**Fox Court**
14 Gray`s Inn Road

The Trustees of Rockspring
Hanover Property Unit Trust.

Sustainability & Energy Statement

**SUSTAINABILITY & ENERGY STATEMENT**
**FOR**
**THE DEVELOPMENT AT FOX COURT**

Reference; 2160
Issue date: 16th January 2013
Status: rev 5,

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C O N T E N T S

# 1.0 INTRODUCTION

This Sustainability & Energy document has been prepared in support of a planning application, at “Fox Court”, 14 Gray`s Inn Road to meet the requirements of Camden Sustainability document CPG 3 Policies and London Plan 2011.

This review evaluates the available options for meeting a 25% improvement in carbon dioxide emissions on 2010 Building Regulations and achieving a 20% minimum carbon reduction through renewable technologies. The review will incorporate their cost effectiveness, environmental benefits, paybacks and provide recommendations which will be taken through to the next stage of the project.

As part of the Sustainability review, we have also considered a green roof and water usage including rain water harvesting.

The development is an extension to an existing office building, which consists of a ground floor retail unit and a further three floors of office areas. As part of the development an Atrium will be formed between the new and existing offices. The Atrium will not be a conditioned space and has been specifically designed for ambient ventilation only. The development is described in GMA Architects Design & Access statement issued separately by GMA Architect.

In line with the London Plan Policy 5.2, this energy assessment will demonstrate how the targeted reduction in carbon dioxide emissions will be met within the *framework* of the London Plan’s energy hierarchy, this assessment includes:-

1. A calculation of baseline energy demand and carbon dioxide emissions.
2. Proposals for reducing the energy demand and carbon dioxide emissions, through energy efficient design.
3. Proposals to further reduce carbon dioxide emissions through decentralised energy, where feasible.
4. Proposals to further reduce carbon dioxide emissions through on-site renewable technologies, where feasible.

The hierarchy adopted is as follows:

1. Adopting sustainable design principles (London Plan Policy 5.3)
2. To supply energy efficiently by prioritising decentralised energy (London Plan Policy 5.5 and 5.6)
3. The use renewable energy (London Plan Policy 5.7)

In addition to the above, the development has been designed to achieve a BREEAM rating of ‘Very Good’. This is covered under separate BREEAM documentation.

## 2.0 BUILDING MODELLING

Buildings in Camden account for 88% of Camden's overall carbon dioxide emissions.

These emissions result from the energy used within buildings. Therefore, the Council encourages all buildings to be as energy efficient as possible. Our approach is to implement the energy hierarchy as set out in the Core Strategy. The energy hierarchy is a sequence of steps that, if taken in order, will minimise the energy consumption in a building.

The baseline energy demand includes an assessment of all the energy consumed in the operation of the development, including regulated energy or 'fixed' consumption (covered by Building Regulations) for example, fixed lighting, heating and hot water systems, ventilation/cooling etc and non-regulated energy sources from 'plug-in' sources (not covered by building regulations) for example, electrical appliances, centralised IT (server room) systems, communications equipment.

As this is a major development it uses the Simplified Building Energy Model (SBEM) to calculate this data.

The energy statement identifies the total baseline energy demand and the carbon dioxide emissions of the development, consisting of an office building over three floors and retail outlet on the ground floor.

## 2.1 Results

Summary of SBEM energy consumption by end use [$kWh/m^2$], **Appendix A**;

| | **Actual** | **Notional** |
|---|---|---|
| Heating | 8.14 | 6.62 |
| Cooling | 13.11 | 10.9 |
| Auxiliary | 7.83 | 9.57 |
| Lighting | 34.4 | 35.37 |
| Hot Water | 2.35 | 2.73 |
| Equipment | 32.03 | 32.03 |
| **TOTAL** | **65.83** | **65.83** |
| **TOTAL EMISSIONS ($kg/m^2$ /annum)** | **30.9** | **30.9** |

## 2.2 Baseline and Carbon Reduction Calculations

The carbon emission baseline calculations for this development are calculated to be 30.9kg$CO_2$/$m^2$/annum. This calculation has been arrived at through the utilisation of Hevacomp. This is Government approved Software and the output delivered can be seen in **Appendix A.**

This equates to a total baseline 2010 Building Regulation Compliant Development to be 57,474 kg$CO_2$/$m^2$/annum (estimated area is 2480$m^2$)

Policy 5.2 of the London Plan - Minimising carbon dioxide emissions, introduces a carbon dioxide reduction target for new developments to make a 25% improvement on current 2010 Building Regulations:

In line with Policy 5.2, the carbon emission baseline calculations for the new office extension and CIBSE benchmark calculations for the retail space have been established, and are calculated to be 30.9kg$CO_2$/$m^2$/annum (see Appendix A).

The extension will consist of a three storey office building and retail outlet on the ground floor. The baseline TER with a 25% reduction in carbon emissions is as follows:

A 25% carbon reduction from the baseline would be $\frac{75}{100}$ x base line TER 30.9kg$CO_2$/$m^2$/annum = **23.18kg$CO_2$/$m^2$/annum**.

In line with Camden and London Plan policies, to meet reduction in Carbon Emissions by 25% based on photovoltaic technology;

= 30.9kg$CO_2$/$m^2$/annum - 23.18kg$CO_2$/$m^2$/annum = **7.72kg$CO_2$/$m^2$/annum**

Estimated floor area is 2480m2, Total annual $CO_2$ = **19,145kg$CO_2$/annum**.

From **Appendix B**, Photovoltaic requirement is 15.96kwhrs/m²/annum, estimated floor area is 2480m2, = 39580kwhrs/annum

Total annual $CO_2$ = **20,581 kg$CO_2$/annum**

The table below is a summary of the base line Target Emission Rate [TER] and the carbon reduction provided by the photovoltaics to satisfy Camden Sustainability policy and London Plan 2011.

| **Summary** [based on floor area 2480m²] | **Carbon Dioxide** | | **Energy generation** |
|---|---|---|---|
| | $kgCO_2/m^2/annum$ | $kgCO_2/annum$ | |
| Base Line TER $CO_2$ | 30.9 | 76,632 | |
| 25% reduction Base line $CO_2$ | 23.18 | 57,486.4 | |
| 25% Renewable energy requirement based on 2480m² of floor area | 7.72 | 19,145 | |
| Photovoltaic energy from iSBEM output | | | 15.96kwhrs/m²/annum, |
| Annual Photovoltaic* energy based on iSBEM output of 15.96kwhrs/m²/annum | 8.29 | 20,581 | 39,580kwhrs/annum, |
| Actual Photovoltaic energy installed 255m² | 8.4 | 20,832 | 40,063kwhrs/annum |

*** Emissions are based on an electrical conversion factor of 0.52kgCO$_2$/kWh**

## 3.0 ADOPTING SUSTAINABLE DESIGN PRINCIPLES

In line with the Camden Sustainability documentation all new developments are to be designed to minimise carbon dioxide emissions.

