sets in CIBSE TM49 'Design Summer Years' for London (2014) using the three design weather years as follows:

- 1976: a year with a prolonged period of sustained warmth.
- 1989: a moderately warm summer (current design year for London).
- 2003: a year with a very intense single warm spell.

For developments in high density urban areas (e.g. Canary Wharf) and the 'Central Activity Zone' the 'London Weather Centre' data set should be used. In lower density urban and suburban areas the 'London Heathrow' dataset should be used. These data sets have been adjusted to account for future climate effects.

The modelling should also consider the additional guidance contained in CIBSE TM52 'The Limits of Thermal Comfort: Avoiding Overheating in European Buildings'.

The London Plan – Draft for consultation, December 2017

A draft of the proposed new London Plan has been published for consultation. The policies are yet to be adopted but the changes pertinent to an energy strategy for a non-residential development are set to shift substantially if adopted. The notable policy carbon emission targets are as follows:

- Non-residential developments are to target zero-carbon (annual regulated energy)
- 35% carbon saving must be from on-site reduction measures
- 15% carbon saving must be from energy efficiency measures
- Any carbon emissions shortfall will need to be offset by making a carbon offset payment to the Local Authority and the carbon offset price is under review and expected to be updated

The proposed policy targets have not been used to determine the energy efficiency and carbon offset payment calculations reported in this energy strategy.

GLA Sustainable Design and Construction SPG (April 2014)

This SPG provides more detailed guidance to aid implementation that cannot be covered in the London Plan. It updates the standards that were developed for the Mayor's SPG on Sustainable Design and Construction in 2006 and identifies these as priorities for the Mayor. The SPG provides guidance and practical advice for those designing schemes including architects, developers and engineers as well as those developing planning policy and neighbourhood plans.

To support the policies in the London Plan the Sustainable Design and Construction SPG includes guidance on:

- energy efficient design
- meeting the carbon dioxide reduction targets
- decentralised energy
- how to offset carbon dioxide where the targets set out in the London Plan are not met
- retro-fitting measures
- support for monitoring energy use during occupation
- an introduction to resilience and demand side response
- air quality neutral
- resilience to flooding
- urban greening
- pollution control
- basements policy and developments
- local food growing

London Borough of Richmond upon Thames Local Plan

Local Plan (2018)

LBR's Local Plan was adopted in July 2018. The Local Plan replaces the previous Local Plan as well as the Local Development Management policies. Key policies relating to energy and sustainability are summarised below.

Policy LP 1 Local Character and Design Quality

The council will require all development to be of high architectural and urban design quality. The high quality character and heritage of the borough and its Villages will need to be maintained and enhanced where opportunities arise. Development proposals will have to demonstrate a thorough understanding of the site and how it relates to its existing context, including character and appearance, and take opportunities to improve the quality and character of buildings, spaces and the local area.

Policy LP 8 Amenity and Living Conditions

Design and layout of buildings enables good standards of daylight and sunlight to be achieved in new development and in existing properties affected by new development.

Policy LP 10 Local Environmental Impacts, Pollution and Land Contamination

Development proposals should not lead to detrimental effects on the health, safety and amenity of existing and new users or occupiers of the development site, or the surrounding land. These potential impacts can include, but are not limited to, air pollution, noise and vibration, light pollution, odours and fumes, solar glare, solar dazzle and land contamination.

Policy LP 17 Green Roofs and Walls

Green/brown roofs should be incorporated into new major developments with roof plate areas of 100sqm or more where technically feasible and subject to considerations of visual impact. If it is not feasible to incorporate a green/brown roof, then a green wall should be incorporated.

Policy LP 20 Climate Change Adaptation

Developments will be encouraged to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property.

New developments should minimise the effects of overheating in accordance with the cooling hierarchy.

Policy LP 22 Sustainable Design and Construction

LP22A Sustainable Design and Construction

1. Developments of 1 dwelling or more, or 100sqm or more of non-residential floor space (including extensions) will be required to comply with the Sustainable Construction Checklist SPD.

2. Developments with new dwellings must achieve a water consumption of 110l per person per day for homes.

3. New non-residential buildings over 100sqm must achieve BREEAM “Excellent”

4. Change of use residential should meet BREEAM Domestic Refurbishment “Excellent”, where feasible.

LP22B Reducing Carbon Dioxide Emissions

1. All new major residential developments should achieve zero carbon standards in line with London Plan policy.

2. All other new residential buildings should achieve 35% reduction

3. All major non-residential buildings should achieve a 35% reduction. From 2019 all major non-residential should achieve zero carbon standards in line with London Plan Policy.

LP22D Decentralised Energy Networks

1. All new development required to connect to existing DE network where feasible (including planned DE networks operational within 5 years of development completion).

2. Major developments will need to provide an assessment of the provision of on-site DE networks and CHP.

3. Where feasible, major developments will need to provide on-site DE and CHP. Provision for future connection should be incorporated where required.

LP22E Retrofitting

High standards of energy and water efficiency in existing developments will be supported wherever possible through retrofitting.

Policy LP 23 Water Resources and Infrastructure

Water resources and supplies will be protected by resisting proposals that would pose an unacceptable threat. Proposals that seek to increase water availability or protect and improve water quality will be encouraged.

Policy LP 30 Health and Wellbeing

Developments that support the following will be encouraged:

- Sustainable modes of travel
- Access to green infrastructure
- Access to local community facilities, services and shops
- Access to local healthy food
- Access to toilet facilities open to all
- Inclusive public realm layout

HOARE LEA

SAM CARLSSON
SENIOR SUSTAINABILITY CONSULTANT

+44 20 3668 7248
samcarlsson@hoarelea.com

HOARELEA.COM

Western Transit Shed
12-13 Stable Street
London
N1C 4AB
England