344

# CHECKLIST FOR DISCHARGE OF CONDITIONS APPLICATIONS

of [redacted]

[redacted]

[redacted]

PLANNING APPLICATION NUMBER 12 / 751 / RC

SITE ADDRESS London Southend airport

Southend airport. Date received 30/5/13

Fee Received: [✓ YES]/NO £ 97.00 online payment

All required information submitted to discharge condition(s)?: [✓ YES]/NO

If no, give **exact** wording for what is required:

conditions 4 ~~[illegible]~~

④ 10% renewable

~~⑥ [illegible] completion~~

[redacted] dates to log. - [redacted]BC.

ACK sent 17/7/13

**Officer Name:**

**Signature:**

G:/LPA/PLS/SHARED/FORMS

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Date: 24 October, 2012

Ref: 3864 LSA phase 2 renewable energy assessment -Rev 4

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# Project No 3864
# Renewable Energy Assessment
# London Southend Airport
# Phase 2 Terminal Extension

Revision 4
October 2012

The Interreg IVB North Sea Region Programme

GSA

London Southend Airport

REVISION:

| Revision | Description | Date |
|---|---|---|
| 0 | Draft report | |
| 1 | Amended to RPS comments | 13/08/2012 |
| 2 | Building report refined | 14/08/2012 |
| | | |
| | | |

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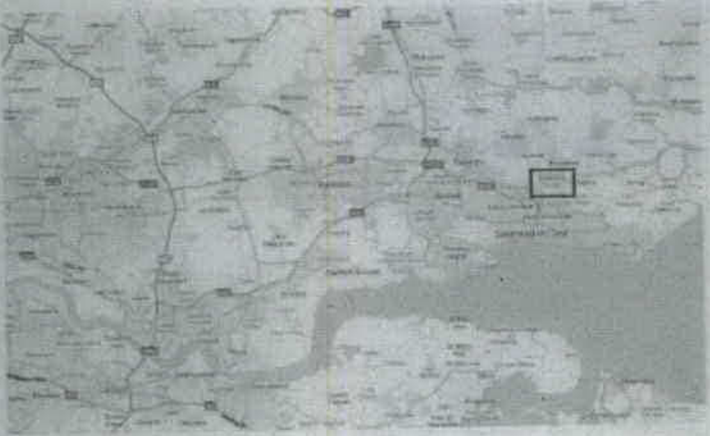
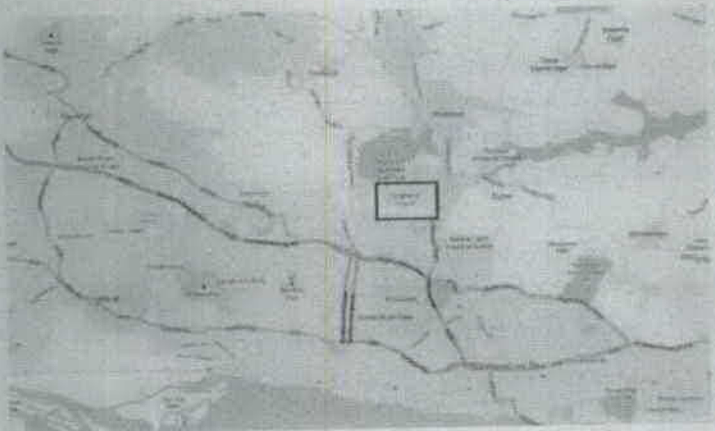
# 1 Introduction

## 1.1 Project Description

The site is located within the London Southend Airport and will be an extension to the existing terminal building.



Area Location Image



Area Location Image

The development generally comprises of a major extension (around 1.5 times the original size) of the existing terminal building completed in 2011.

the Building Research Establishment Environmental Assessment method (BREEAM).