The most cost-effective ways to minimise energy demand are through good design, high levels of insulation and air tightness.

The highest standards of sustainable design are used to improve the environmental performance of the new development, therefore adapting to the effects of climate change over the life of the building.

### 3.1 Building Fabric Performance

The building "U" values proposed for this project are a significant improvement on building regulations Part L2A 2010. Although the "U" value for walls is slightly higher than Camden best practice, we have made an allowance for areas which join onto the existing building will have a higher "U" value.

The external roof "U" value used, whilst slightly higher than Camden best practice, we have made an allowance for the additional roof strengthening due to weight of the green roof increasing roof "U" value.

The table below highlights the improvement in the proposed building "U" values for this project compared against best practice:-

| *Building Fabric* | *Proposed "U" Value $W/m^2K$* | *Camden Best Practice "U" Value $W/m^2K$* | *Building Regulations Part L Limiting "U" Value $W/m^2K$* |
|---|---|---|---|
| *Walls* | **0.25** | **0.2** | **0.35** |
| *Windows* | **1.3** | **1.5** | **2.2** |
| *Roof* | **0.15** | **0.13** | **0.25** |
| *Floor* | **0.2** | **0.2** | **0.25** |

## 3.2 Air Leakage/Air Permeability

High standards of air tightness will reduce heat loss from the buildings by minimising air leakage and infiltration rates through gaps and openings. The office extension has a glass curtain wall with no openable windows, this will achieve an air tightness of less than 3 $m^3/h/m^2$ at 50 Pa.

Taking into consideration the nature of the project as an extension to an existing office building, our carbon emission calculations are based on air tightness rate of 5 $m^3/h/m^2$ at 50 Pa, acknowledging the requirement to pressure test the existing office areas.

Comparison of air tightness against Building Regulations 2010.

| Air Tightness | Proposed $m^3/h/m^2$ @ 50Pa | Camden best practice $m^3/h/m^2$ @ 50Pa | Building Regulations Part L 2010 $m^3/h/m^2$ @ 50Pa |
|---|---|---|---|
| Building Envelope | 5 | 3 | 10 |

## 3.3 Lighting

The new office areas will incorporate high efficient lighting using T5 fluorescents and LED lighting. All lighting will have movement sensors and daylight linking to external window areas to ensure office areas can benefit from natural light, thereby reducing energy consumption and subsequent increased carbon emissions.

All external lighting will have daylight sensors, time clock and key override facilities.

## 3.4 Hot Water Heating/LPHW

The office development has recently undergone some significant improvements; one of which was to upgrade the original heating system with new high efficiency gas boilers.

The new Gas boilers have a high efficiency of 95% in line with current standards and do not require any further upgrade.

## 3.5 Glazing

The curtain walling is designed to encourage and maximise the use of natural light to the office areas through to the Atrium,

The design will seek to minimise excessive solar gain utilising internal blinds [atrium side] provided as necessary.

It should be noted with the curtain walling providing a tight seal to minimise air leakage and with no openable windows, the office area will not benefit from natural ventilation.

The proposed Glazing Installation is manufactured by Kawneer AA100SSG high performance glazing providing a U value of 1.3W/m²k, which exceeds building regulations however provides a higher degree of air tightness using EPDM mouldings. Full details of glazing provided by GMA Architects in their planning submission.

## 3.6 Office Heating & Cooling

The new office areas on all three floors will have a forced air ventilation system, with air evenly distributed utilising duct work located in ceiling voids and discharged into the office space via ceiling mounted diffusers. Return air from the office space will be passed through an air to air heat exchanger which shall have an efficiency rate of over 60%, in line with current Building regulations for Non-domestic building Services compliance guide.

Fresh air will be provided using a central air handling unit at a rate of 12ltr/sec/person.

Office areas shall be temperature conditioned utilising fan coil units located in the ceiling voids. The fan coil units will be complete with both heating and cooling coils.

Chilled water shall be circulated from the existing central plant which has a seasonal Coefficient of Performance [COP] of 4. As part of a recent office refurbishment programme, the original roof mounted package Refrigeration Chillers were removed and replaced with more efficient package Chillers with a COP of 4.0.

LPHW heating to the Fan Coil Units shall be from the existing LPHW system, where the boilers have recently been replaced with high efficiency modules as part of recent upgrade.

