Review of Alternatives to the City Centre Heat Network

1 Executive Summary

This report contains high level analysis of potential renewable and low carbon technologies the University of Cambridge and Cambridge City Council could utilise to lower their carbon dioxide emissions in line with their respective carbon reduction plans.

It was found that the Council's energy demand (excluding the council owned housing that is scattered around the city) was approximately 10% of that of the University's, and that 80% of the carbon dioxide emissions of the University came from its electricity usage. It is likely that more than one carbon dioxide reduction technology will need to be used to reduce the carbon dioxide emissions significantly; however it is clear that the largest opportunity is in electricity producing technologies.

Combined Heat and Power (CHP) technologies may form a part of this carbon reduction plan, however they are only efficient (and therefore carbon dioxide emission reducing) when the heat is used as well as the electricity, hence they are limited in size by the heat demand, not the electricity demand.

Arup have considered several technologies in this study, which are summarised in Table 1 below, along with an approximate capital cost of the technology, a cost of the lifetime reduction in carbon dioxide emissions and lifetime carbon dioxide emissions reduced per m².

Technology	Total cost of electricity [or heat], £/MWh$_e$ [or £/MWh$_{th}$]	Cost per tonne of carbon dioxide emissions avoided, £/tCO$_2$	Simple payback period (years)	Area required per tonne of carbon dioxide emissions avoided m², tCO$_2$/m²
Solar Photovoltaic	£110	£200	13	1.2
Solar Hot Water	£70 [heat]	£300	20+	1.9
Wind	£55	£100	10	500
Biomass (heat only)	£45 [heat]	£200	n/a*	120
Biomass CHP	£250	£400	n/a*	80
Gas Fired CHP	£130	£800	5	75
Anaerobic Digestion	£140	£250	20+	5 - 20
Ground Source Heat Pump	£50 [heat]	£450	n/a**	n/a
Air Source Heat Pump	£50 [heat]	£550	n/a**	n/a

Table 1 – Renewable Technology Summary Table

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* payback period is very dependent upon future woodchip and gas/electricity prices – there is a likelihood of no payback

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*** table excludes all government subsidies available

Using this table, and an analysis of the potential to use the different technologies on the University or Council's premises, it was found that the following technologies should be further investigated as a priority:

- Wind turbines positioned on the University's farm land
- Solar PV positioned on the University's land
- Solar hot water positioned on the roofs of buildings

When all opportunities for the technologies above have been identified, the next technologies to be considered should be:

- Gas fired CHP local heat networks
- Biomass fired CHP heat networks

As the University has both the highest energy demand and the most available land, it is proposed that the University should start identifying the sites that could feasibly incorporate this technology. If CHP plant is being used, heat connections to the Council buildings in the area should be considered on a building by building case. Since the Council do not have the land required for most of these technologies, there is also the opportunity for the Council to part fund the University's electricity generation only projects in return for some of the carbon dioxide savings.

This report considers the utilisation of wastes produced by the University, or collected by the Council, in an anaerobic digestion scheme. This was of particular interest to the University as it demonstrated a high-level of cooperation between the University and the Council. The Council are currently in a long term waste contract with a third party operator, AmeyCespa, who have a waste treatment facility in Waterbeach. It was not possible to find out the nature of this contract, however it is known that AmeyCespa have an anaerobic digester on their site that could potentially compete for feedstock. The figures presented in this report show that anaerobic digestion could be considered further, but collection of the wastes and indeed ownership of the wastes need to be further considered in the first instance.