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Planning Statement
Energy Assessment
10-11 Lincoln's Inn Fields

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Contents:

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Executive Summary
Energy Assessment
10-11 Lincoln's Inn Fields

About the Scheme:

The scheme is a refurbishment of a 6-storey office building. The development is located in London Borough of Camden and has a total Gross Internal Area of approximately 1551 m^2.

The only works to the external envelope will be the replacement of the ground floor windows, first floor bay windows to the front, new dormers to the 5th floor and a new ground floor rear façade.

Planning Policy

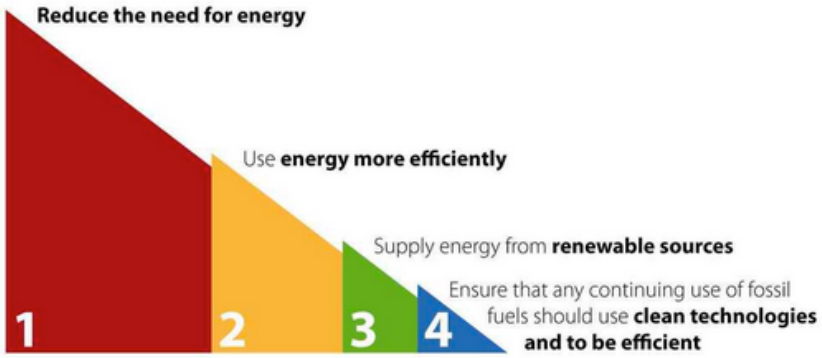
In accordance with the Sustainable, Design and Construction SPG, the scheme is required to achieve a 35% carbon reduction target (beyond the existing building) as set out in The London Plan Policy 5.2.

The scheme complies with the 2013 Building Regulations Part L and the minimum energy efficiency targets in the following documents have been followed:

- Refurbishment (Part L2B) – Consequential improvements to refurbished areas have been made to ensure that the building complies with Part L, to the extent that such improvements are technically, functionally, and economically feasible.

The Energy Hierarchy:

The proposed scheme has followed the energy hierarchy that is illustrated below:



The resulting energy savings are shown below in accordance with the GLA's Energy Hierarchy:

GLA's Energy Hierarchy – Regulated Carbon Emissions				
	Baseline:	Be Lean:	Be Clean:	Be Green:
CO_2 emissions (Tonnes CO_2/yr)	53.22	36.94	-	34.02
CO_2 emissions saving (Tonnes CO_2/yr)	-	16.29	-	2.92
Saving from each stage (%)	-	30.6	-	5.5
Total CO_2 emissions saving (Tonnes CO_2/yr)	19.21			