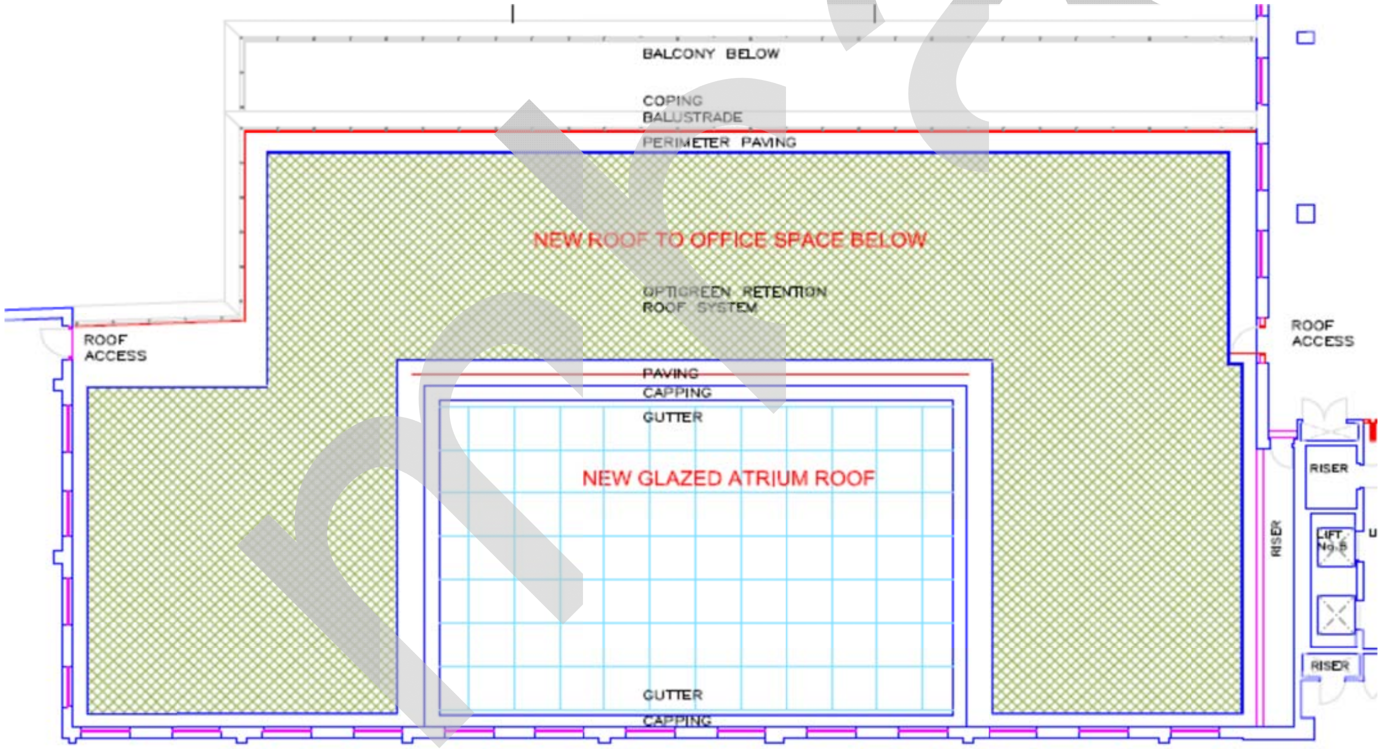
The Atrium is not conditioned and uses ambient air ventilation controlled using automatic louvers at high level to control air flow.

The retail unit on ground floor will have Air to Air heat pumps with an efficiency of 4.5.

### 3.7 Green Roof

In line with Camden`s Sustainability Policy CPG 3 and development Policy DP22 regarding “Brown, Green roofs and Green walls”. The potential for introducing a green wall has been discounted as the proposed extension will have a glass curtain wall.

As part of the new extension, the roof at fourth floor level will be constructed as an ecological feature, incorporating a green roof as indicated in drawing below.



Whilst the green roof is not designed as an accessible area, provision will be provided for maintenance. The green roof will also offer;-

- An environmentally enhanced landscape
- Visual impact will be a benefit for existing building tenants.
- Recycling of water, reducing water runoff and flooding
- Improvement of the building insulation performance
- Habitat creation.

The green roof proposed will be an Optigreen "Retention Roof" meander system with deep trays improves water retention enabling wider variety of plant species to be planted as detailed below;

The “Retention Roof” system has following characteristics;

a) System solutions with defined water retention
b) Water storage delay
c) Prevents accumulation of water in cases of ponding in heights up to 40mm
d) Weight 1.1 – 1.4 KN/m²
e) Layer height 120mm to 140mm
f) Vegetation forms are herbs, grass & sedum
g) Ease of maintenance

## 3.8 Water

In line with Camden`s Sustainability Policy CPG 3 and development Policy DP23 regarding “Water usage”. The new extension is designed to minimise water use and maximise the re-use of water where possible.

The development will use efficient water fittings which shall be achieved by:

a) Dual Flush Toilets in both new extension and upgrading of existing facilities
b) Waterless Urinals
c) Low flow taps and Shower heads
d) Provision of Water meters

<u>Rain Water Harvesting</u>

Rain water harvesting has been considered for this project, with a green roof on the fourth floor having water retention properties.

Unfortunately, water can only be collected from the $7^{th}$ floor roof of the existing building which has a total roof area available of 598m².

The calculation below identifies that the offices will operationally have a low water usage/consumption rate and any benefit gained from the collection of rainwater would be outweighed by the electrical consumption and high carbon emissions produced by the pump and associated equipment, calculation as follows;

| | |
|---|---|
| Roof area available | 598m² |
| Average annual rainfall for London | 584mm |
| Roof collection coefficient - this is based on flat felt roof | 0.3 |
| Estimated annual water collection based on a coefficient of 0.3 | 104,769ltr |
| Daily estimated water usage | 4000ltr |
| Annual water usage, estimated | 1,400,000ltr |
| Annual water costs based on 1,400,000 ltr x £2/m³ | £2,800.00 |

As the roof areas are at differing levels, combined with the fact that some areas also accommodate mechanical plant, the method of drainage from the roofs cannot be changed, the output from this is that the system would have a poor water collection coefficient.

From the above table, the rain water harvesting tank is designed for 10days storage, calculation is as follows;-

10 days storage = 4000ltr/day x 10days storage = 40,000ltr

40,000 ltr tank dimensions based on 2mtr high = 5mtr x 5mtr x 2mtr high

We have estimated that the installation of a rain water harvesting system, consisting of pumps, control equipment, components and storage tanks would be in the region of £ 55,000.00

In summary the potential impact that the installation of a rain water harvesting system would be as follows:

| | |
|---|---|
| Initial installation cost | £55,000.00 |
| Estimated annual pump running costs | £2,520.00* |
| Estimated annual pump carbon emissions based on 7.5kw pump [high pump head] | 16,380kg$CO_2$/Annum |

*Excludes maintenance and running costs for water treatment.

As the existing roof area has a small collection area for rain water harvesting, we would not recommend the installation of this system as the pump running costs and increased carbon emissions will exceed any potential water savings.

Grey Water Recycling

As part of this project grey water recycling was considered, using the same assumed low water usage as with the rain water harvesting analysis. The electrical energy usage and carbon emissions involved in collecting grey water outweigh any benefits from using grey water.

