Crosstree Real Estate Management Ltd

Camden Town Hotel

Energy Strategy for Planning

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Contents

1 Executive Summary

This report outlines the Energy Strategy that is prepared on behalf of Crosstree Real Estate Management Ltd and submitted in support of the planning application for the proposed hotel scheme located at Camden Town Hall Annexe, Argyle Street, London WC1H 8NJ.

The proposed development is for the remodelling, refurbishment and vertical extension of the existing building in connection with the change of use from offices to a hotel; along with associated highway, landscaping and public realm improvement works as described below.

The retention of significant parts of the existing structure and sub-structure is proposed due to the cost and environmental impact of demolition as well as the close proximity to the existing Piccadilly Line infrastructure beneath the site. Energy efficiency is considered as a key design driver for the development as a whole, although the retention of the existing structure imposes some limits the extent to which this can be applied.

In line with the Mayor's Energy Strategy and The London Plan, a progressive strategy will be used to reduce carbon emissions through:

- Use of passive architectural design to provide a building which is inherently low in energy consumption,
- Use of energy efficient systems and modes of operation,
- Consideration of connection to local district heating infrastructure,
- Consideration of production of energy with on-site renewables.

Key passive design measures that will be incorporated into the hotel include good building air tightness, the use of exposed thermal mass, the use of natural daylight and high performance building fabric elements.

Key energy efficient measures that have also been incorporated include reduced electric lighting loads together with good lighting controls, use of high efficiency heat recovery air plant and the use of efficient central plant and systems.

There is no suitable district heating scheme in the vicinity of the site, either current or imminently planned. Therefore, consideration has been given into developing a district heating network from the proposed hotel to serve the hotel, adjacent Town Hall, School and Estates as part of the CHP feasibility. This has concluded that a 100kW(thermal) CHP engine is the most cost effective selection to reduce carbon emissions, balanced with providing clean efficient energy.

An assessment has been made of the new and existing development to give a baseline regulated energy emissions level of **75.6 $kgCO_2/m^2$**, for the new building. The implementation of energy efficient measures and passive design features are estimated to reduce the emissions by approximately **28%** over the Part L2A Notional Target for the new build portion (based on regulated energy).

For the existing build portion, the use of high efficiency fit out measures i.e. lighting, air systems, etc…, it is estimated that a total emissions reduction of **36%** over the BER can be achieved on the existing building by upgrading the fenestration with higher performance glazing and with shower waste water heat recovery.

A calculation has been carried out that combines the assessment methods of the new build and existing build portions and when weighted for the relevant areas the emissions reduction is estimated as **35%**.

Therefore, an overall emissions reduction across the new and existing build portions is estimated at **35%** below the respective area weighted baseline emissions.

This Energy Statement is based on concept design information and currently available technology. This may be reviewed in the future in order to achieve the same objectives in terms of carbon emission reductions. It is envisaged that the final details of the energy strategy would be agreed before construction.

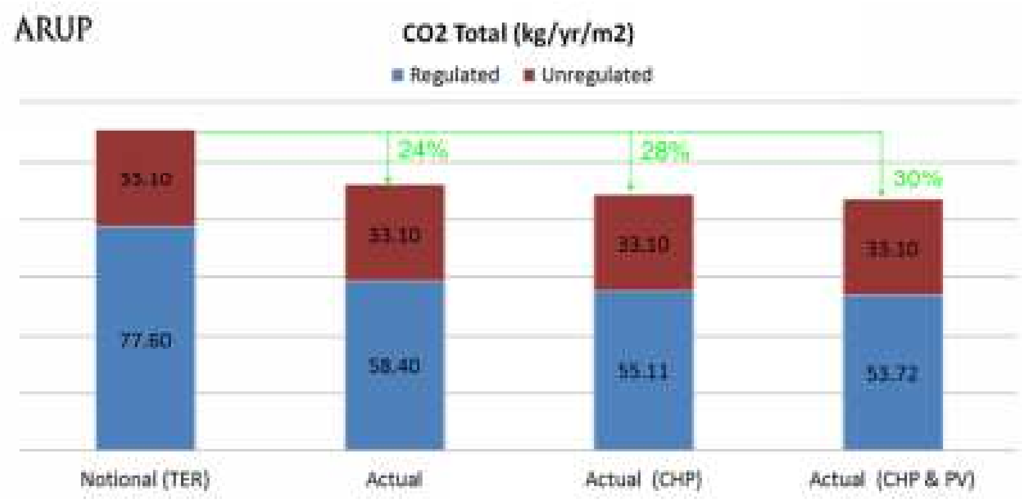


Figure 1 Illustration of 28% carbon emissions reduction for new build portion by technology, using Part L2A 2013 NCM and IES assessment against the (TER).

Figure 2 Illustration of 36% carbon emissions reduction for existing building by efficiency measure using Part L2A 2013 NCM and IES assessment against (BER).

2 Introduction

This report outlines the Energy Strategy that has been prepared on behalf of Crosstree Real Estate Management Ltd for the proposed hotel scheme located at Camden Town Hall Extension, Argyle Street, London WC1H 8NJ.

The proposed development is for the remodelling, refurbishment and vertical extension of the existing building in connection with the change of use from offices to a hotel; along with associated highway, landscaping and public realm improvement works as described below.

The development includes the replacement of the Ground Floor façade and retention of the 1st to 7th façade of the existing building. The existing external south west fire escape staircase is to be removed as part of the renovation to open up the public footpath to Euston Road from Tonbridge Walk.

Energy efficiency is one of the key design goals across all parts of this development. The energy performance of the proposed development has been assessed following the Mayor of London’s hierarchy which describes the following key stages:

- Reducing energy consumption through passive design and efficient building systems (“Be Lean”)
- Supplying energy efficiently (“Be Clean”)
- Using renewable energy (“Be Green”)

This energy statement is based upon an assessment at the current stage of the design process considering the technologies that are currently available. The estimated percentage improvements that are stated in the document are the minimum that will be targeted. As the detailed design develops the most appropriate technologies will be incorporated into the development to achieve the estimated emission improvement targets.

2.1 Energy Performance of Buildings

The energy performance and carbon emissions for the development have been considered against both regional and local planning guidance

2.2 The London Plan

The London Plan (2011) is the Spatial Development Strategy for London published by the Greater London Authority (GLA) and covers all 32 London Boroughs and includes the London Borough of Camden.

The Plan sets out the concept of the Energy Hierarchy which is described as follows:

1. Be Lean: Use Less Energy
2. Be Clean: Supply Energy Efficiently
3. Be Green: Use Renewable Energy

The Plan also contains a number of policies which are relevant to Energy.

- **Policy 5.2: Minimising carbon dioxide emissions**

"The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Non-domestic buildings: Year Improvement on 2010 Building Regulations

2010 – 2013 25 per cent

2013 – 2016 40 per cent

2016 – 2019 As per building regulations requirements

2019 – 2031 Zero carbon

"The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere."

- **Policy 5.3: Sustainable design and construction**

"Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process."

- **Policy 5.6: Decentralised energy in development proposals**

"Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites."

"Major development proposals should select energy systems in accordance with the following hierarchy:

1 Connection to existing heating or cooling networks

2 Site wide CHP network

3 Communal heating and cooling"

- **Policy 5.7: Renewable energy**

"Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible."

2.3 Camden Local Development Framework

Camden's Local Development Framework contains policies covering energy performance and carbon emissions of proposed developments, in particular through the core strategy policy CS13 and the development policies DP22. Development Policy DP22 is entitled "Promoting Sustainable Design and Construction" and Core Strategy policy CS13 is entitled "Tackling Climate Change through Promoting Higher Environmental Standards"

- **Policy CS13**

The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:

1. ensuring developments use less energy,

2. making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;

3. generating renewable energy on-site;

d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

Camden's Sustainability Planning Guidance (CPG3;2013) contains additional information to support the policies set out in the Camden Local Development Framework with sections 2 to 6 of the CPG3 guidance document specifically covering the energy consumption of developments.

2.4 'Be Lean' response

2.4.1 Existing Building

The energy performance of the existing portion of the building will be significantly improved by the replacement of the current building services installation with energy efficient technology in the fit-out and central plant. It is understood that there is no regulatory requirement to upgrade the existing building fabric, however, new glazing is proposed (to reduce emissions, address external acoustics and avoid condensation and discomfort). Amongst other efficient technologies shower waste water heat recovery is proposed, which will reduce the domestic hot water demand by approximately 30-40%, and reduce the boiler plant area.

The energy and carbon reduction benefits of these measures in the refurbished building over and above the existing give a significant benefit and according to the GLA's energy hierarchy are to be adopted before other technologies such as CHP.

2.4.2 New Building

The upper floors (and associated central plant) will be designed to exceed the requirements of the Building Regulations. The energy assessment will demonstrate the savings achieved above the baseline of the building regulations, demonstrating the reduction through efficient design.

The use of the upper floors as front of house accommodation requires large window areas for view and daylight. Fabric Efficiency Measures to counter the solar gain and heat loss via these transparent elements include the addition of; external vertical fins, blinds, solar control glazing and solid façade elements where possible to reduce cooling plant load.