36.1% Total carbon emissions savings over the existing building achieved

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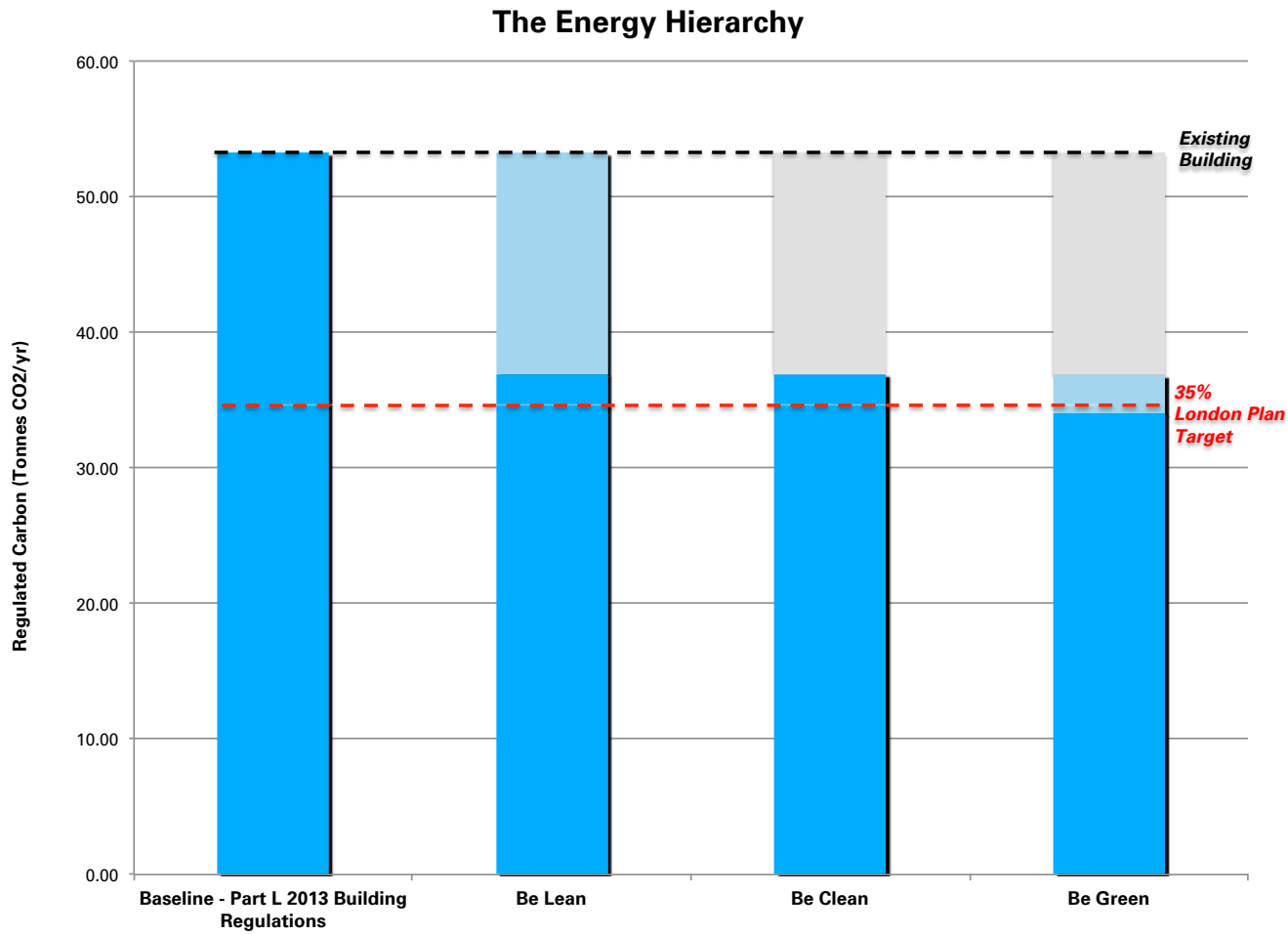
Executive Summary
Energy Assessment
10-11 Lincoln's Inn Fields

GLA's Energy Hierarchy – Regulated Carbon Emissions:

A graphical illustration of how the scheme performs in relation to Building Regulations and the Energy Hierarchy is shown below.

Figure:



Summary:

As demonstrated above the development will reduce carbon emissions by 30.6% from the fabric energy efficiency measures described in the 'Be Lean' section, and will reduce total carbon emissions by 36.1% over Building Regulations with the further inclusion of low and zero carbon technologies (ASHP).

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Executive Summary
Energy Assessment
10-11 Lincoln's Inn Fields

Shortfall in Emissions:

As set out in Policy 5.2 of the London Plan, if the development fails to meet the 35% target, the annual shortfall is determined by subtracting the overall regulated carbon dioxide savings from the target savings. The result is then multiplied by the assumed lifetime of the development's services (e.g. 30 years) to give the cumulative shortfall. The cumulative shortfall is multiplied by the carbon dioxide off-set price to determine the required cash-in-lieu contribution, as shown below.

Carbon Dioxide Emissions – Regulated (Tonnes CO_2/yr)		
	(Tonnes CO_2/yr)	%
Savings from 'Be Lean'-After energy demand reduction	16.29	30.6
Savings from 'Be Clean'-After CHP	0.00	0.0
Savings from 'Be Green'-After renewable energy	2.92	5.5
Total Cumulative Savings	19.21	36.1

Total Target Savings	18.63	35%
Annual Surplus	0.58	

	Annual Shortfall (Tonnes CO2/yr)	Cumulative Shortfall (Tonnes CO2)
Shortfall	-	-

Carbon offset contribution required: £0

Total Carbon Emissions:

As required by the GLA both the regulated and unregulated emissions of the development must be quantified and demonstrated. The total emissions for the scheme are shown below.