In summary the potential impact that the installation of a grey water recycling system would be as follows:

| | |
|---|---|
| Daily estimated water usage | 4000ltr |
| Daily estimated grey water usage for recycling approximately 20% of daily water usage | 800ltr |
| Estimated annual grey water recycled | 280,000ltr |
| Annual water savings based on 280,000 ltr x £2/m³ | £560.00 |

We have estimated that the installation of a grey water recycling system, consisting of pumps and necessary treatment components would be in the region of £ 35,000.00

In summary the potential impact that the installation of a grey water recycling system would be as follows:

| | |
|---|---|
| Initial installation cost | £35,000.00 |
| Estimated annual pump running costs including water treatment | £2,500.00 |
| Estimated annual pump carbon emissions based on 1.5w pump [high pump head] | 4,914kg$CO_2$/Annum |

We would not recommend that grey water recycling is installed, due to the fact that the operational costs associated with pump energy and the incumbent water treatment requirements will exceed any potential benefit from water savings. The increased energy generated by the pump and water treatment equipment will increase the carbon emissions for the project.

## 4.0 RENEWABLE ENERGY OPTIONS

There are a variety of renewable energy technologies that can be installed to supplement this development's energy needs.

Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies.

This section covers Stage 3 of the Energy Hierarchy. Stage 3 involves considering how renewable energy technologies can be used to further reduce the carbon dioxide emissions of a development.

### 4.1 Solar Water Heating

Solar hot water heating systems use heat from the sun to pre-heat domestic hot water.

The system requires solar panels on the roof, ideally south facing and not shaded, linked to hot water storage cylinders. If positioned on a flat roof then a 'A' frame will be required to angle the panels.

Certain systems utilise tracking systems meaning less panels are more efficient, use can be made from the sun's power from morning through to evening.

Flat panels are less effective than vacuum tubes, but more cost effective. Generally in offices the demand for hot water is very limited and is only a small contribution of the CO2 emissions.

### 4.2 Ground source heat pump heating/cooling

Ground source heat pumps can be used to extract heat from the ground by circulating a fluid through a system of pipes to a heat exchanger, which transfers the energy to the distribution network.

This can provide space heating and/or pre-heat domestic hot water. Ground source heat pumps have the advantage that they can act as a source of both heating and cooling for the buildings.

They are practically silent and there are no planning issues, GSHP's require no flues.

Ground source heat pumps are either open-loop (using circulation water in contact with the ground), or closed-loop. Slinky type systems take up more land than a borehole type system.

## 4.3 Air to Water Heat Pumps

Heat can also be obtained from the air, by air to water heat pump systems.

There are cost saving benefits against ground source as there is no need for boreholes.

They are practically silent and there are generally no planning issues, ASHP's require no flues as they are driven by grid electricity. The unit can supply hot water for under floor heating and hot water production with an electrical back up boost facility.

## 4.4 Biomass Heating

Typical biomass fuels are wood chips and wood pellets.

The carbon dioxide emitted from burning biomass is balanced by that absorbed during the fuel's production.

Biomass heating therefore approaches a carbon neutral process.

A fuel store is required and boiler flues are typically taller than a standard gas equivalent, with increased $NO_X$ emissions, therefore planning and land use should be considered.

## 4.5 Wind Power

Wind turbines use the wind's lift forces to turn a rotor, which in turn generates electricity.

It is only viable for the right site; generally an urban location makes wind non-viable. Planning is often an issue.

## 4.6 Combined Heat and Power (CHP)

A combined heat and power system can be utilised most effectively in a district system, generating heat (in the form of hot water/and electricity from an on site turbine.

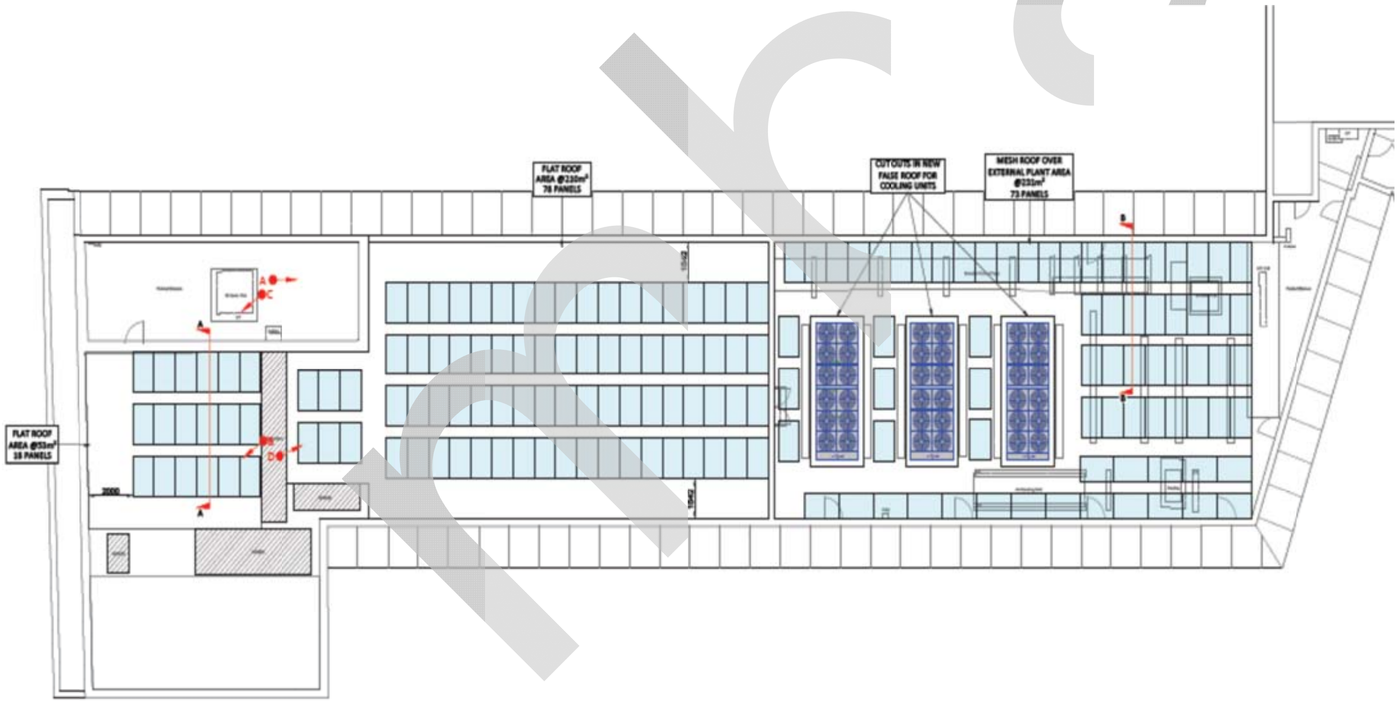
As the electricity is generated on site the inefficiencies of the National Grid mean a saving in carbon emissions. This is classed as a low carbon system rather than a renewable system.