2.5 'Be Clean' response – CHP

2.5.1 Context

The following CHP Feasibility Studies have been carried out:

1. A Study commissioned by Camden in 2009 to look into the size of a CHP required to serve the Town Hall and Town Hall Extension. (Carbon Trust, Warburton, 2009)

Recommendation:

Option 4: 238kWe CHP. Develop Camden Centre auditorium converted to offices and air conditioning in existing Town Hall to increase occupancy density. Feed heat to Town Hall, Camden Centre, Town Hall Annex, Argyle School, Tonbridge and Hastings Housing.

2. Later study commissioned by Camden in 2011 which looked into the feasibility of establishing a heat network between the old town hall and surrounding housing developments (excluding town hall extension). (Max Fordham, Wroot & Taylor, 2011)

Conclusion:

This found the heat network to be beneficial in terms of CO_2 reduction but unlikely to be financially viable.

As the second study did not include the heat load from the Town Hall Extension Camden Planning Officers have recommended that further feasibility studies are carried out to assess:

A. A shared heat source between the Town Hall and THX

B. A shared heat source between the Town Hall and THX including the possibility for extending the network further to the nearby residential developments.

2.6 'Be Green' response

Having assessed the relevant technologies for the hotel in section six of this report, PV panels have been found offer a 1.8% reduction in carbon emissions for the new build portion. However, a PV array can't be adopted in this development as it would have to be located above the chiller enclosure, which would increase the building height and exceed the proposed height limit. Solar Thermal panels could reduce carbon emissions by up to 4.5% of the new build portion; however, they are not adopted due to the conflicting spatial requirements on the roof level and would also conflict with the CHP system scheme proposed.

Due to minimal contribution to DHW load, unknown quantity of new piling, and complexity of integration with LTHW system, ground source heating and cooling may not be possible, and if so may not be technically or commercially viable for the existing office to hotel refurbishment.

3 Baseline Energy Demand and Carbon Emissions

The baseline emissions for the proposed development have been estimated using government approved IES-VE Compliance assessment software. These baseline estimates have considered the regulated energy emissions (i.e. those emissions covered by Building Regulations such as lighting, heating, cooling, ventilation energy use and fan & pump energy).

Baseline emissions have been separately estimated for the new and existing building areas of the development. The unregulated energy (i.e. those that are not covered by Building Regulations such as computer use within hotel rooms or energy used for housekeeping), has been assumed to be as modelled for the notional building.

3.1 Hotel – New Building

3.1.1 Methodology

The regulated energy emissions have been estimated by the use of IES Virtual Environment software (ver. 7.0.2); a government approved thermal modelling software package for the assessment of Part L Compliance. The baseline emissions rate is the Target Emission Rate (TER) for the building, which is equivalent to the emissions rate from a building that is compliant with Part L2 (2013). The calculation of the TER has been undertaken utilising the National Calculation Methodology set out in the 2013 Part L2 document. Appendix A3 contains the BRUKL report for the energy analysis undertaken. The baseline emissions for the unregulated energy are based upon the "Equipment" emissions as calculated by the IES Virtual Environment software (ver. 7.0.2). It is assumed that all guest room equipment will be electrical. The area of the new development considered for the energy compliance assessment is approximately **3343m²**.

3.1.2 Regulated Energy

Table 1 summarises the 'baseline' regulated energy consumptions and carbon emissions for the new development.

Regulated Energy Balance	Energy		CO_2 Emissions	
	kWh/yr	kWh/yr/m^2	kg/yr	kg/yr/m^2
LTHW Heating Energy	72,355	21.64	15,629	4.68
Chillers Energy	25,607	7.66	13,239	3.96
Lighting Energy	59,226	17.72	30,620	9.16
Pump / Fan Energy	108,357	32.41	56,021	16.76
DHW Energy - LTHW	666,167	199.27	143,892	43.04
DHW Energy - Electric	0.00	0.00	0.00	0.00
Carbon / Energy Total	**931,712**	**278.71**	**259,400**	**77.6**

Table 1: Baseline (Notional) Regulated Energy Consumption and Carbon Emissions for the New Development Portion

The proportion of regulated baseline carbon emissions attributed to each use are illustrated in Figure 3

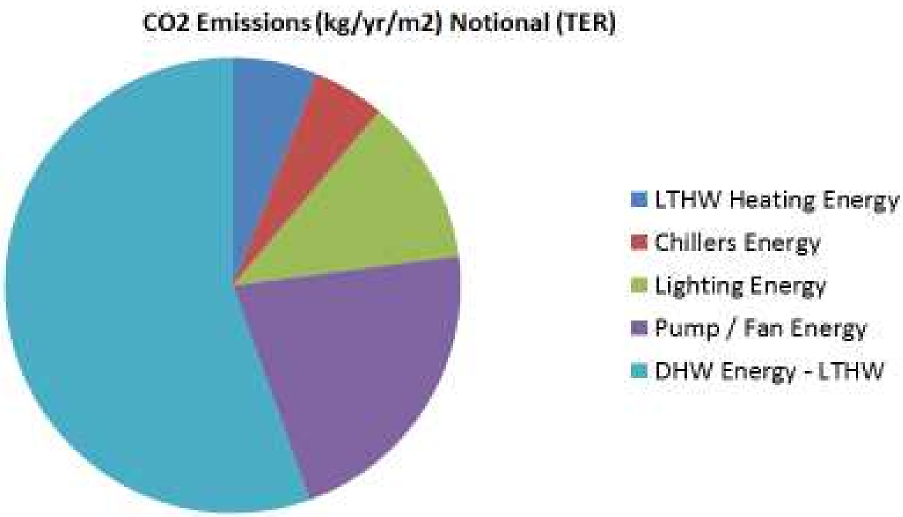


Figure 3 New Building Portion Baseline Regulated Carbon Emissions by Use

3.1.3 Unregulated Energy

Table 2 summarises the estimated 'baseline' unregulated energy consumptions and carbon emissions for the development based on the NCM Hotel energy profile and usage used within IES-VE modelling environment.

Unregulated Energy Balance	Energy		CO_2 Emissions	
	kWh/yr	kWh/yr/m^2	kg/yr	kg/yr/m^2
Carbon / Energy Balance	213,229	63.78	110,659	33.10

Table 2: Baseline Un-Regulated Energy Consumption and Carbon Emissions for New Building Portion.

3.2 Hotel – Existing Building

3.2.1 Methodology

The regulated energy emissions have been estimated by the use of IES Virtual Environment software (ver. 7.0.2); a government approved thermal modelling software package for the assessment of Part L Compliance. The baseline emissions rate is the Building Emission Rate (BER) for the existing building, which is equivalent to the emissions rate from a building that is operated as a hotel, utilising the National Calculation Methodology set out in the 2013 Part L2 document.

The baseline emissions for the unregulated energy are based upon the "Equipment" emissions as calculated by the IES Virtual Environment software (ver. 7.0.2). It is assumed that all guest room equipment will be electrical. The area of the new development considered for the energy compliance assessment is approximately **15100**m^2.

3.2.2 Regulated Energy

Table 3 summarises the 'baseline' regulated energy consumptions and carbon emissions for the existing development as a hotel, **with no upgrades, operated according to the NCM Hotel under Part L2 (2013).**

Regulated Energy Balance	**Energy**		**CO_2 Emissions**	
	kWh/yr	**kWh/yr/m^2**	**kg/yr**	**kg/yr/m^2**
LTHW Heating Energy	443,463	29.37	95,788	6.34
Chillers Energy	52,052	3.45	26,911	1.78
Lighting Energy	267,335	17.70	138,212	9.15
Pump / Fan Energy	464,050	30.73	239,914	15.89
DHW Energy - LTHW	3,054,802	202.30	659,837	43.70
DHW Energy - Electric	0.00	0.00	0.00	0.00
Carbon / Energy Total	**4,281,702**	**283.56**	**1,160,662**	**76.87**

Table 3: Baseline Regulated Energy Consumption and Carbon Emissions for the Existing Development Portion.

The proportion of regulated baseline carbon emissions attributed to each use is illustrated in Figure 4.