Carbon Dioxide Emissions – Regulated and Unregulated (Tonnes CO_2/yr)			
	Regulated Emissions	Unregulated Emissions	Total Emissions
Baseline: Part L 2013	53.22	27.42	80.65
Be Lean: After demand reduction	36.94	27.42	64.36
Be Clean: After CHP	-	-	-
Be Green: After Renewable energy	34.02	27.42	61.44

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Introduction
Energy Assessment
10-11 Lincoln's Inn Fields

Aim of this study:

The purpose of an energy assessment is to demonstrate that climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy. It also ensures energy remains an integral part of the development's design and evolution.

Methodology:

The methodology followed in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the document "ENERGY PLANNING: Greater London Authority guidance on preparing energy assessments (March 2016)"

Under the GLA's guidance and the London Borough of Camden's policy document CPG3, applications for major developments should be accompanied by an energy statement. The energy statement should provide information demonstrating how the energy hierarchy has been followed i.e. 'Lean, Clean, Green', including consideration of passive design and decentralised energy options such CHP/Community CHP.

This report has followed these documents and comprises the following components:

- BASELINE: A calculation of the existing building CO_2 emission baseline using approved software. The baseline assumes a gas boiler would provide heating and any active cooling would be electrically powered. The default boiler efficiency has been used, and minimum building regulation specifications have been used for the cooling, mechanical ventilation and lighting.
- LEAN: A calculation of the impact of demand reduction measures. For example, passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading, and active design measures such as high efficacy lighting and efficient mechanical ventilation with heat recovery.
- COOLING HIERARCHY: in accordance with Policy 5.9 of London Plan, measures that are proposed to reduce the demand for cooling have been set out such as minimisation of solar and internal gains and night cooling strategies.
- CLEAN: in accordance with Policy 5.6 of London Plan, this report has demonstrated how the scheme has selected heating, cooling and power systems to minimise carbon emissions. This comprises an evaluation of the feasibility of connecting to existing low carbon heat networks, planned networks, site-wide and communal heat networks and CHP.
- GREEN: in accordance with Policy 5.7 of London Plan, this report has conducted a feasibility assessment of renewable energy technologies. This comprised a site-specific analysis of the technologies and if applicable how they would be integrated into the heating and cooling strategy for the scheme.

Please note that these findings are currently subject to a detailed analysis from a building services design engineer and qualified quantity surveyor.

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Establishing Emissions: The Carbon Profile

Energy Assessment

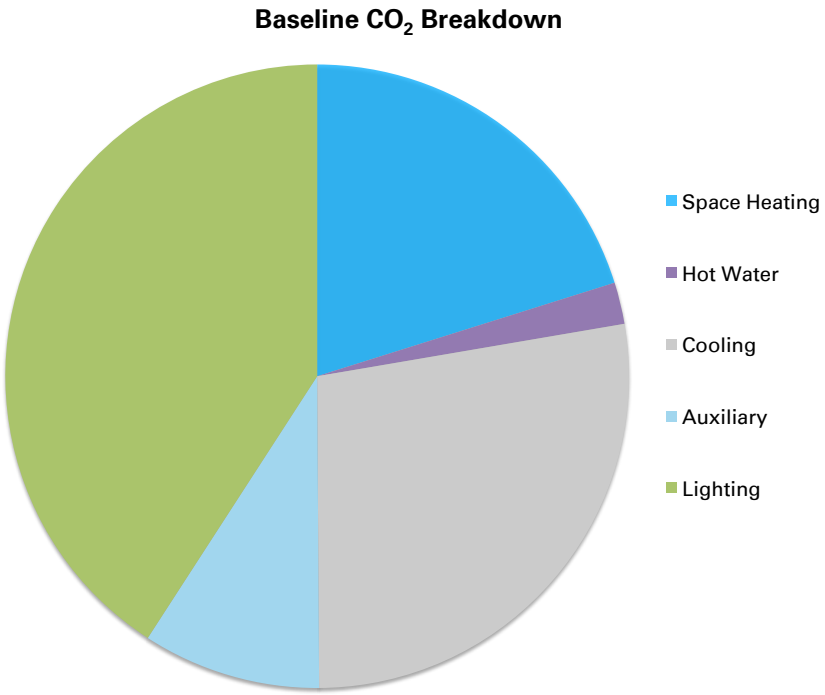
10-11 Lincoln's Inn Fields

Building Regulations Part L 2013 Minimum Compliance:

The 'baseline' carbon emissions for the development are 53.22 Tonnes CO_2/yr.

The pie chart below provides a breakdown of the scheme's baseline carbon emissions by system over the course of one year.