## 4.7 Photovoltaic Electricity Generation [PV]

This option considers an array of PV solar cells to generate electricity, which could either be roof-mounted or located on south to west facing elevations.

Although generally expensive, they can be effective in providing power when wind generation is not viable.

Planning is not considered an issue. Optimal location for the PV panels will be on the roof of the existing building, with the panels angled approximately 5° for minimal visual impact, shown on MBA drawing 2160/M/690 [attached] as indicated below;



## 5.0 RENEWABLE APPRAISAL

Calculations have been undertaken based upon the technologies discussed in section 4 to establish the renewable contribution available from each of the aforementioned technologies.

| Energy Source | System selection | Annual thermal output (kWh/yr) | Annual elec. Output (kWh/yr) | $kgCO_2$ Saving per annum | Est. Capital Cost (£) Installed | Simple Payback (Yrs) | Sizing and performance notes |
|---|---|---|---|---|---|---|---|
| Solar water heating panels<br><br>Vacuum panels | 200m$^2$ | 103,800 | - | 22,700 | £300,000 | 16 | Area of solar panels selected to contribute towards the domestic hot water load.<br>Payback and $KgCO_2$ saving based against an 85% high efficiency gas boiler system and gas generated electricity. |
| Ground source heating | 250kW | 500,000 | - | 109,345 | £750.000 | 10 | Thermal output size to deliver the total space heating load.<br>Assumed COP of 5.0 (includes ground loop).<br>Payback and $KgCO_2$ saving based against an 85% high efficiency gas boiler system and gas generated electricity. |
| Air to Water Heat pumps | 250kW | 500,000 | - | 87,475 | £500,000 | 5 | Air source heat pumps sized to deliver the base thermal load. Assumed COP of 4.0 and 2000 operating hours in winter (No ground loop required) Payback and $KgCO_2$ saving based against an 85% high efficiency gas boiler system and gas generated electricity. |

| Energy Source | System selection | Annual thermal output (kWh/yr) | Annual elec. Output (kWh/yr) | $kgCO_2$ Saving per annum | Est. Capital Cost (£) Installed | Simple Payback (Yrs) | Sizing and performance notes |
|---|---|---|---|---|---|---|---|
| Biomass boiler | 250kW | 500,000 | - | 95,000 | £375,000 | 6 | Biomass boiler sized to deliver the total hot water and heating load. Wood fuel assumed to be 100% sustainable therefore Carbon Neutral, although this does not include delivery of fuel supply to site. Payback and $KgCO_2$ saving based against an 85% high efficiency gas boiler system. |
| QR5 Wind Turbine | Site Application (6kW) | - | 9,600 | 4,992 | £35,000 | 15 | Free-standing vertical axis wind turbine selected to suit a more flexible urban location. Sized to reduce site emissions by 9% |
| Combined Heat and Power | 160kW thermal 95kW electrical | 45,000 | 26,695 | 23,286 | £65,000 | 4 | CHP sized at 95kW electrical and 160kW thermal, to run in conjunction with boiler plant. Suitable for district system only. |
| Solar PV modules | 25kWp | - | 39,580 | 20,832 | £75,000 | 16 | Solar PV efficiency approx. 10%. Payback includes new Feed in Tariff data. |

## 6.0 CONCLUSIONS

In support of the planning application, the following energy strategy will meet the requirement of the London Plan and Camden`s Sustainability Policies, it will achieve a 25% improvement in carbon dioxide emissions on 2010 Building Regulations and provide over 20% carbon reduction through renewable technologies is proposed.

For this development we propose to use photovoltaics as they offer most suitable Renewable Technology, a summary of the Renewable Technologies is as follows:

| | |
|---|---|
| **Photovoltaics** | Providing suitable south-facing orientation can be provided, therefore PV panels are an effective means to meet the Carbon Target. A 25kWp array of approx. 255$m^2$ will provide a 27.5% reduction through this renewable technology. |
| **Solar Hot Water Heating** | It is not feasible to achieve the targets through solar hot water panels, as the amount of hot water required is limited (2.35kWh/$m^2$/annum), therefore this renewable is not suitable for the scheme. |
| **Ground Source Heat Pumps** | These systems are expensive to procure, would require multiple boreholes, and given the limited land availability is not suitable for the site. |
| **Air Source Heat Pumps** | This option is not recommended due to limited siting of condensers, higher carbon emissions, and limited flexibility. |
| **Biomass** | A biomass system could only be effective as part of a district system, and would require access for fuel delivery and a regular supply of fuel. Due to the high cost and management of such a system this system is not considered suitable for this site, and it is not recommended. |
| **Wind Power** | Due to the high density, limited land availability, planning issues and effective wind speed in the area, this is not a recommended option. |
| **Combined Heat and Power** | CHP would only be effective as part of a wider district system network, requiring central plant and management by the developer. Maintenance would be an issue, and would need to run in conjunction with boilers as CHP has down-time. If considered to be viable further investigation would be required, but this is not a recommended system as the primary load is one of cooling and the lack of use of waste heat during summer |
| **District vs Non-District Systems** | The layout, density and siting of this development means that a district system would not be effective. There are additionally no local district heating systems available within the vicinity, however by way of future-proofing systems should be designed that they can tap-in to new district systems should the facility arose. |

As set out in section 3.8, detailing the rain water harvesting system & grey water recycling, the systems do not provide a suitable payback on the investment nor for future revenue cost. In addition, carbon emissions produced by water pumps and water treatment exceeds any benefit gained by saving and recycling water. It is not proposed to proceed with rain water harvesting or grey water recycling technology's.