### 1.3 Methodology

The procedure followed in this report incorporates the principles defined by the energy hierarchy:

- Energy demand is first assessed based on existing minimum legal requirements (Building Regulations current at the time of the report)
- The baseline energy demand is converted to equivalent carbon dioxide emissions for reporting purposes
- Energy conservation measures are then identified to reduce the energy demand (estimates at this stage so all suggestions must be confirmed at detail design stage).
- Low carbon measures are assessed to supply the required energy in as efficient a way as possible
- Finally renewable energy supply options to meet the required reduction of the development's carbon dioxide emissions are identified
- Revised energy demand and equivalent carbon dioxide emissions are identified to confirm compliance with Planning Authority requirements

The energy demand assessment used in this report was carried out using a tool based on the methodology described in the 'London Renewables toolkit'. Although originally designed to assist in implementing the energy policy of the Greater London Assembly the methodology is applicable to assessment of renewable energy supply technology options throughout the UK. Consequently the methodology is recognised by the majority of councils in the UK as an appropriate method for determining the site energy demand and resulting carbon dioxide emissions.

### 1.4 Technologies considered

Energy efficiency technologies and renewable options considered:

- Combined Heat & Power (CHP)
- Energy from wind
- Photovoltaic panels
- Solar water heating
- Energy from biomass
- Geothermal sources such as ground source heat pumps

## 3 Energy Efficiency - Passive / Control Measures

In order to reduce the carbon emission of a building below Building Regulation requirements, the design team will employ the following example methodology which is consistent with the appended energy hierarchy. The following points list the energy measures that will be considered by the design team in order to limit the energy consumption and the carbon footprint of the Development.

Step One

Initial energy demand reduction via passive measures to the building envelopes:

- Reduce the air permeability of the building envelope (a target air infiltration rate of $4.3m^3/h.m^2$)
- By Optimising the U-Values of the external fabric. This may be realised by improving on the requirements of Part L of the Building Regulations.

Step Two

Initial energy demand reduction via systems by implementation of low-cost energy- efficient measures such as:

- Selecting boilers with high efficiency e.g. SEDBUK A rated
- Delayed-start controls including optimisation and compensation heating controls
- Zone time and temperature control to heating system for different parts of the building via a building energy management systems
- Timed and thermostatic control to hot water system via a building management system
- Passive design to encourage day lighting, flexible lighting controls and reduce artificial lighting demand
- Thermal design to reduce overheating and the need for cooling chillers

Step Three

Robust supply strategy by combining efficient delivery of energy with low and zero carbon technologies.

Step Four

It should be recognised that the points raised in this report are strictly applicable to parts of the development under the direct control of the airport operator. A major contribution to the energy demand of the development is provided by the retail tenants and specific constraints may need to be placed on the installation and operation of their energy consuming equipment.

its close proximity to the load. The power and heat usually serve a single building or site, although there are examples of them serving whole towns.

#### 4.1.2 Selection Criteria

Although combined heat and power (CHP) is considered a low carbon technology and not a renewable energy supply technology it is appraised for this site as many local authorities require consideration of this technology as part of the renewable energy assessment process. As the development information available is outline in nature the appraisal undertaken here can do no more than identify if gas fired CHP should be considered further. If this report identifies that gas fired CHP might be viable a more detailed assessment will be required when the thermal and electrical energy demands of the development can be accurately assessed.

Space heating demand varies with the seasons but domestic hot water demand remains constant throughout the year. To be economically viable gas fired CHP units need to operate a minimum of 5,000 hours each year. In order to achieve the minimum operating hours CHP units are normally configured to serve base thermal energy demand. The sizing constraint therefore lies in the summer months and as evident in the chart comprises the site domestic hot water (DHW) demand.

Normally electricity produced is utilised on-site to meet part of the proposed development's demand. If periods of low electrical demand occur the electricity can be exported from the site to the local electricity network.

#### 4.1.3 Viability

Analysis of the site energy demand identifies that there is insufficient thermal demand to justify installation of a gas fired CHP unit to serve the new terminal building alone.

The viability of a central CHP scheme might benefit from the opportunity to offer connections to adjacent sites. This could be investigated but is not factored into the results of this report.