Carbon Emissions in Tonnes CO_2/yr	Heating	Hot Water	Cooling	Auxiliary	Lighting
	10.73	1.15	14.69	4.92	21.75



Overview:

The chart above shows that lighting is the primary source of carbon emissions, and cooling is the second largest, across the scheme as a whole.

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‘Be Lean’: Demand Reduction Measures

Energy Assessment

10-11 Lincoln’s Inn Fields

Be Lean - Summary:

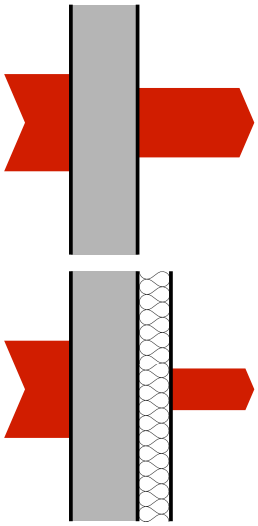
Demand reduction measures have reduced the scheme’s carbon emissions by 30.6 % over the existing building baseline.

Building Fabric Passive Design measures:

U Values:

Element	Minimum Building Regulations U-value W/m²K	Existing U-values W/m²K	Proposed U-value W/m²K
External wall (existing)	-	0.39	0.39
External wall (new)	0.28	0.39	0.28
Ground floor (existing)	-	0.58	0.58
Exposed floor	0.22	0.58	0.22
Roof (upgraded)	0.18	1.19	0.58
Roof (new)	0.18	1.19	0.18
Glazing (existing)	-	3.69	3.69
Glazing (new)	1.80	3.69	1.80

Please note that the roof U-value of 0.58W/m2K has been accepted by the Building Control Manager by an email on the 7th of September 2016.



Graphic illustrations of the heat flow through a wall and how is it minimized with low u-value (consequence of the additional insulation).

Airtightness:
The target air permeability for the scheme has been modelled as 25 m³/(hr.m²) @ 50 pa.

This will require careful attention to two key areas:

- Structural leakage
- Services leakage

Structural leakage occurs at joints in the building fabric and around window and door openings, loft hatches and access openings. There will also be some diffusion through materials such and cracks in masonry walls typically this is caused by poor perpends in blockwork inner leafs. Structural leakage is hard to remedy retrospectively. Good detailing at the design stage is therefore essential.

Services leakage occurs at penetrations from pipes and cables entering the building. These can be sewerage pipes, water pipes and heating pipes. As well as electricity cables there may also be telecommunication cables. Attention therefore, needs to be paid to sealing all penetrations during constriction.

Thermal Bridging:
The scheme has been indicatively modelled with the default thermal bridge y-values.

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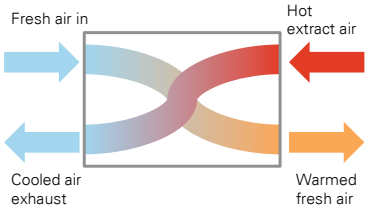
‘Be Lean’: Demand Reduction Measures

Energy Assessment

10-11 Lincoln’s Inn Fields

Energy Efficient Services Active Design measures:



Graphic illustration of a heat recovery unit, which exploits the extract hot air of the room to heat the cold supply air.

Heating:
For the ‘Be Lean’ scenario, heating will be provided by a gas boiler, featuring time and temperature zone control, delayed thermostat and a weather compensator. The heat will be distributed via air distribution system. The gas boiler will have a minimum efficiency of 91%.

Ventilation:
Balanced mechanical ventilation with heat recovery (80% efficiency) will be provided to the office spaces with a specific fan power of 1.5 W/l/s. Local extract ventilation will be provided to wet rooms with a SFP of 0.3W/l/s.

Air Conditioning:
Cooling will be provided by split systems, the systems will have an energy efficiency rating of 3.7.

Lighting:
High efficiency lighting with a lumen efficacy of 85lm/W has been specified for the development.