In line with Camden`s Sustainability Policy, we confirm the following sustainable measures will be provided;

| | |
|---|---|
| **Water** | Dual Flush Toilets in both new extension and upgrading of existing facilities<br>Waterless Urinals<br>Low flow taps and Shower head<br>Provision of Water meters |
| **Green Roof** | Provided to Fourth floor roof with water retention system |
| **Building Fabric** | Improvement in building "U" values as indicated in section 3.1 |
| **Lighting** | High efficient lighting will be installed where practical will be LED<br>Increased control of equipment and daylight linking |

**Building EPC** – attached

With the implementation of the measures identified in this document, we can confirm the new extension Energy Performance Certificate [EPC] will be;

| EPC rating | B |
|---|---|
| EPC score | 26 |

## 6.1 Carbon Compliance to Meet Planning Requirements

**In line with the London Plan, Carbon Dioxide Emissions after each stage of the Energy Hierarchy are summarised in the following table:**

| | Carbon dioxide emissions ($Kg\ CO_2/yr/m^2$) |
|---|---|
| Building Regulations 2010 Part L Compliant Development (Appendix A) | **30.9 $Kg\ CO_2/yr/m^2$** |
| After renewable energy (Appendix B) | **22.4 $Kg\ CO_2/yr/m^2$** |
| Total Reduction of carbon utilising Renewable Energy (25kWp PV) | **27.5%** |

Notes: Emissions are based on an electrical conversion factor of 0.52kg$CO_2$/kWh

## 6.2 Summary

Overall the proposed development has been designed to meet the requirements set out in Camden`s Sustainability & Energy Policies, and are in line with the London Plan to meet a 25% reduction in Carbon emissions.

The development benefits from sustainable design by the improved performance of the building fabric and use of a green roof providing an environmentally enhanced landscape and water retention features.

The reduction in energy using photovoltaic renewable technology is highlighted in the Energy Hierarchy exceeding the requirements of the London Plan.

# Appendix A - BRUKL Document without PV

# BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

**Project name**

# Fox Court

As designed

**Date:** Fri Jan 25 14:24:30 2013

## Administrative information

### Building Details

**Address:** Gray's Inn Road, London,

### Certification tool

**Calculation engine:** SBEM

**Calculation engine version:** v4.1.d.0

**Interface to calculation engine:** Design Database

**Interface to calculation engine version:** v25.05

**BRUKL compliance check version:** v4.1.d.0

### Owner Details

**Name:** Information not provided by the user

**Telephone number:** Information not provided by the user

**Address:** Information not provided by the user, Information not provided by the user, Information not provided by the user

### Certifier details

**Name:** Robert Elliot Diamond

**Telephone number:** 01206 224 270

**Address:** 874 The Crescent,Colchester Business Park,Colchester,CO4 9YQ, Information not provided by the user, CO4 9YQ

## 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 | 30.9 |
| 1.2 | Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 30.9 |
| 1.3 | Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 30.9 |
| 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

### 2.a Building fabric

| Element | $U_{a\text{-}Limit}$ | $U_{a\text{-}Calc}$ | $U_{i\text{-}Calc}$ | Surface where the maximum value occurs* |
|---|---|---|---|---|
| Wall** | 0.35 | 0.25 | 0.25 | OFFICE 1 Wall 1 |
| Floor | 0.25 | 0.2 | 0.2 | RETAIL Exposed Floor 1 |
| Roof | 0.25 | 0.15 | 0.15 | OFFICE 2 Exposed Roof 1 |
| Windows***, roof windows, and rooflights | 2.2 | 1.3 | 1.3 | OFFICE 1 Window 1 |
| Personnel doors | 2.2 | - | - | "No heat loss personnel doors" |
| Vehicle access & similar large doors | 1.5 | - | - | "No heat loss vehicle access doors" |
| High usage entrance doors | 3.5 | - | - | "No heat loss high usage entrance doors" |

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = 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 |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 10 | 5 |

### 2.b Building services

**The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.**

| | |
|---|---|
| **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- HVAC 1

| Heating seasonal efficiency | Cooling nominal efficiency | SFP [W/(l/s)] | HR seasonal efficiency |
|---|---|---|---|
| 0.97 | 4 | 0.1 | 0.6 |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | YES |

2- HVAC 3

| Heating seasonal efficiency | Cooling nominal efficiency | SFP [W/(l/s)] | HR seasonal efficiency |
|---|---|---|---|
| 4.5 | 4.5 | - | - |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | YES |

3- HVAC 2

| Heating seasonal efficiency | Cooling nominal efficiency | SFP [W/(l/s)] | HR seasonal efficiency |
|---|---|---|---|
| 0.97 | - | - | - |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | YES |

1- Default DHW

| Heating seasonal efficiency | Hot water storage loss factor [kWh/litre per day] |
|---|---|
| 0.97 | - |

**Local mechanical ventilation and exhaust**

| Zone | Supply/extract SFP [W/(l/s)] | HR seasonal efficiency | Exhaust SFP [W/(l/s)] |
|---|---|---|---|
| WC 1 | - | - | 1.5 |
| WC 2 | - | - | 1.5 |
| WC 3 | - | - | 1.5 |

**General lighting and display lighting**

| Zone | General lighting [W] | Display lamps efficacy [lm/W] |
|---|---|---|
| OFFICE 1 | 4180 | - |
| OFFICE 2 | 4990 | - |
| OFFICE 3 | 4100 | - |
| RETAIL | 7010 | 50 |
| WC 1 | 680 | - |
| WC 2 | 680 | - |
| WC 3 | 680 | - |

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

| Zone | Solar gain limit exceeded? (%) | Internal blinds used? |
|---|---|---|
| OFFICE 1 | YES (+0%) | NO |
| OFFICE 2 | YES (+0%) | NO |
| OFFICE 3 | YES (+0%) | NO |
| RETAIL | YES (+0%) | 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

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Area [m²] | 2480 | 2480 |
| External area [m²] | 2697 | 2697 |
| Weather | LON | LON |
| Infiltration [m³/hm²@ 50Pa] | 5 | 5 |
| Average conductance [W/K] | 776.85 | 561.54 |
| Average U-value [W/m²K] | 0.29 | 0.21 |
| Alpha value* [%] | 13.56 | 4.02 |

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

## Building Use

| % Area | Building Type |
|---|---|
| 31 | **A1/A2 Retail/Financial and Professional services** |
| | A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways |
| 69 | **B1 Offices and Workshop businesses** |
| | B2 to B7 General Industrial and Special Industrial Groups |
| | B8 Storage or Distribution |
| | 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: Telephone exchanges |
| | Others: Miscellaneous 24hr activities |
| | Others: Car Parks 24 hrs |
| | Others - Stand alone utility block |

## Energy Consumption by End Use [kWh/m²]

| | Actual | Notional |
|---|---|---|
| Heating | 8.14 | 6.62 |
| Cooling | 13.11 | 10.9 |
| Auxiliary | 7.83 | 9.57 |
| Lighting | 34.4 | 35.37 |
| Hot water | 2.35 | 2.73 |
| Equipment* | 32.03 | 32.03 |
| **TOTAL** | **65.83** | **65.19** |

* Energy used by equipment does not count towards the total for calculating emissions.