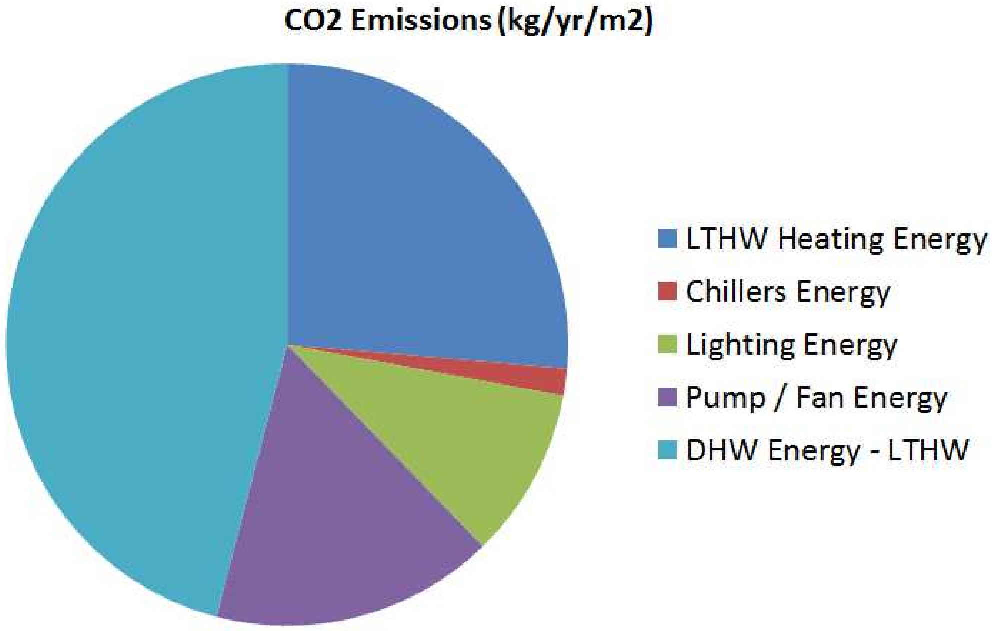


Figure 4 Existing Building Portion Baseline Regulated Carbon Emissions by Use

3.2.3 Unregulated Energy

Table 4 summarises the estimated 'baseline' unregulated energy consumptions and carbon emissions for the existing development.

Unregulated Energy Balance	**Energy**		**CO_2 Emissions**	
	kWh/yr	**kWh/yr/m^2**	**kg/yr**	**kg/yr/m^2**
Carbon / Energy Total	**1,162,247**	**76.97**	**603,206**	**39.95**

Table 4: Baseline unregulated Energy Consumption and Carbon Emissions for existing building portion.

4 Reduce Energy Demand

The first stage of the Mayor's energy hierarchy set out in The London Plan is to reduce the energy demand (i.e. to be lean)

4.1 Passive Design

Improving & optimising passive design is the most effective means for carbon reduction, ensuring the buildings are inherently low in energy use.

There are a range of energy-efficiency measures that will be applied to the new and existing parts of the development as an integral part of the design process:

4.1.1 Thermal Envelope Performance

The existing building façade comprises of 50mm insulated, solid concrete elements and single glazing housed in non-thermally broken metal frames. The design proposals are to replace the poor existing glazing with new higher performance double glazing on the existing facade.

Improving the U-value of the external glazing of a building reduces the transfer of heat from within a room to the outside and vice versa, so reducing the associated heating or cooling energy, required to serve the space.

The glazing in the new build element will be a double glazed type with thermally broken metal frames to further improve the overall energy performance.

4.1.2 Envelope Air Tightness

Air tightness is important to limit the amount of unwanted air infiltration into a building and improves the response factor of the building to external temperature changes. When the external temperatures are significantly lower (or higher) than the desired internal temperatures, infiltration increases the heating or cooling load of the building. The façade will be specified to achieve very good air tightness levels and careful design of the vertical and horizontal interfaces within the building envelope will be made. Good practice construction techniques will be employed and air tightness tests will be made on completion to ensure that finished construction achieves the design values. Air tightness targets which match current Building Regulations will be adopted as follows:

- New Build Elements – $3.0m^3/hr/m^2$ @ 50Pa
- Existing Built Elements – $3.0m^3/hr/m^2$ @ 50Pa

4.1.3 Minimising Solar Gain

4.1.3.1 New Build

The extent of glazing within the new façade design has been carefully considered to minimise unwanted solar gains whilst maximising the beneficial effects of natural day lighting. The extent of solar control on the top floor varies by orientation to take into consideration the differing prevailing solar exposure on each elevation and a recommended amount of shading on the top floor has been determined. Fixed vertical external shading is proposed for the development on the new floors in the form of vertical shading fins. It is anticipated that the top floor lounge will be provided with controlled blinds which will limit the effect of any solar gains, and improve the occupant's comfort. These blinds will also reduce any glare on the occupants during dining.

4.1.3.2 Existing Build

In the existing building, the façade is being retained along with the existing window aperture, which limits the scope of works to upgrading the individual glazing units. The replacement glazing units will have solar control performance properties to limit solar gains and blackout blinds or curtain recesses will be provided to allow occupant-controlled internal shading, which can further reduce summer solar gains.

4.1.4 Passive Solar Gains

4.1.4.1 Commercial Areas

Passive solar gains during the winter can be used to offset the fabric heat losses in the winter thereby reduce the heating load for the building. The active building controls will automatically adjust the amount of heating in each zone thereby reducing the amount of heating energy supplied.

4.1.5 Thermal Mass

The exposed thermal mass in the guest rooms will act as a store of heating and cooling energy. The thermal inertia that results is effective in dampening the peaks of the daily external temperature swing. This reduces the energy required to maintain comfortable internal conditions, particularly when the rooms are unoccupied.

In particular, the existing parts of the building are constructed of a heavy weight concrete construction, which is an ideal construction to exploit the energy reduction benefits offered by the use of thermal mass.

4.1.6 Ventilation

It is proposed that the buildings will be provided with natural ventilation through operable windows to allow comfort conditions to be achieved within each guest suite with outside air. This achieves the combined benefits of connecting occupants with the outdoors, providing high levels of fresh air, rapidly diluting indoor pollution levels, offering easy occupant control and saving energy.

It is also proposed in line with building regulations Part F that each guestroom will be provided with mechanical ventilation with a heat recovery ventilation system that will operate at a slightly enhanced rate to provide good indoor air quality for occupant comfort levels. Air intakes for the guest room air handling plant will be taken from 10th & Roof level. This will ensure that the best possible ventilation air will be provided to the guest suites.

Each guest room will still be provided with user operable windows for the purposes of purge ventilation, however, these windows will not be relied upon for general ventilation.

4.2 Energy Efficient Building Systems

Following the incorporation of the passive design measures described above, the building systems proposed for the development will have their energy consumption reduced by the use of energy saving devices and good practice control systems, discussed below

4.2.1 Building Systems

The proposed energy efficiency measures for the development will include the following:

- Low energy artificial lighting installation and controls,
- Variable speed drives on pumps and fans where appropriate
- Reduced specific fan power at central ventilation plant (1.6W/l/s)
- High efficiency natural gas fired boilers (96%)
- High efficiency turbo air cooled chillers (SEER > 5)
- High efficiency heat recovery devices to all ventilation plant (>70%)
- Shower Waste Water Heat Recovery (40% DHW Load with Storage Saving)
- CHP Unit providing ~40% of the heat demand of the new building portion (based on estimated Real(Benchmark) Building Load).

These measures will be implemented in a holistic approach to the overall building design and will be incorporated wherever feasible.

- High efficiency variable volume fan coil units are proposed for the double height lounge, ancillary retail units, front of house and some back of house areas as they offer the solution that can best be integrated into the narrow ceiling void structure and architectural proposals, as well as representing a demand controlled energy efficient solution to the spaces with varying occupancy patterns.
- High efficiency variable volume fan coil units are being considered for the hotel guest rooms with manual speed control set by the occupants to achieve the desired comfort conditions. Temperature set-point controls will be limited to +/- 2C to avoid unnecessary over-heating/cooling of the guest room.
- The final building services solution will depend upon the overall final design of the development and the overall final energy performance will need to be reviewed in the context of the final building services strategy for the building.

4.3 Implications of Renovating an Existing Building

As described earlier, the presence of the existing Piccadilly Tube line beneath the site requires the development to utilise all of the existing building structure and sub-structure. This allows the development to minimise additional structural interventions and sub-structure works which would be both carbon intensive as well as disruptive.

Whilst the overall proposals for the development strive to significantly improve the passive energy performance in many areas (for example improved air tightness and fabric thermal performance) the re-use of the existing structure does slightly constraint the extent of passive design measures that can be incorporated. Slight limitations include:

- The footprint of the existing building results in a deep plan guest rooms on the typical floors, which reduces the amount of floor plate that can be provided with natural daylight.
- The existing structure has potentially constrained floor to ceiling heights and require careful coordination of architecture, structure and building services solutions to maximise the achievable height of these spaces.
- As the new upper levels will be supported from the existing structure and substructure, there is a requirement to minimise the additional weight imposed by the new build elements. As a result this limits the extent of thermal mass which can be incorporated into the new floor levels.

The re-use of the existing structure also limits some low and zero carbon technologies as described in Section 6.

Hence, the energy savings presented in the remainder of this report therefore need to be read in context with the fact that constraints of the site require the re-use of the existing elements of the building, whilst noting a carbon benefit of not demolishing and rebuilding the existing structure.

4.3.1 Reduction in Energy Emissions

4.3.1.1 New Building

Table 5 below illustrates the predicted reduction in carbon emissions following the implementation of passive design features and energy efficiency measures. As can be seen, these figures illustrate that there may be a possible saving of **28**% from the baseline (regulated) energy emissions by using lean and clean technologies before considering green measures. PV (Be Green) provides a 1.8% improvement over the “Be lean & Be clean”.