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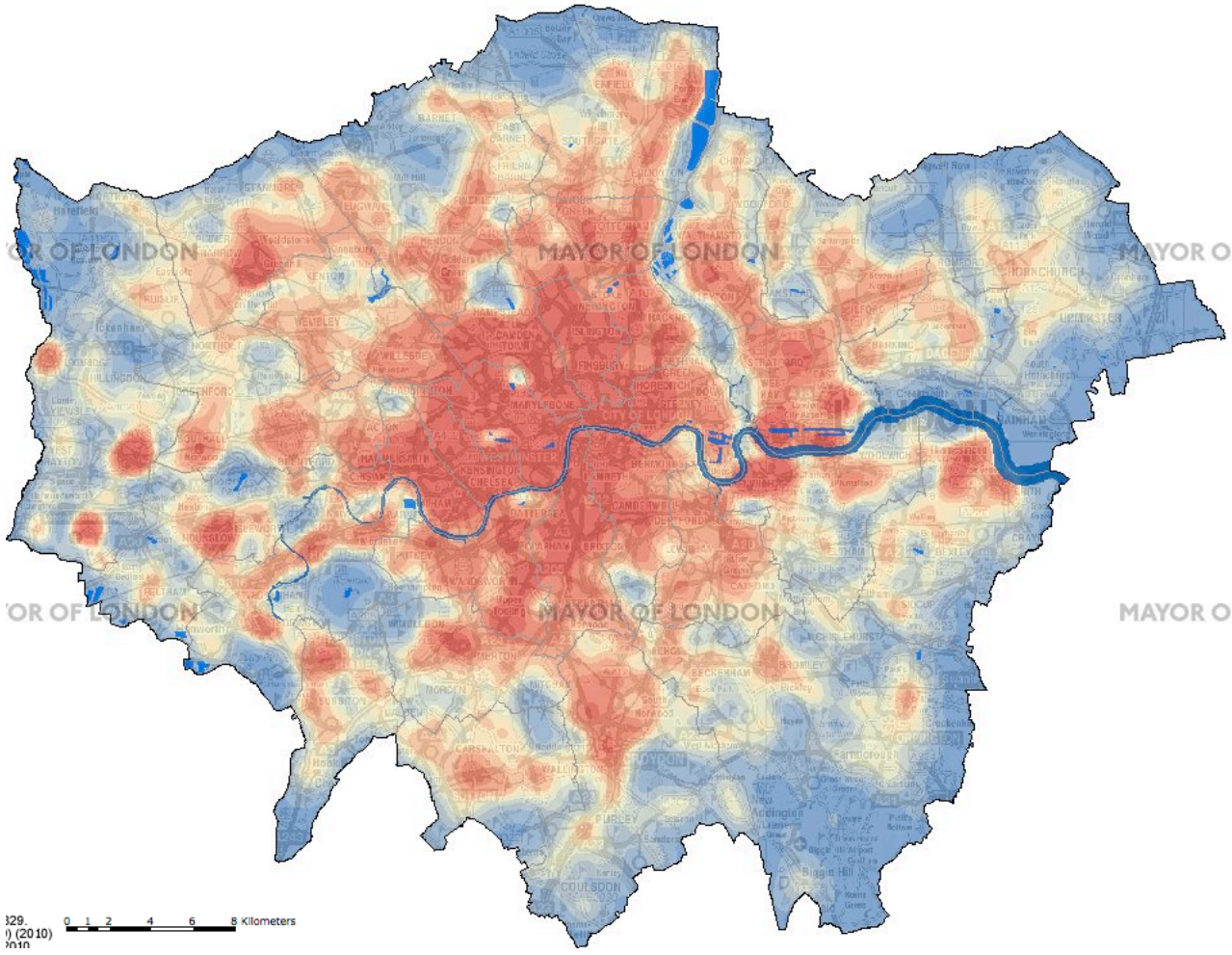
‘Be Clean’: Heating Infrastructure & CHP Energy Assessment 10-11 Lincoln’s Inn Fields

Heating Infrastructure including CHP:

Once demand for energy has been minimised, schemes must demonstrate how their energy systems have been selected in accordance with the order of preference in Policy 5.6B of London Plan. This has involved a systematic appraisal of the potential to connect to existing or planned heating networks and on site communal and CHP systems.

Heating Infrastructure:

The London Heat Map (shown below) has been consulted to establish the possibility of connecting to heating infrastructure.