***This technology is not recommended for further consideration in the context of the proposed development.***

### 4.2 Wind turbines

#### 4.2.1 Description

Wind turbines are available in a variety of shapes, sizes and duties, with the most common being a propeller blade/windmill configuration with a horizontal axis. Turbines are also available in vertical axis arrangements in a number of styles, and purpose built rooftop modules or integrated systems are emerging onto the market. The comparative scale of the wind turbines is

### 4.2.5 Viability

***This technology is not recommended for this development due to proximity of residential properties and hazards to airport operations.***

## 4.3 Photovoltaic panels

### 4.3.1 Description

Photovoltaic systems convert solar energy directly into electricity through semiconductor cells. The cells produce DC electricity and are typically arranged in modules that include an inverter to convert the electricity into AC that can be used by the building systems.

The amount of electricity generated by the panels varies depending on the external light conditions. The peak energy generated from 1m2 of solar panel is generally in order of 120W. The panels generate electricity from both direct light and diffuse light (i.e. non- direct light scattered via the atmosphere).

Photovoltaic panels can either be mounted external to the building or be integrated into the building cladding (known as Building Integrated Photovoltaic Panels or BIPV). Where the panels are mounted externally, the optimum orientation for the panels is south facing at an inclination of 35°. When integrated into south facing vertical cladding, the solar panels are de-rated by some 30% and provide a reduced peak output and energy contribution.

### 4.3.2 Selection Criteria

Photovoltaic panels (PV) might be incorporated into the design and provide an electrical power output used to offset incoming electrical energy.

Solar energy density reduces at higher latitudes. The map below indicates the change in solar energy density across the UK together and the relative position of the site.

#### 4.3.3 Noise

The photovoltaic panels themselves contain no moving parts and are silent in operation. Inverters are normally located internally and might exhibit a low 'electric' hum however location in services space mitigates this and noise is not considered an issue with this technology.

#### 4.3.4 Viability

This technology can achieve the carbon dioxide saving to ensure building emission rate is less than the target emission rate and the energy produced by photovoltaic panels is in the form of electricity which can supplement savings from other technologies. The energy produced is at its peak at mid-day in the summer months, falling off substantially through the winter. Excess electricity can be exported for a price that is fixed by the feed-in tariff arrangements specified by the government. The feed-in tariff will also provide a payment for all of the electricity generated.

However, provision for exporting electricity will not be provided at this stage.

***This technology is recommended for further consideration in the context of the Proposed Development.***

### 4.4 Solar thermal

#### 4.4.1 Description

Solar hot water heating systems harvest energy from the sun to heat water. This is typically achieved in the UK through the use of solar heating panels positioned on the roof of the building. A fluid, typically water, is passed through tubes within the panels and absorbs the solar radiation that in turn increases the temperature of the fluid.

There are a number of different types of panels that can be used, which vary in cost and efficiency. A fewer number of more efficient panels may achieve the same heat output, but the cost of panels increases significantly as efficiency is increased.

The majority of heat output from solar hot water systems is achieved during the summer and mid seasons, with the least heat energy obtained during the winter. For this reason in the UK, this type of system is generally used to provide heating to domestic hot water systems, which typically has a consistent year-round demand.

Heated water that passes through the solar collectors is linked to a well-insulated hot water storage cylinder where the heat energy is transferred a stored until needed. The distance between solar collector and storage cylinder should be kept to a minimum to avoid heat losses from the pipework.

Biomass can be utilised in a number of ways. This report considers the direct combustion of biomass wood fuels in a boiler located on site. In a development such as this biomass boilers can be used to replace central boiler systems, utilising fuel from local sources. A secure local source would have the advantage of reducing the transportation required for the fuel supply, and also benefit the local community by providing an additional source of revenue from existing waste wood.

The advantage of using a biofuel is that it could reduce the size of a gas connection to the site, thereby presenting a saving in utility infrastructure costs. A disadvantage is that the fuel would have to be delivered to, and waste collected from, the site. The fuel supply would also need to be secured over a period of time.

#### 4.5.2 Selection criteria

These installations are able to reduce the $CO_2$ emissions considerably. However there are other factors such as fuel delivery traffic and NOx emissions that reduce the viability of this technology.