System Breakdown	CO_2 Emissions (kg/yr/m^2)			
	Notional (TER)	Actual (BER)	(CHP)	(CHP & PV)
LTHW Heating Energy	4.68	6.30	6.30	6.30
Chillers Energy	3.96	4.02	4.02	4.02
Lighting Energy	9.16	6.18	6.18	6.18
Pump / Fan Energy	16.76	15.22	15.22	15.22
DHW Energy - LTHW	43.04	26.68	26.68	26.68
Regulated	77.60	58.40	55.11	53.72
Unregulated	33.10	33.10	33.10	33.10
	Percentage Improvement	24.73%	28.97%	30.77%

Table 5: Regulated Carbon Emissions for New Build Portion after Implementation of Energy Efficiency Measures.

Figures 5 & 6 present a breakdown of the energy efficiency measures by technology and policy respectively.

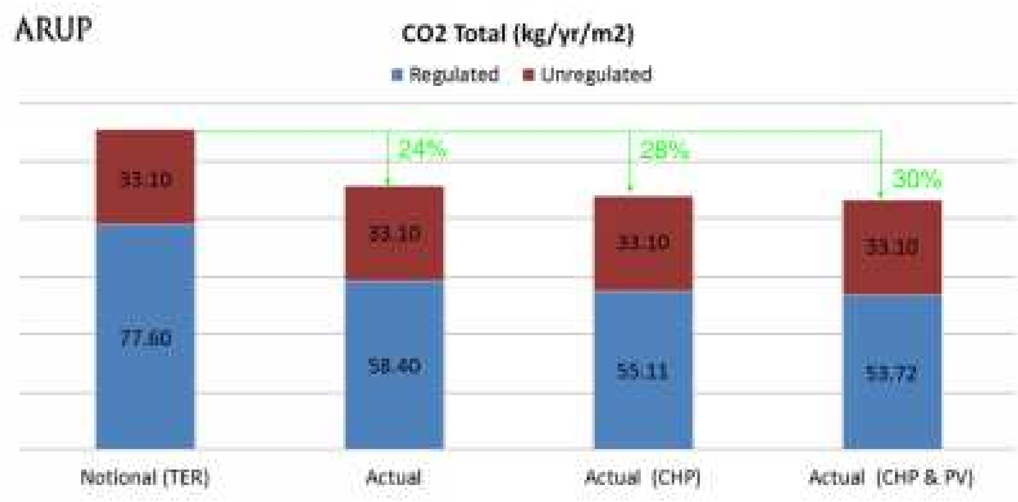


Figure 5 Carbon Emissions reduction for new build portion by technology.

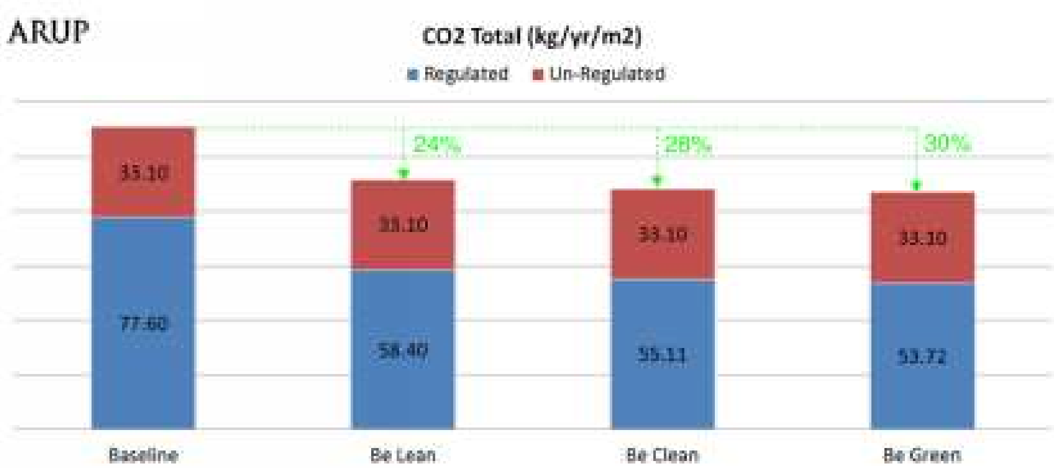


Figure 6 Carbon Emissions reduction for new build portion by planning policy.

4.3.1.2 Existing Building

Table 6 below illustrates the predicted reduction in carbon emissions following the implementation of passive design features and energy efficiency measures. As can be seen, Table 6 illustrates a potential saving of **36**% from the baseline (regulated) energy emissions with lean measures only i.e. without CHP or renewable measures.

System Breakdown	CO_2 Emissions (kg/yr/m^2)		
	Existing	Upgraded Windows	New Windows & SWHR
LTHW Heating Energy	24.75	6.34	6.34
Chillers Energy	1.46	1.78	1.78
Lighting Energy	9.22	9.15	9.15
Pump / Fan Energy	15.33	15.89	15.89
DHW Energy - LTHW	43.14	43.70	26.22
Total	93.90	76.87	59.39
	Percentage Improvement over Existing	18.14%	36.75%

Table 6: Regulated Carbon Emissions for Existing Build Portion after Implementation of Passive and Energy Efficient Measures.

Figure 7 Carbon Emissions reduction for existing build portion by efficiency measure.

5 Decentralised Heating and Power

This is the second stage of the energy hierarchy set out in policy (i.e. be clean), and the improvements to the buildings highlighted in the preceding sections have led to a reduction in the requirements for both space cooling, space heating and domestic hot water.

The percentage (%) of CHP contribution has been provided instead of power (kW) due to the discrepancy between measured benchmark data and the applicable Part L Energy Models.

The CHP % contribution has been based on the NCM Hotel Profiles provided in IES-VE, along with CIBSE TRY 2005 weather file data to determine the space heating load and DHW load, and therefore the % of power contributed to this load.

It will inevitably been seen that the real building operation may be higher in load than the Actual NCM building and effort has been made to size the CHP % to the Real building load.

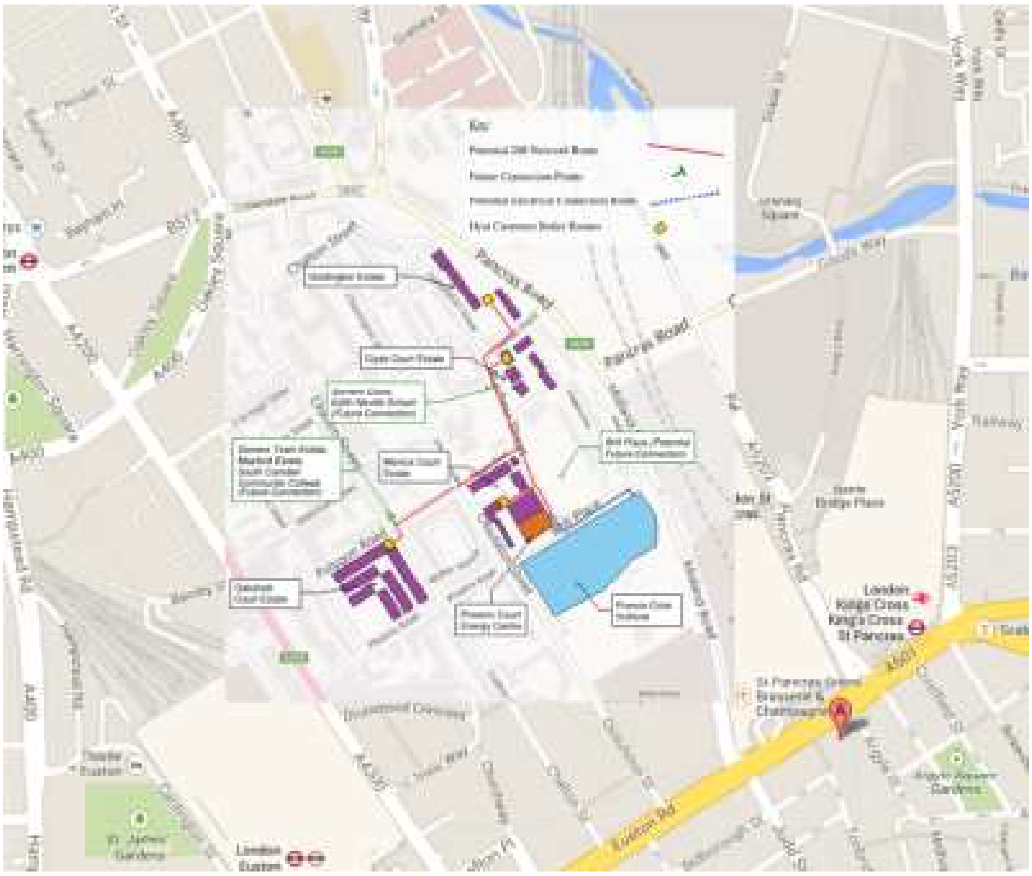
It should be borne in mind, therefore, that in any consideration of Combined Heating and Power the hourly heating and power loads provided, which may be expected in the proposed development, will be a relatively low percentage of the heating and power capacity, such that the unit doesn't unnecessarily dump heat. Also, the aim is to use all the CHP power production within the hotel is considered the primary objective as there is insufficient space to accommodate a step-up transformer to distribute to the grid, and it would not be cost effective.