Source: http://www.londonheatmap.org.uk/Mapping

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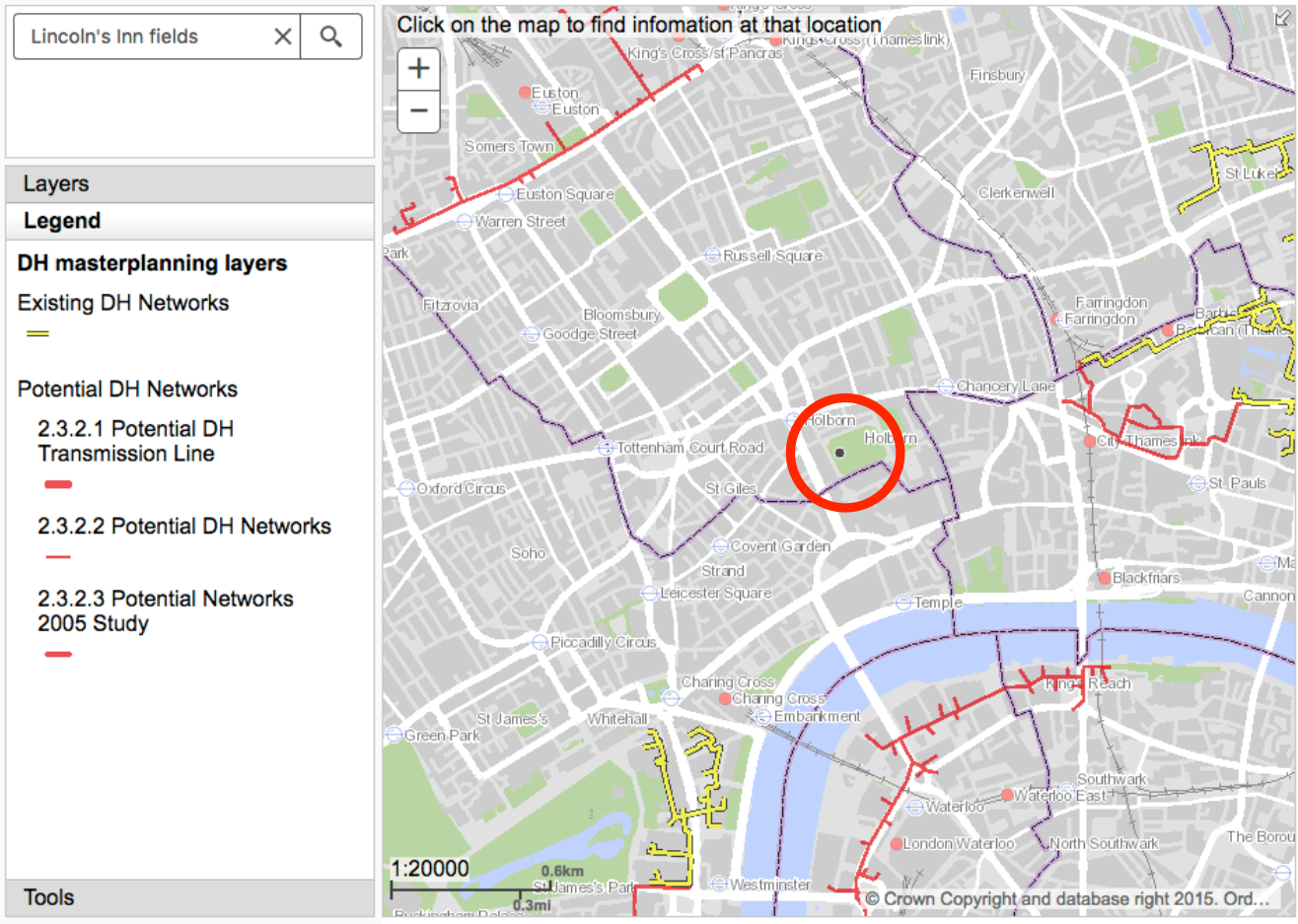
‘Be Clean’: Connection to Existing and Planned Networks

Energy Assessment

10-11 Lincoln’s Inn Fields

Existing and Planned Networks:

Existing networks:
A review of the London Heat Map demonstrates that there are no existing networks present within connectable range of the scheme. A map of the existing and potential networks in the scheme’s location is shown below.



There are no existing or potential networks within the vicinity of the scheme; therefore, a connection is not possible.

