1.0 PURPOSE

The purpose of this report is to partially fulfil the requirements for the first credit associated with the BREEAM ENE4 credit and, in addition, provide an energy statement to the planning authority, in support of this planning application, in regard to the considerations made during the design process in respect of the provision of low & zero carbon technologies. This report has been prepared in accordance with the National Planning Policy Framework (NPPF) which supports the transition to a low carbon future and confirms it is the responsibility of applicants to contribute to energy generation from renewable or low carbon sources, which is also advocated in the Council's emerging Draft Submission Core Strategy.

The BREEAM ENE4 credit requires an investigation into the feasibility of various low carbon and renewable energy solutions that are able to achieve a minimum 10% reduction in the proposed building's regulated CO_2 emissions, or preferably a 20% reduction for a further credit.

Regulated CO2 emissions are not indicative of real building energy consumption and CO_2 emissions but rather are assessed using approved CIBSE AM11 compliant thermal modelling software (IES).

The preliminary thermal model for the development confirms a building emission rate of 17.4 kg CO_2/m^2. Using a 'treated area' of 4677.5m^2, this confirms that the LZC technologies to be considered should be able to achieve the following level of CO_2 savings:

10% reduction = 8,319 kg
20% reduction = 16,378 kg

On over-riding requirement on this however, in order to achieve the BREEAM ENE1 credit, is for a mandatory 25% improvement on Part L2(A) 2010 which would require a building emission rate of 14.1 kg CO_2/m^2 to be achieved.

2.0 EXCLUDED LZC TECHNOLOGIES

2.1 Ground Source Heat Pumps

Ground source heat pumps have been considered to be unsuitable for the following reasons:

- Extremely confined site, minimal space for boreholes.
- The long term success of the solution relies on a balance between annual heat and cooling requirement which we do not have in this facility due to the displacement ventilation strategy which substantially reduces the annual mechanical cooling energy requirement.

2.2 Combined Heat & Power

A small scale CHP solution (~40 kW thermal load) has been considered however it is deemed that in an office facility, where domestic hot water consumption is very low and internal gains are relatively high, that there will be insufficient utilisation of the waste heat for CHP to be financially viable.

CIBSE technical memorandum AM12 4.3.2 recommends a minimum 4000 hours of annual running time for this solution to be financially viable whilst our estimates suggest on that, on this project, annual running time could be well below 2500 hours.

Tri-generation (combined cooling heating and power) has been discounted on the grounds of capital cost, low efficiencies associated with absorption chiller plant, and the issue of the associated heat rejection plant which would result in issues regarding rights to light.

2.3 Solar Domestic Hot Water

It has been found on this project that application of a solar domestic hot water system of sufficient size is self-defeating in that in order to achieve the required level of carbon emissions, the level of required domestic hot water storage is greatly increased which penalises the building emissions rate.

For this reason, and due to the relatively low domestic hot water consumption associated with office buildings, we also consider that a photovoltaic cell solution should take preference to the application of solar domestic hot water.

2.4 Wind Power

Wind power was eliminated early in design process due to the physical constraints of the site. The site is surrounded closely by neighbouring buildings which would be significantly impacted by a wind turbine installation, both in terms of acoustics and flicker issues.

2.5 Biomass

Under Part L2(A) 2010 calculation procedures, the carbon reduction benefit of Biomass has lessened from that typically achieved in the past in Part L2(A) 2006 assessments.

This is primarily thought to be due to the calculation procedure of the ‘notional building’ being revised to be based on same fuel as the actual building. So, whereas Part L2(A) 2006 would compare a biomass fuelled building against a gas fuelled notional building, Part L2(A) 2010 now compares both the ‘notional’ and ‘actual’ buildings on the basis of the same fuels.

This issue, along with the following considerations has rendered a Biomass solution as inappropriate for the project:

- Extremely confined site with insufficient space for the storage of Biomass fuels (even wood pellets) and their associated delivery arrangements.

- The site is surrounded in a heavily trafficked city centre environment which would be adversely impacted by what would be frequent Biomass fuel delivery.

3.0 INCLUDED LZC TECHNOLOGIES

Taking into account the site's local issues and energy demand, the following technologies deemed worthy of further consideration for the project are;

- Photovoltaic cells
- Air Source Heat Pump

None of the above are deemed to present the project with any acoustic or similarly concerning issues for neighbouring buildings. Naturally, a roof mounted PV cell installation is a relatively low-profile unobtrusive strategy whilst an air source heat pump could be integrated within the air handling plant that is specified for the project.

3.1 Photovoltaics

In order to achieve the 25% betterment on minimum Part L2(A) requirements, this solution would comprise a roof mounted array in the order of 250m^2, in its optimum installation arrangement, and would achieve a building emission rate of 14.0 kg CO_2/m^2.

We would expect a system of this size to turn around an annual yield in the order of 29,500kWh which is commensurate with a CO_2 saving of 15,547kg. Whilst somewhat bettering the 10% reduction in regulated CO_2 emissions for the BREEAM ENE4 credit, this figure is still short of the 20% reduction milestone.

The estimated cost for the system is £180k and thus, with an electrical energy tariff of 0.12p/kWh, and an assumed feed-in tariff of 0.13p/kWh, the simple payback period is expected to be in the region of at least 25 years.

There are no known grants available at this time for the funding of the PV cells (it is not thought that any energy would be exported), however it is thought that the installation would qualify for feed-in tariffs as suggested above.

3.2 Air Source Heat Pump (ASHP)

On this project, an air source heat pump could be integrated within the roof top air handling units to facilitate all of the fresh air ventilation heating and cooling requirements.

The benefit of an ASHP is understated in the thermal model since, for Part L2(A) 2010 assessment, it uses standard NCM data ventilation rates rather than the actual design. Nevertheless the carbon emissions savings associated with the provision are attributed to be only 0.7 kg CO_2/m^2 (2,339 kg)

The provision of an ASHP solution therefore appears to be of somewhat lesser benefit than a photovoltaic cell installation. This is probably due to both the high efficiency of heat recovery being adopted on the scheme (75% efficient thermal wheel) and the active ventilation strategy which will result in a minimum annual heating and cooling requirement for the mechanical ventilation.

It should be noted however that the implementation of both the PV cells and the air source heat pump would result in the 20% carbon emission reduction milestone being achieve and hence a further BREEAM credit being awarded under the ENE4 credit section.

4.0 RECOMMENDATION

The recommended LZC technology for the ACL Duke Street project is a PV cell installation capable of an annual energy yield of 29,500 kWh. This is approximately equivalent to a 250m^2 array.

This will achieve 25% betterment of Part L2(A) 2010 requirements and hence achieve the mandatory requirements of the BREEAM ENE1 credit plus, in addition, secure two further BREEAM credits under the ENE4 scoring.

The installation should achieve annual running costs in the order of £7,000 per annum, based on current electrical tariffs (0.12p/kWh) and a feed-in tariff of 0.13p/kWh.

The above solution could be supplemented with an air source heat pump solution in order to secure a further credit under BREEAM ENE4 scoring. However, the following energy efficiency features of the scheme reduce the level of benefit that an ASHP can typically achieve:

- Displacement ventilation (air cooled to no lower than 18°C)
- Thermal wheel heat recovery 75% efficient (pre-heats air to 15°C)
- Variable air volume operation linked to both internal temperature and air quality levels.
- Overnight purge cooling and thermal massing.

END OF REPORT