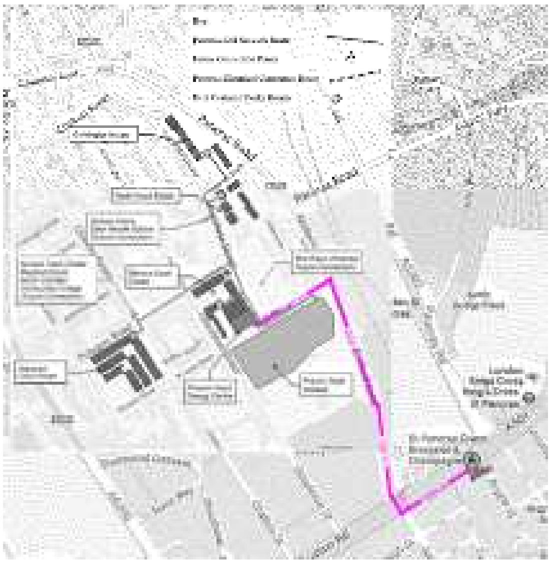
5.1 Connection to Existing Decentralised Energy Networks

The figures below illustrate the current district heating networks in the vicinity of the proposed development. As can be seen, the development is located within 1km of the heat networks situated around Camden Town Hall.

Camden policy requires the feasibility of connection to adjacent networks to be studied (King's Cross and Euston Road heat networks). We have information on the Euston Road network that suggests a connection would not be financially viable. Further information gathered from Argent suggests that the proximity, available capacity and likely cost of a connection to the King's Cross system is unlikely to be financially viable or acceptable in terms of the roadwork disruption in bringing pipework across the Euston Road), see figures below.

5.1.1 Euston Road Network





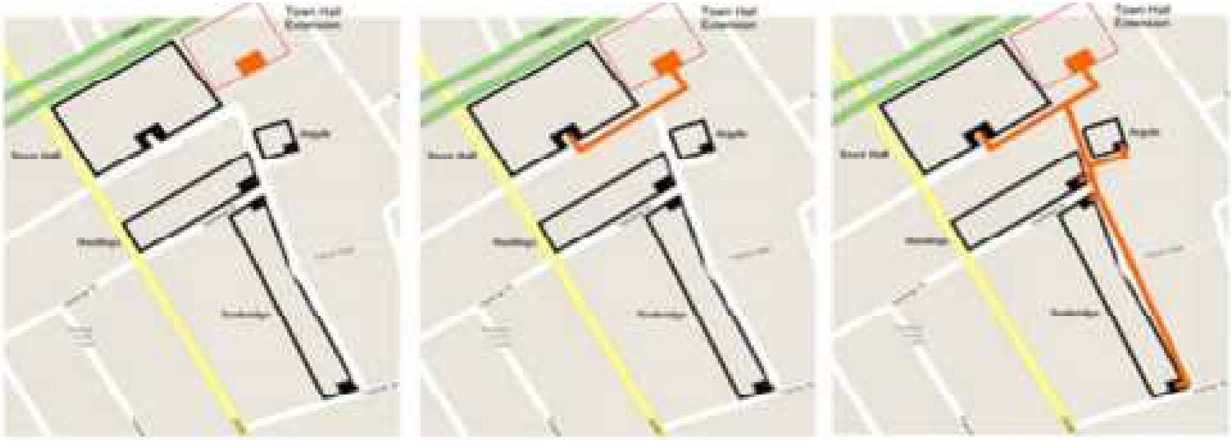
5.1.2 King's Cross Network

5.2 Combined Heat and Power (CHP)

Arup has conducted a feasibility study for using CHP and has investigated three possible scenarios based on the preliminary loads and analysis for supplying energy to the:

1. Hotel,
2. Hotel and Town Hall,
3. Hotel, Town Hall, and adjacent sites (school and housing).

The sizing would aim to meet a portion of the domestic hot water load i.e. part of the base load, and aim to fully utilise the electrical output on site. This is necessary to avoid expensive export arrangements in the form of an additional step-up transformer, with a resulting low export tariff, compared with offsetting the typical tariff for consumption on site via grid supplied electricity.



1 Hotel only

2 Hotel + TH

3 Hotel + TH + School + Estates (North connection only)

5.2.1 Conclusion

In terms of sizing, the recommended CHP selection is a unit to provide 5% of the heat capacity of the hotel heat load, i.e. 100kWth and to operate this unit for over 6000hrs. Refer to Appendix A2 for full details of this feasibility study which shows this selection to be the most cost and space effective option with the lowest simple payback.

The alternative scenarios have been found to have a longer payback period due to cost of the works to interconnect the loads, in particular the distribution pipework in the street to serve the school and housing.

Scenario	Size (kWt)	% of load	Pipe work (m)	CAPEX			Carbon Saving Tonne CO_2/yr.	Simple Payback (years)	20 Year NPV	OPEX
				CHP	System Cost	Total Cost				
Hotel	100	5	0	£70k	-	£70k	278	1	£860k	£65k
	150	7.5		£105k		£105k	345	1.5	£733k	£81k
	200	10		£140k		£140k	418	2.5	£603k	£98k
Hotel & Town Hall	150	20	75	£143k	£38k	£181k	427	2.5	£588k	£100k
	185	27		£164k		£202k	516	4	£449k	£121k
	200	29		£269k		£307k	555	6	£516k	£130k
Hotel, Town Hall, and adjacent	200	20	250	£140k	£516k	£656k	588	13	-£30k	£138k
	300	28		£210k		£726k	874	14	-£62k	£205k
	400	37		£280k		£796k	1157	14.5	-£94k	£272k

6 Renewable Energy

The third stage of the Mayor's energy hierarchy set out in The London Plan is to consider providing the remaining energy demand from renewable sources (i.e. be green)

6.1 Renewables Overview

There are many technologies which generate energy from renewable resources. The viable technologies for this site & for the hotel include the following:

- Photovoltaic
- Solar thermal for pre-heating DHW
- Ground source heating and cooling

6.1.1 Photovoltaic (PV) Panels

Photovoltaic are semiconductors which convert incident solar radiation (insolation) into electricity. They are an excellent technology in the urban context; there are many roofs in London which are ideal for PV.

The key to the efficacy of PV is regular cleaning & no shading. If shading occurs on an individual module, the electrical output of the whole array is reduced. This tends to mean that the optimum siting of modules should be completely unshaded. Where this is unavoidable, bespoke electrical wiring can be made to an array to ensure that the maximum output can be achieved even when particular modules are shaded.

There is predicted to be a significant electrical load within the hotel building and it could be practical to use the electricity generated from the PV panels within the building.

The development has identified an area of approximately 90m² that is potentially available for PV panels. This will be dedicated to the new building portion offering a carbon emissions reduction of around 1.8%, however it should be noted that due to the restricted planning height of the building the PV panels would be located above the proposed chillers plant enclosure, which would protrude above the planning height.

Verdict: Technically Feasible with a very small contribution, but not proposed due to height restriction.

6.1.2 Solar Hot Water Heating

Solar water systems harness solar energy to heat water, typically domestic hot water. This is undertaken by solar panels through which a fluid flows. Similarly with PV panels, these can be mounted on the roof or on the building.

Evacuated tube type modules provide a higher level of output. They are generally installed with buffer vessels to store the hot water generated, and they are also usually installed in conjunction with another method of hot water generation to provide back up during non-peak days. It is estimated that around 90m² of solar hot water panels could be located at roof level and laid flat on the roof, which conflicts with the FOH roof space.

Solar hot water systems are well suited for hotel developments where the demand for hot water per person is larger and more constant. However, for this development, the roof of the hotel is part of the key amenity space strategy for the development and therefore there are no suitable places for solar hot water panels if PV where to be located above the chiller plant enclosure.

The solar hot water panels could be considered technically feasible for the hotel if CHP wasn't installed and provide a carbon reduction of approximately 4.5% of the new build portion. As there are conflicting spatial requirements for the upper levels, it is proposed that solar thermal panels would not offer an effective carbon reduction technology due to the onsite CHP system being proposed.

Verdict: Technically feasible, not proposed due to height restriction and conflict with heat production from the CHP in summer.

6.1.3 Ground Source Heating and Cooling

Soil temperature is mainly influenced by the temperature of the atmosphere at ground level and by solar radiation. Below ground at around 2-3m depth, the temperature over the course of a year is approximately constant at the mean annual air temperature. For this development, it is likely to be around 12-13°C. As a result of these constant temperatures, the ground has the potential (via a heat pump) to provide both heating during the winter and cooling during the summer.