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‘Be Clean’: Site Wide Networks and CHP

Energy Assessment

10-11 Lincoln’s Inn Fields

Site-wide Heat Networks:	In accordance with section 8.2 of the GLA guidance for Energy Planning, where it is demonstrable that a site wide network is not feasible then an individual heating strategy can be implemented. A site wide network will not be adopted because the development on site will not have adequate density and local conditions are not favourable to centralised distribution. Therefore, it is considered that distribution losses would be relatively large and the effectiveness and carbon reducing potential would be undermined when compared to an individual servicing strategy.
Combined Heat and Power (CHP)	In accordance with section 8.3 of the GLA guidance for Energy Planning where connection to an area wide heat network will not be available in the foreseeable future i.e. 5 years following completion, or the development is of such a scale that it could be the catalyst for an area wide heat network, applicants should evaluate the feasibility of on-site CHP GLA guidance stipulates that small, or purely residential developments of less than 350 dwellings will not be expected to include on-site CHP. CHP systems are best utilised where there is a consistent and high demand for heat. Because of the small electricity supplies and demand of this scheme, a CHP installed to meet the base heat load would typically require the export of electricity to the grid. The administrative burden of managing CHP electricity sales at a small scale without an active energy service companies (ESCOs) is prohibitive for smaller operators of residential developments. The heat demand profile of this residential scheme is not suitable to CHP. The implemented fabric improvements from the ‘Be Lean’ scenario have also reduced the energy demand from space heating to hot water. For CHP systems to be economically viable they need to run for at least 5,000 hours per year. Therefore, a CHP system would most likely be oversized, and as a result less efficient and economic.

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‘Be Clean’: Cooling
Energy Assessment
10-11 Lincoln’s Inn Fields

Policy 5.9 Overheating and Cooling:

The aim of this policy is to reduce the impact of the urban heat island effect in London and encourage the design of spaces to avoid overheating and excessive heat generation, and to mitigate overheating due to the impact of climate change.

Where design measures and the use of natural and/or mechanical ventilation are not enough to guarantee the occupant’s comfort, in line with the cooling hierarchy the development’s cooling strategy must include details of the active cooling plant being proposed, including efficiencies, and the ability to take advantage of free cooling and/or renewable cooling sources.

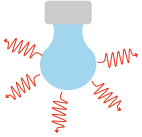
Where appropriate, the cooling strategy should investigate the opportunities to improve cooling efficiencies through the use of locally available sources such as ground cooling and river/dock water-cooling.

The Cooling Hierarchy:

Major developments should reduce potential overheating and reliance on air conditioning systems and demonstrate this with the Cooling Hierarchy:

1) **Minimise internal heat generation through energy efficient design**
2) **Reduce the amount of heat entering the building in summer (e.g. shading and fenestration)**
3) **Manage the heat within the building through thermal mass, room height and green roofs**
4) **Passive ventilation**
5) **Mechanical ventilation**
6) **Active cooling systems (ensuring the lowest carbon option)**

Avoiding Overheating Measures taken:



LED bulbs can emit 80% less heat compared to an incandescent bulb and their life span is up to 41 times more.

The following measures have been taken in accordance with the cooling hierarchy to reduce overheating and the need for cooling:

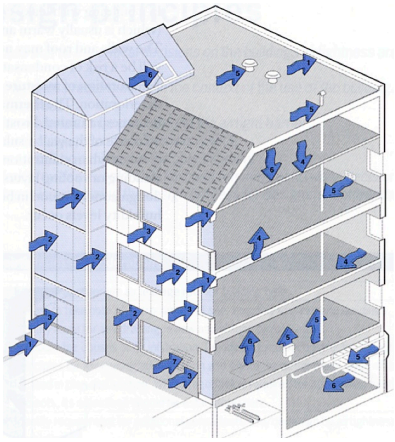
1) Minimise internal heat generation through energy efficient design

Internal heat gains have been minimised where possible. Energy Efficient appliances will help reduce internal heat gain and reduce the cooling requirement.

Energy efficient lighting will also be specified. LED lighting will be specified and a lumen efficacy of 85 lm/W will be targeted.

‘Be Clean’: Cooling
Energy Assessment
10-11 Lincoln’s Inn Fields

Avoiding Overheating Measures taken:



Examples of possible air leakage points in a building.

Examples of how the thermal mass absorbs heat during day and emits it during night.

2) Reduce the amount of heat entering the building in summer (e.g. shading and fenestration)

Direct solar gains will be controlled in the following ways:

- Solar control – all methods controlling solar gain to within tolerable limits have been considered. The reduced solar gain factors from low emissivity windows with a g-value of 0.4 for the ground floor and first floor (front façade) and a g-value of 0.30 for the 5th floor has been specified.

Heat transfer and infiltration has been controlled in the following ways:

- Insulation levels have been maximised where it is possible (new elements only) and the resulting u-values meet the requirements by Building Regulations. The build-ups therefore prevent the penetration of heat as much as practically possible. See the ‘Be Lean’ section of this report for target u values.