## 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 | Indicative Target |
|---|---|---|
| Heating + cooling demand [MJ/m²] | 202.27 | 169.43 |
| Total consumption [kWh/m²] | 65.83 | 65.19 |
| Total emissions [kg/m²] | 30.9 | 30.9 |

## 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** | 22 | 156.1 | 7.6 | 12 | 8.9 | 0.81 | 3.52 | 0.97 | 4 |
| | **Notional** | 4.8 | 137.1 | 1.7 | 10.3 | 14.4 | 0.79 / 0.81 | 3.6 | ---- | ---- |
| [ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 27.4 | 236.4 | 1.7 | 19 | 0 | 4.41 | 3.36 | 4.5 | 4.5 |
| | **Notional** | 15.7 | 201.9 | 1.8 | 15.2 | 0 | 2.43 | 3.6 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 111.6 | 36.1 | 34 | 0 | 27.5 | 0.91 | 0 | 0.97 | 0 |
| | **Notional** | 158.1 | 24.7 | 55.4 | 0 | 11.3 | 0.79 / 0.81 | 0 | ---- | ---- |

### 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 | $U_{i\text{-}Typ}$ | $U_{i\text{-}Min}$ | Surface where the minimum value occurs* |
|---|---|---|---|
| Wall | 0.23 | 0.25 | OFFICE 1 Wall 1 |
| Floor | 0.2 | 0.2 | RETAIL Exposed Floor 1 |
| Roof | 0.15 | 0.15 | OFFICE 2 Exposed Roof 1 |
| Windows, roof windows, and rooflights | 1.5 | 1.3 | OFFICE 1 Window 1 |
| Personnel doors | 1.5 | - | "No heat loss personnel doors" |
| Vehicle access & similar large doors | 1.5 | - | "No heat loss vehicle access doors" |
| High usage entrance doors | 1.5 | - | "No heat loss high usage entrance doors" |

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = 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 |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 5 | 5 |

### Thermal bridges

There is at least one junction in the project whose linear thermal transmittance has been defined as having been calculated following a quality-assured accredited construction details approach in accordance with a scheme approved by the Secretary of State.

# Appendix B  -  BRUKL Document with PV

# BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

**Project name**

# Fox Court

As designed

**Date:** Fri Jan 25 14:25:49 2013

## Administrative information

### Building Details

**Address:** Gray's Inn Road, London,

### Certification tool

**Calculation engine:** SBEM

**Calculation engine version:** v4.1.d.0

**Interface to calculation engine:** Design Database

**Interface to calculation engine version:** v25.05

**BRUKL compliance check version:** v4.1.d.0

### Owner Details

**Name:** Information not provided by the user

**Telephone number:** Information not provided by the user

**Address:** Information not provided by the user, Information not provided by the user, Information not provided by the user

### Certifier details

**Name:** Robert Elliot Diamond

**Telephone number:** 01206 224 270

**Address:** 874 The Crescent,Colchester Business Park,Colchester,CO4 9YQ, Information not provided by the user, CO4 9YQ

## 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 | 30.9 |
| 1.2 | Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 30.9 |
| 1.3 | Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 22.4 |
| 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

### 2.a Building fabric

| Element | $U_{a\text{-}Limit}$ | $U_{a\text{-}Calc}$ | $U_{i\text{-}Calc}$ | Surface where the maximum value occurs* |
|---|---|---|---|---|
| Wall** | 0.35 | 0.25 | 0.25 | OFFICE 1 Wall 1 |
| Floor | 0.25 | 0.2 | 0.2 | RETAIL Exposed Floor 1 |
| Roof | 0.25 | 0.15 | 0.15 | OFFICE 2 Exposed Roof 1 |
| Windows***, roof windows, and rooflights | 2.2 | 1.3 | 1.3 | OFFICE 1 Window 1 |
| Personnel doors | 2.2 | - | - | "No heat loss personnel doors" |
| Vehicle access & similar large doors | 1.5 | - | - | "No heat loss vehicle access doors" |
| High usage entrance doors | 3.5 | - | - | "No heat loss high usage entrance doors" |

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = 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 |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 10 | 5 |

### 2.b Building services

**The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.**

| | |
|---|---|
| **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- HVAC 1

| Heating seasonal efficiency | Cooling nominal efficiency | SFP [W/(l/s)] | HR seasonal efficiency |
|---|---|---|---|
| 0.97 | 4 | 0.1 | 0.6 |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | YES |

2- HVAC 3

| Heating seasonal efficiency | Cooling nominal efficiency | SFP [W/(l/s)] | HR seasonal efficiency |
|---|---|---|---|
| 4.5 | 4.5 | - | - |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | YES |

3- HVAC 2

| Heating seasonal efficiency | Cooling nominal efficiency | SFP [W/(l/s)] | HR seasonal efficiency |
|---|---|---|---|
| 0.97 | - | - | - |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | YES |

1- Default DHW

| Heating seasonal efficiency | Hot water storage loss factor [kWh/litre per day] |
|---|---|
| 0.97 | - |

**Local mechanical ventilation and exhaust**

| Zone | Supply/extract SFP [W/(l/s)] | HR seasonal efficiency | Exhaust SFP [W/(l/s)] |
|---|---|---|---|
| WC 1 | - | - | 1.5 |
| WC 2 | - | - | 1.5 |
| WC 3 | - | - | 1.5 |

**General lighting and display lighting**

| Zone | General lighting [W] | Display lamps efficacy [lm/W] |
|---|---|---|
| OFFICE 1 | 4180 | - |
| OFFICE 2 | 4990 | - |
| OFFICE 3 | 4100 | - |
| RETAIL | 7010 | 50 |
| WC 1 | 680 | - |
| WC 2 | 680 | - |
| WC 3 | 680 | - |