There are a number of ways in which the ground can be used: horizontal pipes in the ground; vertical boreholes, and putting the pipe work in piles. In all cases, the system is closed and the working fluid is pumped around. Open loop systems tend to use an aquifer deep underground to act as a heat sink; this technology is not widely used in the UK and various trial installations in London are not performing as designed.

In London, the ground make-up is such that clay is found in the tens of metres under the surface;

unfortunately clay does not allow for the dissipation of heat effectively as it does not allow the free movement of water, hence, heat cannot be effectively moved. The use of heat pumps should be such that the net heat which is extracted and re-introduced to the ground over a year is equal i.e. the amount of heating and cooling supplied by the technology should be equal.

Horizontal pipe arrays, open or close loop boreholes or energy piles all require an extensive amount of ground and foundation works to install. As one of the key aspirations for this development is to re-use the existing foundations, the development will not require extensive ground works, only additional reinforcement where necessary which may include new piles, therefore, there is no consideration of any scope for utilising ground source heating and cooling systems as part of the refurbishment.

Verdict: Not Feasible due to minimal contribution to DHW load, uncertainty of new piling scope, complexity of incorporation in any additional piling, and complexity of integration with LTHW system.

6.2 Conclusion

Both solar hot water heating and photovoltaic panels are technically feasible for the development, however, height restrictions make them difficult to integrate into the designated plant areas. The Solar Thermal panels can potentially offer a greater emissions reduction potential per m^2 of plant area, however, as has been identified, introducing Solar Thermal also reduces the benefit of using a CHP system.

7 Summary

An assessment has been undertaken, following the methodology set out in Part L 2013, to estimate the baseline regulated carbon emissions for the proposed hotel.

Passive design and energy efficiency measures (Be lean & Be Clean) in the form of upgraded windows and shower waste water heat recovery are proposed to reduce the emissions for the existing build portion. For the existing portion this equates to a total emissions reduction of **36%** against the (BER) based on regulated energy for using the NCM Hotel within IES-VE.

For the new build portion passive design and energy efficiency measures (Be lean & Be Clean) in the form of high performance façade and fenestration with solar control, shower waste water heat recovery and combined heat and power are proposed to reduce the emissions for the new build portion. This equates to a total emissions reduction of **28%** against the (TER) based on regulated energy for hotel use with IES-VE.

There is no suitable local district heating network within the vicinity of the site; however, it is proposed to install a CHP system within the hotel re-development, which can provide heat and power to the hotel.

A calculation has been carried out that combines the assessment methods of the new build and existing build portions and when weighted for the relevant areas the emissions reduction is estimated as **35%**.

Therefore, an overall emissions reduction across the new and existing build portions is estimated at **35%** below the respective area weighted baseline emissions.

A1 Correspondence with Decentralised Energy Networks

From: Benoit Dufour [mailto:Benoit.Dufour@argentllp.co.uk]
Sent: 11 November 2014 17:14
To: Jonathan Ward
Subject: RE: KX - DHN Connection

Jonathan

No problem at all.!

Pancras Road is very congested already with utilities including key gas network. Threading more utilities through it would be a real nightmare and a costly one!

Ben

Benoit Dufour
Project Manager

ARGENT

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From: Jonathan Ward [mailto:Jonathan.Ward@arup.com]
Sent: 11 November 2014 5:11 PM
To: Benoit Dufour
Subject: RE: KX - DHN Connection

Benoit
Merci Beaucoup.

Regards

Jonathan

Jonathan Ward
Associate Director

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t +44 20 7636 1531 **d** +44 20 7755 3460
www.arup.com

From: Benoit Dufour [mailto:Benoit.Dufour@argentllp.co.uk]
Sent: 11 November 2014 17:06
To: Jonathan Ward
Cc: Farrah Hassan-Hardwick
Subject: KX - DHN Connection

Jonathan

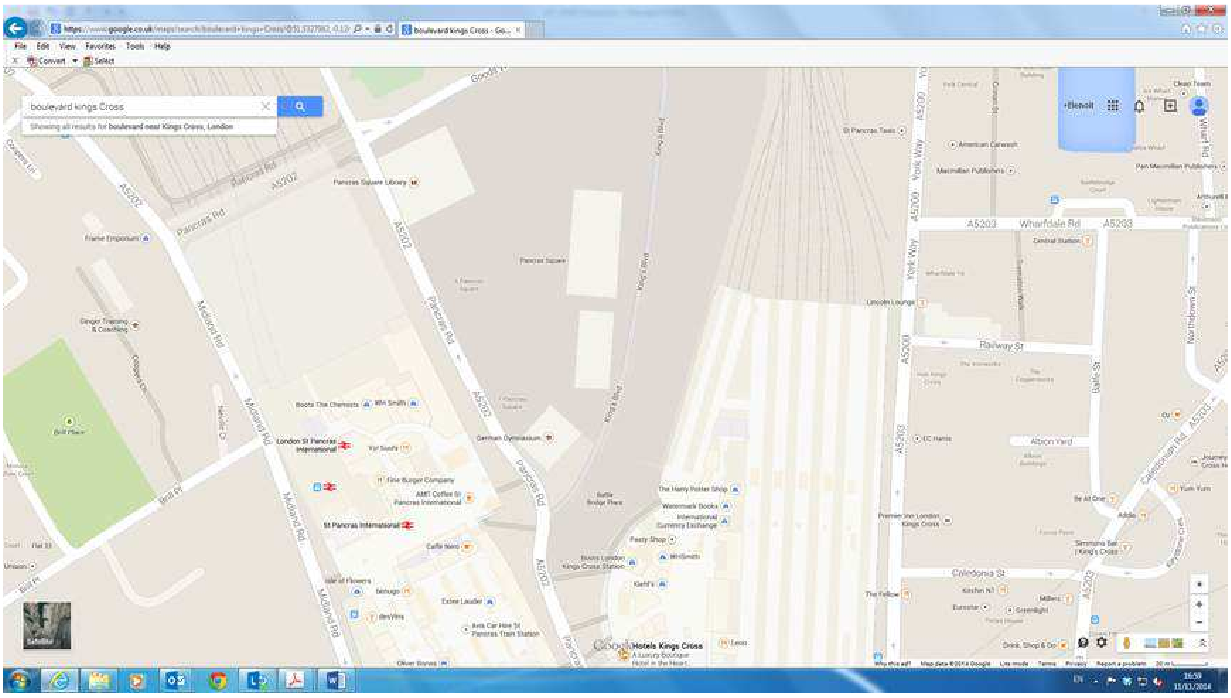
It was good to meet you this morning. As promised I have investigated a bit about offsite connections from the existing Energy Centre located within the King's Cross site.
As expected, the current capacity of the heating system is based on our sitewide demand and there is no capacity for offsite connections, other than anything we are obliged to do under our S106. There is no anticipated / obligated connection to the South of our site.

For your information, the current DHN is located within the King's Boulevard (slightly North of the German Gym). The bird cage we discussed this morning is located at the junction of Pancras Road and King's Boulevard.

If you need to demonstrate that this connection is not feasible based on costs, the civil works would need to include all trenching / pipework / re-instatement from King's Boulevard, down Pancras Road up to the junction with Euston Road and then crossing Euston Road to your site. Also, it is extremely likely that the length of DHN installed in King's Boulevard would not be of an appropriate size to serve your site; this would require a significant upgrade up to Goods Way / Granary Square.

Hope this helps for now.

Regards



Benoit Dufour
Project Manager

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A2 CHP Appraisal Report

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Project title	Camden Town Hotel	**Job number**	235190
cc		**File reference**	
Prepared by	Feras Al-Mukhtar Jonathan Ward	**Date**	15 December 2014
Subject	Camden Town Hotel CHP Appraisal		

1 CHP Study

1.1 Background

The following CHP Studies have been carried out in the past:

1. Study commissioned by Camden in 2009 to look into size of CHP required, serving the Town Hall and Town Hall Extension. (Carbon Trust, Warburton, 2009)

Recommendation: Option 4: 238kWe CHP. Develop Camden Centre auditorium converted to offices and air conditioning in existing Town Hall to increase occupancy density. Feed heat to Town Hall, Camden Centre, Town Hall Annex, Argyle School, Tonbridge and Hastings Housing.

Later study commissioned by Camden in 2011 which looked into the feasibility of establishing a heat network between the old town hall and surrounding housing developments (excluding town hall extension). (Max Fordham, Wroot & Taylor, 2011)

Conclusion: This found the heat network to be beneficial in terms of CO2 reduction but unlikely to be financially viable.