3) Manage the heat within the building through thermal mass, room height and green roofs.

The following measures have been specified to manage heat accumulation within the building:

- High thermal mass – exposed building fabric materials such as masonry or concrete have been utilised in the form of concrete floors and dense masonry external walls. These materials act as ‘thermal batteries’; they absorb heat gains during the day when the building is occupied and ‘store’ it for an extended period, thereby helping to stabilise daytime temperatures. At night this heat can be dissipated, which ‘resets’ the heating cycle.

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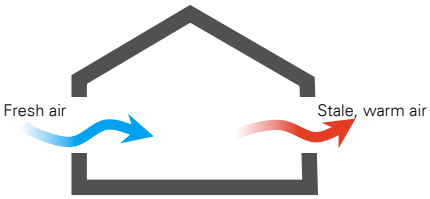
‘Be Clean’: Cooling
Energy Assessment
10-11 Lincoln’s Inn Fields

Avoiding Overheating Measures taken:



Typical building section demonstrating passive cross ventilation.

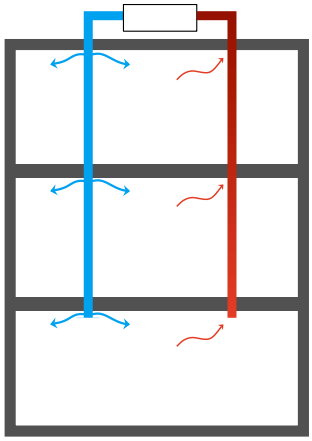
- Room heights – high ceilings are traditionally used in hot climates to allow thermal stratification so that occupants can inhabit the lower cooler space, and to decrease the transfer of heat gain through the roof. The existing building has floor to ceiling heights of approximately 2.5m. The roof has been upgraded and insulated to achieve a U-value of 0.58 W/m^{2}K, to minimise the penetration of heat through the roof.

4) Passive ventilation

Ventilation that does not use fans or mechanical system has been specified to reduce the cooling load.

- Openable windows are specified on the front façade of the 2nd to 4th floor of the building.

Avoiding Overheating Measures taken:



Typical building section demonstrating a simple method of supply and extract ventilation system.

5) Mechanical ventilation

Passive ventilation will not be adequate to cool the building to the required temperature. Mechanical ventilation will be utilised in the following forms:

- A mixed mode system will be implemented. This will be complimentary to the passive cooling measures taken. During summer months, mechanical ventilation using fans will circulate and remove hot air from the building. The building will also adopt a zoned design to allow natural ventilation where possible and mechanical ventilation where there are increased cooling loads.

- Fan powered ventilation: single point extracts will be used in WCs. A whole building system will be specified which will use air handling units with separate supply and extract fans. Heat recovery units will also be specified to reduce energy demand.

- The mechanical systems will have the following efficiencies which are in compliance with the Non-Domestic Building Services Compliance Guide:
  - ✓ Specific fan power of 0.3 W/l/s for extract fans
  - ✓ Specific fan power of 1.5 W/l/s for whole ventilation systems with heat recovery
  - ✓ Heat recovery efficiency of 80%

‘Be Clean’: Cooling
Energy Assessment
10-11 Lincoln’s Inn Fields

Overheating Risk:

According to the GLA guidance on preparing energy assessments (March 2016), a dynamic modelling to assess the risk of overheating should be carried out. The overheating risk assessment according to the dynamic thermal modelling, considering all the above-described passive measures, concludes that the development cannot meet the overheating requirements according to CIBSE TM52.

Therefore an active cooling system is crucial in order to retain the thermal comfort in the occupied spaces. The results of the overheating analysis considering all the described passive measures and the implementation of an active cooling system are shown in the following table. The whole overheating assessment can be found in a separate report.

Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Basement – Office	0.0%	0.00	0	PASS
Ground Floor – Entrance Lobby	0.0%	0.00	0	PASS
Ground Floor – Office	0.0%	0.00	0	PASS
1st Floor – Office	1.7%	1.61	0	PASS
2nd Floor – Office	3.9%	2.67	0	PASS
3rd Floor – Office	5.2%	3.01	0	PASS
4th Floor – Office	4.7%	2.91	0	PASS
5th Floor – Office	2.1%	1.63	0	PASS