1 Technical Annex 1 D – Passive energy consumption reduction measures

The following potential measures have been reviewed to determine suitability and potential impacts on carbon emissions:

- Improve building fabrics and glazing
- Improve air tightness
- Natural lighting
- Natural ventilation

Each of these issues is addressed in detail in the following pages and referenced sections of this report.

1.1 Improve Building Fabrics and Glazing

The proposed development would seek to minimise the carbon emissions by selecting building fabrics and overall building designs that exceed the requirements of Part L, whilst being economic in construction terms, delivering ongoing energy savings throughout the life of the building.

Improving the building fabric as well as reducing the emissivity of the glazing effectively diminishes heat loses / gains thus reducing the amount of energy required to maintain a comfort temperature in buildings. These reductions can also be achieved by using materials with less conductivity than the standard ones or purely by increasing the thickness of the materials used for insulation.

The proposed development will aim to reduce the U-values beyond Part L wherever possible. Further investigation will be carried out during detailed design.

1.2 Improve Air Tightness

Buildings with high air change rates (above the requirements for the occupants) have higher energy consumption because infiltrating air needs to be conditioned.

Building regulations 2006 Part L impose a strict control on the air tightness of the buildings not allowing more than 10 $m^3/h.m^2$ at 50 Pa. and aiming at values around 7 $m^3/h.m^2$. Specific guidance is available from the DCLG and general measures that will help to improve air tightness are:

- Keep doors closed with automatic actuators in public buildings;
- Improving the building construction standards;
- Using high quality windows without leaks and
- Sealing joints along windows and doors.

- Building orientation is also important because leaky surfaces exposed to wind increase air infiltration thus extra attention has to be paid to surfaces exposed to prevailing winds.

The proposed development will aim to increase the level of air tightness beyond Part L wherever possible. Further investigation will be carried out during detailed design.

1.3 Natural Lighting

A building designed to maximise the use of natural light allows for the reduction of energy consumption and related CO_2 emissions associated with lighting. This can be facilitated by maximising façade to floor plate ratios and minimising the depth of the floor plan. External circulation paths in the development needing artificial lighting should be minimised but without compromising safety. Natural lighting is of particular importance in public buildings such as schools, community centres, and etcetera.

Buildings and facilities can be specifically designed to make use of natural daylight, e.g. by the use of shallow depth spaces and maximising façade to floor plate ratios - this can result in significant energy savings by reducing the daily usage of the artificial lighting systems. In addition, occupants' sense of well being and productivity have been shown to increase when workplaces are wholly or predominantly naturally lit (CIBSE, 2003) .

- Natural lighting is one of the measures that cannot be used to further reduce CO_2 emissions beyond 2006 Part L regulations because, once implemented, no more savings could be accounted without changing the building.
- Natural lighting should be capable of reducing the electricity consumed by offices to levels around 8 W/m^2 according to internal research carried out and a case study presented in the Modern Building Services Journal (MBS, 2006). This is equivalent to a reduction of 40% in the energy consumption and carbon emission levels. These can only be achieved if used together with some active mitigation measures like low energy lamps, high-frequency electronic ballasts, mirror luminaries and light sensors. Lamps may be smoothly dimmed down to 10% of their maximum light output and a suitable photocell responds to the combined daylight and artificial illumination level to provide a constant level of illumination. Where feasible, the use of light pipes and skylights should be encouraged.
- Although natural lighting is desirable, solar gains must be limited such that the average solar and internal gains during the occupancy in July are less than $35W/m^2$.

The proposed development will aim to maximise the use of natural light wherever possible. Further investigation will be carried out during detailed design.

1.4 Natural Ventilation

Natural ventilation consists of providing fresh air to the building by natural means without using fans. By using natural ventilation strategies energy consumption in the building is reduced because there is no need to mechanically force air into spaces to condition them. Natural ventilation requires a careful design and centrally driven operation i.e. the BMS will actuate the windows, etcetera. when required.

Naturally ventilated buildings present some disadvantages. For example, some variation of the internal temperature with external climatic conditions must be expected and odours and noise can come through the openings. In addition to this, some buildings with excessive internal heat gains not be suitable for a commercial letting market if not air conditioned or comfort cooled.

Statistics from major landlords show that for 2001 naturally ventilated offices' average energy charges based on net letable area were in the region of 10% of the total service charge compared with 15% of the total service charge for air-conditioned offices (CIBSE, 2003).

The use of air conditioning or comfort cooling may be reduced or avoided by adopting a night ventilation strategy to cool the building fabric overnight, thereby reducing peak indoor temperatures during occupied hours. Studies have shown that a night ventilation strategy can reduce peak daytime temperatures by around 2°C, effectively providing up to 20kWh/m^2/year of free cooling. (Connect, 2004). For such a system to function, the building structure must have a high thermal mass to store the coolth.

For large buildings, the complete control of natural ventilation by manual window openings is not possible and some form of automatic control is essential normally via a BMS system. However, where natural ventilation is employed, some variation of internal temperature with external climatic conditions must be expected. Atria would be encouraged as would the use of high façade to floor plate ratios within buildings.

Commercial viability and acoustic concerns would influence the final solution for each building and whilst natural ventilation would be encouraged, selection will be driven by these factors. Generally residential developments would primarily utilize natural ventilation. Residential accommodation would be naturally ventilated for housing, in appropriate instances, although these may be impractical for other elements of the development due to:

- Building Use – areas with high internal gains or restrictions to ventilation openings are unlikely to be viable for natural ventilation solutions.
- Location – adjacency to roads may result in unacceptable air quality at low-level ventilation inlets and noise penetration through openings.
- Commercial Concerns – to achieve the correct environment, e.g. hotels, some uses will show significant reduction in the value of the building area should competitive standards with similar building not be maintained.

The proposed development aims to utilise natural ventilation wherever possible. Further investigation will be carried out during detailed design.