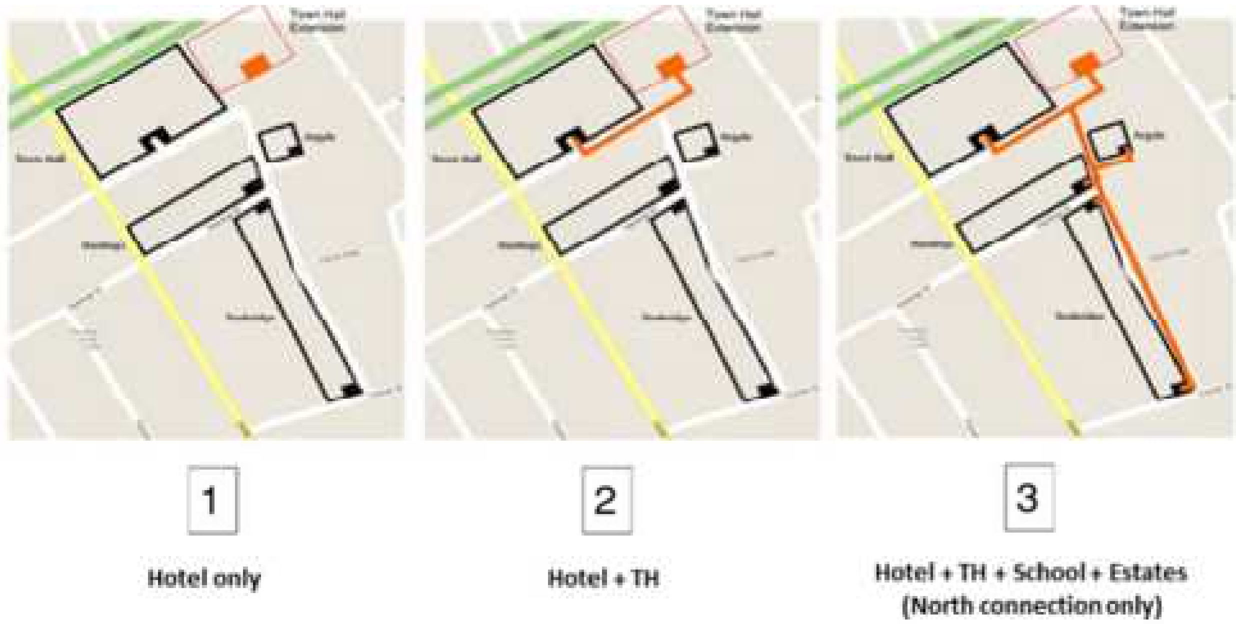
As the second study excluded the heat load from the Town Hall Extension Camden Planning Officers have recommended that further feasibility studies are carried out to assess:

A. A shared heat source between the Town Hall and THX

B. A shared heat source between the Town Hall and THX including the possibility for extending the network further to the nearby residential developments.

A feasibility study for CHP has been undertaken to consider the following options:

4. Boiler and CHP serving Hotel only Boiler and CHP serving Hotel and Town Hall



5. Boiler, CHP and network serving Hotel, Town Hall, and adjacent sites (school and housing)

1.2 CHP Strategy

Arup has investigated three possible scenarios based on the preliminary loads and analysis for supplying energy to the;

- Hotel only – **Base Case**, (Thermal & Electrical)
- Hotel & Town Hall via the basement (Thermal)
- Hotel, Town Hall, Argyle Primary School & Estates (Thermal)

The CHP's Electrical Output portion would ideally supply the hotel only, but for larger size CHP engines there is a risk that more complex (and less lucrative) export to the local grid might be required. Negotiation of this possible export to the grid has not taken place with UKPN yet.

1.3 CHP Sizing vs. CAPEX vs. Simple Payback

A selection of CHP sizes were investigated considering a base case of a £125k Heat Infrastructure Tariff, the results of which are tabulated below;

1.3.1 CAPEX / OPEX

Scenario	CHP Size (kWt)	% of heating capacity	Pipe work (m)	CAPEX			Carbon Saving Tonne CO_2/yr	Simple Payback (years)	20 Year NPV	OPEX
				CHP	System Cost	Total Cost				
Hotel	100	5	0	£70k	-	£70k	278	1	£860k	£65k
	150	7.5		£105k		£105k	345	1.5	£733k	£81k
	200	10		£140k		£140k	418	2.5	£603k	£98k
Hotel & Town Hall	150	20	75	£143k	£38k	£181k	427	2.5	£588k	£100k
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Hotel, Town Hall, School and Estates	200	20	250	£140k	£516k	£656k	588	13	-£30k	£138k
	300	28		£210k		£726k	874	14	-£62k	£205k
	400	37		£280k		£796k	1157	14.5	-£94k	£272k

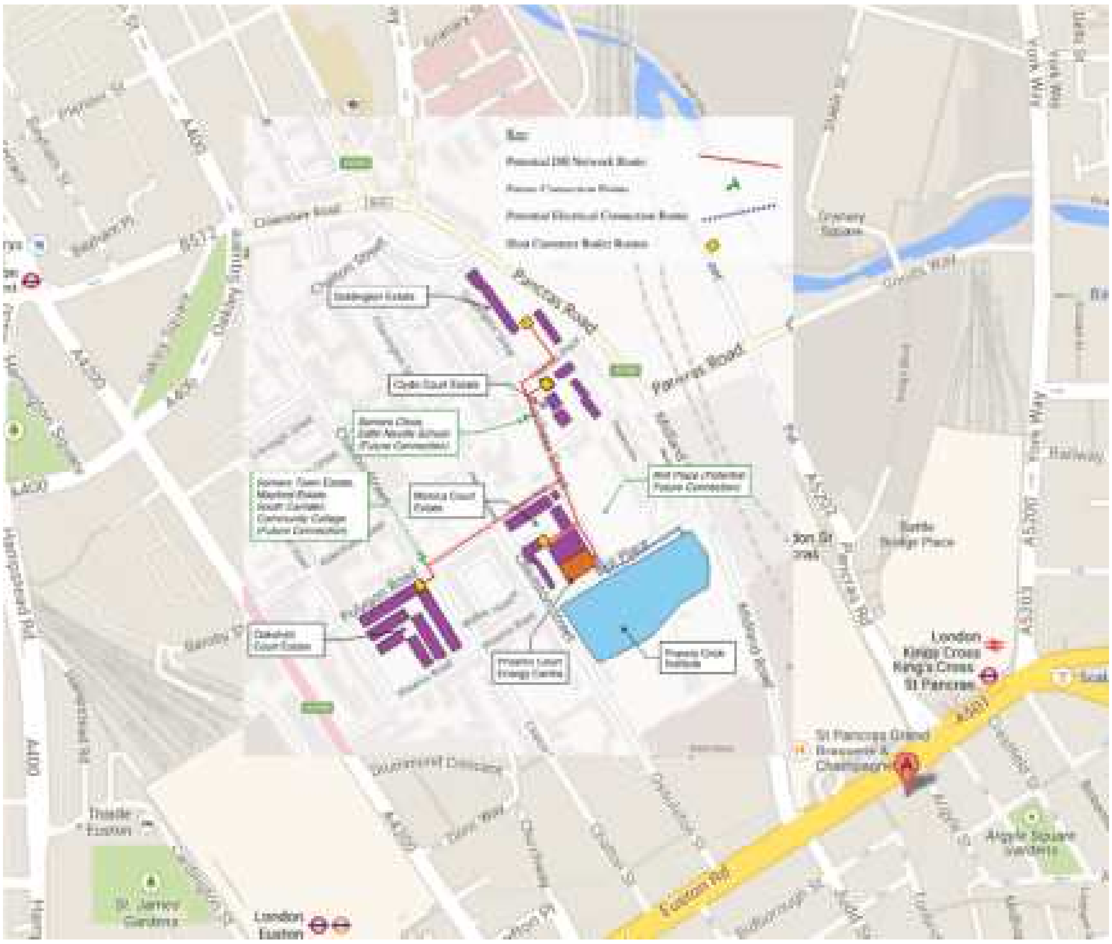
1.4 Conclusion

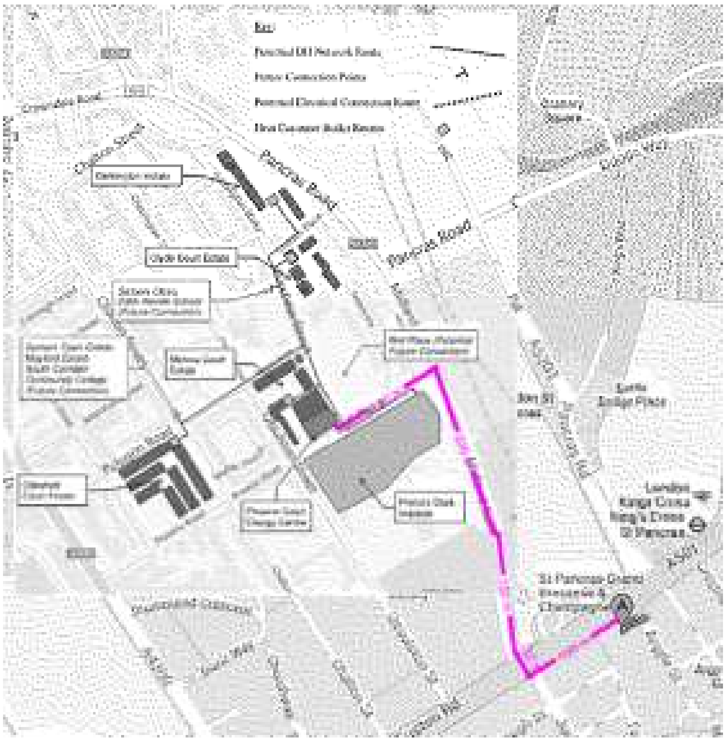
the above assessment shows that a reasonable selection to provide 5% of the heat capacity would be a CHP unit with a 100kW thermal output, operated for more than 6000 hours. This has a good business case and space impact of approximately 25m2 in the sub-basement.

