MEMORANDUM

Date	12 July 2011
Reference	UA001881
From	Philip Harker
To	Jenny Barker, CDC
Copies	Nicole Lazarus, BioRegional
	Alex Wilson, Barton Willmore
Subject	**Updated zero carbon calculation**

The zero carbon calculation sheets issued as a part of the Bicester planning application Energy Strategy have been updated to address the issues raised during discussions with BioRegional. The following key changes have been made to the calculation sheets which are summarised in the table below.

Reference	Changes	Comments
1	Non-domestic floor areas	Non-domestic floor areas have been updated. The school floor area and the total area of other non-domestic buildings have increased to match the application drawings. .
2	Gas boiler efficiencies	The following gas boiler efficiencies have been introduced: • domestic -90% • non-domestic-85% These efficiencies are used to convert the energy benchmarks to the fossil fuel benchmarks and vice versa.
3	Non-domestic buildings energy benchmarks	Energy benchmarks of non-domestic buildings taken form TM46 were reduced by 25% (both fossil fuel and electricity components). The non-domestic energy benchmarks have been calculated by assuming that the used TM46 energy benchmarks reflect energy consumption of 2006 Part L compliant buildings and by reducing them by 25%.
4	Unregulated emissions calculation	The unregulated emissions calculation methodology has been modified to account for the CO_2 emissions associated with electric cooking.
5	Energy savings - appliances energy efficiency	There is a commitment to provide A and A+-rated fridges, freezers, washing machines and induction hobs in all homes. Energy savings from the energy efficient appliances have been included in the zero carbon model. It is estimated that provision of the energy efficient appliances can reduce the energy demand associated with appliances by up to maximum 21 %. However, in order to be more realistic, the carbon model assumes the energy demand reduction of 18% Energy savings associated with the provision of energy efficient hobs and energy efficient cookers have now been reduced from 50% to 33%.
6	Domestic and non-domestic roof areas available for PV installation	South facing roof area of each house was calculated based on the provided architectural drawings. The calculation shows that the average roof area is 40.27 m2. This area does not include area of roof overhangs which is estimated to be circa 3.5-4.5 m^2.

		It is assumed that for each house we can utilise 85% of the available roof area (34.3 m^2). This results in an increase in roof mounted PV over the previously estimated 30 m^2. It was estimated that school has circa 2520 m2 of roof area. It was assumed that 60% of the total roof area of the school building can be used for installation of PV panels. All other non-domestic buildings have a total roof area of circa 3600 m2. It was assumed that 70% of the total roof area of non-domestic buildings can be used for installation of PV panels. The total installed capacity of PV systems is 2186 kWp.
7	Deduction of PV annual output due to overshadowing losses	The overshadowing effect caused by some of the roofs is taken into consideration during monthly solar energy output calculations. The Overshadowing and Daylighting Study concluded that although some of the roofs will be overshadowed for a short period of time in the winter months, the effect will be minimal effect on the solar panels as the solar flux intensity during this period is low. For the rest of the year the roofs are clear of shadows. The overshadowing study shows that the overshadowing effect will reduce the total annual energy production only by approximately 4 %.
8	Carbon savings - solar thermal system	The initial CO_2 savings provided by the solar thermal system have been significantly reduced due to the fact that the savings are achieved by using solar thermal system instead of gas CHP. It was previously assumed that the solar thermal system is used instead of gas boiler system.
9	Zero carbon balance calculation	The zero carbon balance calculation has been split into three sections: domestic, non-domestic and school. The calculation shows that domestic and non-domestic buildings together as well as the school building on its own can achieve zero carbon compliance.

The energy strategy has been developed with the intention that under normal operation and maintenance regimes of the energy centre the operation of the gas boiler system is not required. The CHP unit will be adequately sized to meet all the required demand between June and September without the need to operate the biomass boiler or the gas-fired back-up boilers during that period. Planned maintenance of the biomass boiler will take place during summer months when this boiler is not in use. The biomass boiler will operate for a couple of weeks during summer months when planned maintenance of the gas CHP needs to take place.

If potential failure of the gas CHP or the biomass boiler occurs, the system should normally be able to meet the thermal demand by increasing the operation hours of one of these units and by utilising the full capacity of the thermal store.

It is unlikely that failure will affect both gas CHP and the biomass boiler at the same time. However, should this occur and the backup gas boiler system needs to be operated then this can be accommodated within the domestic and non-domestic carbon balance (excluding school) for upto 10 days. If the school building is included in the carbon balance, significantly longer downtime for the gas CHP and the biomass boiler can be accommodated within the total carbon balance.

The site will have capacity to enable electric car charging.

The updated zero calculation results have been provided in a series of the following tables which are attached and should be read in conjunction with this memo.

- Table 1 – Baseline energy demand
- Table 2 – Advance Practice Energy Efficiency (APEE) demand
- Table 3 – Energy demand profiles
- Table 4 – Energy Strategy – carbon balance
- Table 5 – Plant and Thermal store sizing
- Table 6 – Solar PV system output
- Table 7 – Solar Thermal system output
- Table 8 – Biomass storage