#### 4.5.3 Noise

Biomass heating systems offer two sources of noise. The first from the equipment while in operation normally from a feed screw at regular intervals to transfer stored wood fuel chips or pellets to the burner. The second from noise associated with the delivery of fuel into hoppers from a delivery lorry. Although this should not be required every day the deliveries during the winter will be more frequent than in the summer months.

#### 4.5.4 Viability

***Biomass heating is not considered a preferential renewable energy supply technology for this development due to the lack of heating demand, fuel delivery issues, air quality issues and low carbon dioxide emissions reductions.***

### 4.6 Biomass combined heat and power

#### 4.6.1 Description

This is a version of CHP using biomass combustion

#### 4.6.2 Selection Criteria

As with a natural gas fired CHP unit biomass CHP units provide both electricity and heat output from a biomass fuel source.

Closed loop systems: Lengths of plastic pipe are buried in the ground, either in a borehole or a horizontal trench. The pipe forms a closed loop charged with a water/antifreeze mixture.

Open loop systems: For inner city developments these typically use ground water sourced from bore holes, although water sourced from canals is an option in certain locations. River and sea water are also good sources where available.

Borehole cooling (or heating) is effectively an open loop system which uses the ground water temperature directly. The ground water is pumped to the surface and used for heat extraction and/or heat rejection before it is pumped back into the aquifer via a second (recharge) borehole. The capacity of the system is limited by the amount of water that can be extracted and the allowable rise/fall in temperature of the water before discharge. The use of boreholes is subject to approval of planners and the Environment Agency, and the feasibility depends on local geology, the available water yield, and the presence of other boreholes in the area.

### 4.7.2 Selection criteria

The best efficiencies for this technology are achieved when cooling, as well as heating, takes place. Emerging advice from the Environment Agency also suggests that a temperature balance will be required in future licensing of such schemes. This means that any heat taken from the ground must be replaced over the course of a year. On small schemes this can be achieved by natural means – higher ambient temperatures in summer warm the earth and below ground water movements transfer heat. In large schemes such as this it is possible that regular heat abstraction could cause local cooling.

### 4.7.3 Noise

Heat energy is extracted from the ground by pumping a heat transfer fluid through pipes formed into vertical piles. The pumps will be located inside the building plant space where mitigation measures can be applied if necessary, hence noise is not considered an issue for this technology.

### 4.7.4 Viability

As this development has a cooling energy demand the installation of ground source for heating and cooling maximises the carbon dioxide emissions reduction possible. Ground source heating and cooling provides possibly the highest carbon dioxide emissions saving for tis development. However the technology is expensive and preliminary investigations suggest that the geology in the Southend area is not suited to ground source heating and cooling.

The best results are obtained when the cooling energy requirement in summer is similar to the

## 5 Conclusion:

The technologies considered most viable for the site are:

- Solar photovoltaic panels: In order to demonstrate compliance with Part L of building regulations and also Condition 5, Photo Voltaic (PV) panels are proposed as a source of onsite electrical energy generation. Approximately 440 panels providing a total of 858 $m^2$ active PV area is needed to generate 10% of Annual Energy consumption. An indicative roof layout showing PV panels is appended to this report to demonstrate that this option is feasible.
- Air source heat pumps: We proposed energy efficient air source heat pumps to provide space heating and cooling for the building. Air source heat pumps falls under low carbon technology as for every 1 KW of electrical energy 5 to 6 KW of thermal energy can be generated by extracting heat energy from the air.

Technologies not considered viable for the site are:

- Ground source heat pumps
- Natural gas fired combined heat and power
- Solar hot water heating
- Biomass fuelled boilers
- Small scale building mounted wind turbines
- Large scale wind turbines

Life cycle cost and payback predictions for the feasible options are as follows:

***This report confirms that by incorporating PV technology for onsite energy generation the development will comply with Condition 5 of the planning permission. Air source heat pumps, providing space heating/cooling will add further to the development's energy efficiency.***

## 6 Appended Information

- BRUKL report from SBEM calculation software
- RPS drawings of roof and section