1.5 Options for connecting to adjacent District Heating

Camden policy requires the feasibility of connection to adjacent networks to be studied (King's Cross and Euston Road heat networks). We have information on the Euston Road network that suggests a connection would not be financially viable. Further information gathered from Argent suggests that the proximity, available capacity and likely cost of a connection to the King's Cross system is unlikely to be financially viable or acceptable in terms of the roadwork disruption in bringing pipework across the Euston Road), see images below.

Euston Road Network





King's Cross Network

A3 New Build – BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

As designed

Date: Wed Nov 12 10:40:22 2014

Administrative information

Building Details

Address: Camden Town Hall Annex, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.2

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.2

BRUKL compliance check version: v5.2.b.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building should not exceed the target

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	77
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	77
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	75.6
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values which do not meet standards in the 2013 Non-Domestic Building Services Compliance Guide are displayed in red.

2.a Building fabric

Element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	08000012:Surf[1]
Floor	0.25	0.2	0.2	GF000002:Surf[3]
Roof	0.25	0.14	0.14	GF000002:Surf[4]
Windows***, roof windows, and rooflights	2.2	1.41	1.41	GF000002:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	3

Page 1 of 8

2.b Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- FCU Heating & Cooling - Guest Rooms

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	3.3	0	1.55	0.75
Standard value	0.91*	2.7	N/A	1.6	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

2- CAV with HR Fresh Air - Generic

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	3.3	0	1.55	0.75
Standard value	0.91*	2.55	N/A	1.6	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

3- Min. Fresh Air - Heated Space

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	0	1.5	0.75
Standard value	0.91	N/A	N/A	1.5	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

4- FCU Heating & Cooling with Fresh Air - Generic

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	3.3	0	1.55	0.75
Standard value	0.91*	2.7	N/A	1.6	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

5- CAV with No HR - Kitchens

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	3.3	0	1.55	-
Standard value	0.91*	2.7	N/A	1.6	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- DHW Guest Rooms & Other

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	-
Standard value	0.9*	N/A

* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.

2- CAV with No HR - Kitchens

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	-
Standard value	0.8	N/A

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0
Standard value	Not provided	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00_Outdoor_Bar	-	-	-	1.6	-	-	-	1.6	-	-	N/A
08_Guest_room_toilet areas	-	-	-	1.6	-	-	-	1.6	-	-	N/A
08_Guest_Room_Toilet_Area	-	-	-	1.6	-	-	-	1.6	-	-	N/A
08_Hotel_Rooms	-	-	-	1.6	-	-	-	1.6	-	-	N/A
08_Hotel_Rooms	-	-	-	1.6	-	-	-	1.6	-	-	N/A
09_Guest_Toilet_Area	-	-	-	1.6	-	-	-	1.6	-	-	N/A
09_Guest_Toilet_Area	-	-	-	1.6	-	-	-	1.6	-	-	N/A
09_Guest_Toilet_Area	-	-	-	1.6	-	-	-	1.6	-	-	N/A
09_Hotel_Rooms	-	-	-	1.6	-	-	-	1.6	-	-	N/A
10_Internal_Restaurant	-	-	-	1.6	-	-	-	1.6	-	-	N/A
10_North_Corner_Restaurant	-	-	-	1.6	-	-	-	1.6	-	-	N/A
10_North_Restaurant	-	-	-	1.6	-	-	-	1.6	-	-	N/A
10_VIP_Bar	-	-	-	1.6	-	-	-	1.6	-	-	N/A
10_West_Corner_Restaurant	-	-	-	1.6	-	-	-	1.6	-	-	N/A
10_West_Restaurant	-	-	-	1.6	-	-	-	1.6	-	-	N/A
10_South_Restaurant	-	-	-	1.6	-	-	-	1.6	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W] Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
00_Outdoor_Bar	-	100	-	1045
08_Guest_room_toilet areas	-	100	-	338
08_Guest_Room_Toilet_Area	-	100	-	338

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
08_Hotel_Rooms	-	100	-	990
08_Hotel_Rooms	-	100	-	1065
08_Lifts_&_Lobby	-	100	-	129
08_NE_Stairs	-	100	-	143
08_SE_Stairs_Lift	-	100	-	138
09_Guest_Toilet_Area	-	100	-	215
09_Guest_Toilet_Area	-	100	-	214
09_Guest_Toilet_Area	-	100	-	216
09_Hotel_Rooms	-	100	-	1617
09_NE_Lift&Lobby	-	100	-	126
09_NE_Stair	-	100	-	143
09_Plant_Air_&_Cooling	40	-	-	1790
09_SW_Stair&Lift	-	100	-	138
10_Internal_Restaurant	-	100	60	1222
10_Lobby_Circ	-	100	-	203
10_North_Core	-	100	-	157
10_North_Corner_Restaurant	-	100	60	201
10_North_Lifts_Circ	-	100	-	147
10_North_Restaurant	-	100	60	559
10_South_Core_Circ	-	100	-	174
10_VIP_Bar	-	100	60	182
10_West_Corner_Restaurant	-	100	60	113
10_West_Restaurant	-	100	60	401
10_Kitchen	-	100	-	1840
10_South_Restaurant	-	100	15	280

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00_Outdoor_Bar	NO (-21.6%)	NO
08_Guest_room_toilet areas	N/A	N/A
08_Guest_Room_Toilet_Area	N/A	N/A
08_Hotel_Rooms	NO (-54.8%)	NO
08_Hotel_Rooms	NO (-44.7%)	NO
08_Lifts_&_Lobby	N/A	N/A
08_NE_Stairs	NO (-45.4%)	NO
08_SE_Stairs_Lift	NO (-45.8%)	NO
09_Guest_Toilet_Area	N/A	N/A
09_Guest_Toilet_Area	N/A	N/A
09_Guest_Toilet_Area	N/A	N/A
09_Hotel_Rooms	NO (-57.2%)	NO
09_NE_Lift&Lobby	N/A	N/A
09_NE_Stair	NO (-45%)	NO
09_SW_Stair&Lift	NO (-41.7%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
10_Internal_Restaurant	YES (+39.3%)	NO
10_Lobby_Circ	NO (-87.3%)	NO
10_North_Core	YES (+10.6%)	NO
10_North_Corner_Restaurant	NO (-7.3%)	NO
10_North_Lifts_Circ	YES (+31.7%)	NO
10_North_Restaurant	NO (-2.1%)	NO
10_South_Core_Circ	N/A	N/A
10_VIP_Bar	NO (-45%)	NO
10_West_Corner_Restaurant	NO (-6.1%)	NO
10_West_Restaurant	YES (+5.6%)	NO
10_Kitchen	N/A	N/A
10_South_Restaurant	NO (-0.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	3343.2	3343.2
External area [m²]	3303.1	3303.1
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	2168.28	1724.09
Average U-value [W/m²K]	0.66	0.52
Alpha value* [%]	9.96	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
100	**C1 Hotels**
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	29.18	21.64
Cooling	7.77	7.66
Auxiliary	29.44	32.41
Lighting	11.96	17.72
Hot water	205.86	199.26
Equipment*	63.78	63.78
TOTAL**	**284.21**	**278.69**

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	204.41	171.66
Primary energy* [kWh/m²]	433.91	442.47
Total emissions [kg/m²]	75.6	77

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	111.2	70.1	34.8	4.2	25.7	0.89	4.58	0.96	5.7
	Notional	83.7	76.6	27	5.6	33.4	0.86	3.79	----	----
[ST] Constant volume system (fixed fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	0	821.9	0	69	67.6	1.16	3.31	0.96	5.7
	Notional	0.4	605	0.1	44.4	60.4	0.86	3.79	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	0	0	0	0	0	1.09	0	0.96	0
	Notional	0	0	0	0	0	0.86	0	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	148.9	136.1	46.6	8.3	33.2	0.89	4.58	0.96	5.7
	Notional	83.9	127.5	27	9.3	40.2	0.86	3.79	----	----
[ST] Constant volume system (fixed fresh air rate), [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	10.9	128.2	2.6	10.8	46.5	1.16	3.31	0.96	5.7
	Notional	24.9	119.6	8	8.8	27.4	0.86	3.79	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U_{i-Typ}	U_{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	08000012:Surf[1]
Floor	0.2	0.2	GF000002:Surf[3]
Roof	0.15	0.14	GF000002:Surf[4]
Windows, roof windows, and rooflights	1.5	1.41	GF000002:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

U_{i-Typ} = Typical individual element U-values [W/(m²K)]

U_{i-Min} = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

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