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

| Zone | Solar gain limit exceeded? (%) | Internal blinds used? |
|---|---|---|
| OFFICE 1 | YES (+0%) | NO |
| OFFICE 2 | YES (+0%) | NO |
| OFFICE 3 | YES (+0%) | NO |
| RETAIL | YES (+0%) | 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

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Area [m²] | 2480 | 2480 |
| External area [m²] | 2697 | 2697 |
| Weather | LON | LON |
| Infiltration [m³/hm²@ 50Pa] | 5 | 5 |
| Average conductance [W/K] | 776.85 | 561.54 |
| Average U-value [W/m²K] | 0.29 | 0.21 |
| Alpha value* [%] | 13.56 | 4.02 |

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

## Building Use

| % Area | Building Type |
|---|---|
| 31 | **A1/A2 Retail/Financial and Professional services** |
| | A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways |
| 69 | **B1 Offices and Workshop businesses** |
| | B2 to B7 General Industrial and Special Industrial Groups |
| | B8 Storage or Distribution |
| | 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: Telephone exchanges |
| | Others: Miscellaneous 24hr activities |
| | Others: Car Parks 24 hrs |
| | Others - Stand alone utility block |

## Energy Consumption by End Use [kWh/m²]

| | Actual | Notional |
|---|---|---|
| Heating | 8.14 | 6.62 |
| Cooling | 13.11 | 10.9 |
| Auxiliary | 7.83 | 9.57 |
| Lighting | 34.4 | 35.37 |
| Hot water | 2.35 | 2.73 |
| Equipment* | 32.03 | 32.03 |
| **TOTAL** | **65.83** | **65.19** |

* Energy used by equipment does not count towards the total for calculating emissions.

## Energy Production by Technology [kWh/m²]

| | Actual | Notional |
|---|---|---|
| Photovoltaic systems | 15.96 | 0 |
| Wind turbines | 0 | 0 |
| CHP generators | 0 | 0 |
| Solar thermal systems | 0 | 0 |

## Energy & $CO_2$ Emissions Summary

| | Actual | Indicative Target |
|---|---|---|
| Heating + cooling demand [MJ/m²] | 202.27 | 169.43 |
| Total consumption [kWh/m²] | 65.83 | 65.19 |
| Total emissions [kg/m²] | 22.4 | 30.9 |

## 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 | 22 | 156.1 | 7.6 | 12 | 8.9 | 0.81 | 3.52 | 0.97 | 4 |
| | Notional | 4.8 | 137.1 | 1.7 | 10.3 | 14.4 | 0.79 / 0.81 | 3.6 | ---- | ---- |
| [ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity | | | | | | | | | | |
| | Actual | 27.4 | 236.4 | 1.7 | 19 | 0 | 4.41 | 3.36 | 4.5 | 4.5 |
| | Notional | 15.7 | 201.9 | 1.8 | 15.2 | 0 | 2.43 | 3.6 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | Actual | 111.6 | 36.1 | 34 | 0 | 27.5 | 0.91 | 0 | 0.97 | 0 |
| | Notional | 158.1 | 24.7 | 55.4 | 0 | 11.3 | 0.79 / 0.81 | 0 | ---- | ---- |

## 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** | **$U_{i\text{-}Typ}$** | **$U_{i\text{-}Min}$** | **Surface where the minimum value occurs*** |
|---|---|---|---|
| Wall | 0.23 | 0.25 | OFFICE 1 Wall 1 |
| Floor | 0.2 | 0.2 | RETAIL Exposed Floor 1 |
| Roof | 0.15 | 0.15 | OFFICE 2 Exposed Roof 1 |
| Windows, roof windows, and rooflights | 1.5 | 1.3 | OFFICE 1 Window 1 |
| Personnel doors | 1.5 | - | "No heat loss personnel doors" |
| Vehicle access & similar large doors | 1.5 | - | "No heat loss vehicle access doors" |
| High usage entrance doors | 1.5 | - | "No heat loss high usage entrance doors" |

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = 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** |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 5 | 5 |

**Thermal bridges**

There is at least one junction in the project whose linear thermal transmittance has been defined as having been calculated following a quality-assured accredited construction details approach in accordance with a scheme approved by the Secretary of State.

# Appendix C - Energy Performance Certificate [EPC]

# Energy Performance Certificate
Non-Domestic Building

HM Government

**Gray's Inn Road**
**London**

**Certificate Reference Number:**
0090-2090-0030-1000-0703

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

## Energy Performance Asset Rating

More energy efficient

A+

Net zero $CO_2$ emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

26 — This is how energy efficient the building is.



## Technical information

| | |
|---|---|
| **Main heating fuel:** | Natural Gas |
| **Building environment:** | Air Conditioning |
| **Total useful floor area ($m^2$):** | 2480 |
| **Building complexity (NOS level):** | 4 |
| **Building emission rate ($kgCO_2/m^2$):** | 22.41 |

## Benchmarks

**Buildings similar to this one could have ratings as follows:**

36 If newly built

97 If typical of the existing stock

## Administrative information

This is an Energy Performance Certificate as defined in SI2007:991 as amended

| | |
|---|---|
| **Assessment Software:** | Design Database v25.05 using calculation engine SBEM v4.1.d.0 |
| **Property Reference:** | 000000000000 |
| **Assessor Name:** | Robert Elliot Diamond |
| **Assessor Number:** | LCEA011217 |
| **Accreditation Scheme:** | CIBSE Certification Ltd |
| **Employer/Trading Name:** | Ingleton Wood LLP |
| **Employer/Trading Address:** | 10 Lake Meadows Business Park, Billericay, Essex |
| **Issue Date:** | 29 Jan 2013 |
| **Valid Until:** | 28 Jan 2023 (unless superseded by a later certificate) |
| **Related Party Disclosure:** | Not related to the owner |

**Recommendations for improving the property are contained in Report Reference Number: 0290-0900-0407-0100-0004**

## If you have a complaint or wish to confirm that the certificate is genuine

Details of the assessor and the relevant accreditation scheme are on the certificate. You can get contact details of the accreditation scheme from the Government's website at www.communities.gov.uk/epbd, together with details of the procedures for confirming authenticity of a certificate and for making a complaint.