ANNEX 4

High level Potential Sustainable Energy Options for the Community Stadium

York City Council are committed to making York a sustainable city as outlined in the Corporate Strategy 2009/2012. The council aims to be clean and green, reducing it's impact on the environment while maintaining York's special qualities and enabling the city and its communities to grow and thrive. As part of the business case for a Community stadium in York the council are aiming to develop and build the very first Eco Stadium.

Currently Dartford FC's Princes Park Stadium is probably the most sustainable stadium ever built in Britain. Constructed of timber with a sedum green roof, the stadium is partially below ground level to limit noise problems in the vicinity. The stadium also has a solar thermal system and energy efficient building services.

With any development the council has to follow strict planning and sustainable development guidelines. As a minimum the stadium development will need to achieve a minimum BREEAM rating of 'Excellent' as well as be able to provide at least 20% of it's own energy through renewable or sustainable means, it will also have to meet stringent requirements under the Council's Interim Planning Statement: Sustainable Design and Construction 2007.

From 2019 commercial buildings will have to be carbon neutral and not reliant on fossil fuels or the national grid. Though the community stadium is anticipated to be built and opened before 2019 it would be excellent opportunity for York to build the very first Community Eco Stadium and potentially the very first carbon neutral stadium in the UK. This would set a national precedent and show the residents of York how committed the council is to making York a sustainable city through leading by example.

There are many technologies and approaches that can be used to reduce carbon emissions from buildings, some have quick returns in terms of carbon and finance, others save carbon but have no financial incentive to encourage investment. Some technologies also act as a valuable educational tool, that could demonstrate to the community the council's commitment to saving carbon. The table below demonstrates the effect that a handful of potential sustainable technological solutions could have.

Technology	Investment k £	CO2 save Tonne/year	Revenue save/-cost £	Pay Back Years	Typical Applicaton
Thermal Solar – Hot water	Low	Low	Low	Prohibitive possible financial assistance available	New Build Excellent educational value
PV Solar - Photovoltaic Panels 10kw	High	Low	Low	Prohibitive Possible financial assistance available	New build – site specific Excellent educational value
Wind Turbine *dependant on	Medium	Medium ???? George	Low	Long term and specific	Site specific Excellent

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size		how can it be low?		funding available	educational value
Heat pumps	High	High	High	Prohibitive Possible financial assistance available	New build Site specific
Combined Heat and Power Unit	High	High	High	Possible ESCo financing solution – see below	New Build
Bio Diesel boilers	Medium	Very high	Cost	Never	Existing oil fired plant
Water Rain and grey	Low	N/A but will save water and consumption bills	medium	Short term	Excellent educational value

There are sustainable methods that the stadium might be able to employ that have not been invested in this preliminary report. New technologies are also continually in development. Below, however, are several known examples and case studies that show how sustainable energy has been incorporated and used in other projects.

Thermal Solar (Hot Water)

Oaklands Pool in York will be a 6 lane 25 metre pool with a teaching pool. It will have the largest array of solar thermal panels in the country which will span approximately 30m by 15m. The panels cost £260,000 to install and should produce 82 megawatt hours of energy per annum. This is enough heat to keep the swimming pool water for three quarters of the year.

Photovoltaic Solar (PV)

An outline feasibility study for solar power generation at the Tottenham Hotspur Stadium has been undertaken by Carbon Descent on behalf of Friends of the Earth. .

It is estimated that 80% of the suitable roof area will be usable for solar installations which is approximately 14,600m². This provides enough space for the installation of 1,170 kwp of solar panels assuming 10m² per kwp. This system should be capable of generating a total of 790 megawatt hours of electricity per year (saving around 355 tonnes of CO2 per year compared to conventional grid electricity).

Typical costs for solar PV range from £5,000 to £7,500 per kilowatt installed. As this would be a very large installation, it would be reasonable to suggest costs could be to the low end of the range. The installed cost based on an

optimistic £5,000 per kilowatt figure would be £5.85M, based on a mid-range figure of £6,500 per kW the overall costs would be £7.6M.

Assuming the entire cost of the solar panels was borne by Spurs the simple payback would take about 90 years. However with grant funding the outlay by the football club could be significantly reduced.

From our own research conducted around PV solar power there is a possibility that a feed in tariff could be introduced by the government in 2010/11 which could enhance the payback prospects of any renewable electricity like the PV panels. At present, there is no clear indication of the level at which feed in tariffs might be introduced in the UK. A comparison of various feed in tariff schemes in operation on the Continent revealed support of €0.33/kWh in Spain, €0.42 in Germany, €0.45 in France and €0.46 in Italy.

However there are several issues surrounding feed in tariffs. The main complication is that the grid may not be able to cope with the excess energy that could be produced through renewable means. This would prevent any potential 'payback' energy being realised. Furthermore it is unlikely that a development scheme as large as a stadium complex would be able to generate any additional electricity to sell back to the grid.

The Eco Depot in York has an array of approximately 10 by 5 metres of PV solar panels. It cost about £250,00 to install and currently produces about 3kwh. To put this in to perspective a floodlight uses about 100kw per hour. The array is however an excellent educational resource and promoted extensively to visitor of the depot.

Wind Turbine

In July 2008 Middlesbrough FC received planning permission for a full size 2-3mw wind turbine standing 125m high which will be sited in the car park to the east of the stadium. It is estimated that the turbine will cut electricity bills by around £130,000 per year. Manchester City have also been investigating the feasibility of a similar wind turbine at their stadium.

The Eco Depot in York also has a wind turbine and this generates modest amounts of energy but provides an excellent educational resource and is a visible commitment of CYC ambition to create a sustainable city.

Water

Both rain and grey water can be used to increase the sustainability of the stadium. Rain water can be harvested from the roof and stored in tanks. Firstly the stored water can be used for watering the pitch. Secondly if the stadium was to have an on site swimming pool, after filtration, the rain water could be used to replenish pool levels. (It is estimated that a litre of water is lost each time a bather gets out of the swimming pool).

Grey water collected from internal gutters, showers, baths and wash basins can be collected. It can then be used to flush toilets. Each tonne (cubic metre) of water re-used will save approximately £4.50.

Ground source heat pumps
Ground source heat pumps use pipes buried in the garden to extract heat from the ground so it can be used throughout the year, even in the middle of winter. The heat generated is usually used to warm water for radiators or under-floor heating systems. It can also be used to pre-heat water before it goes into a more conventional boiler. In regards to the stadium the system could be used to heat the offices and buildings during the day and then diverted during the evening to heat the pitch and keep it frost free.

Costs for ground source heat pumps are approximately £1000 for every kw installed. Electricity is needed to make the ground source heat pumps operate but for every one kw invested 4 to 5kw are generated in heat. This technology works out cheaper than gas.

There are currently several heat pumps across York. One example of this type of renewable energy is at McArthur Glen, the Designer Outlet.

A good example of ground source heat pumps is Tolvaddon Energy Park in Cornwall which is the most environmentally advanced business park in Cornwall. Development was funded through a £4 million investment from the South West Regional Development agency and the Objective One European Funding Programme. The project is a flagship commercial development heralding the very best environment friendly and sustainable construction techniques for modern buildings.

Each of the 19 individual units, ranging from 750sq ft to 5,000sq ft, have been specifically designed to minimise energy use and deliver high quality working environments for tenants and their staff. The heating system is made up of individual heat pumps, ranging from 4kW to 24kW for each of the 19 units. The heat pumps are connected to over forty, 70m vertical ground arrays installed. Compared to oil fired heating there have been significant financial savings and a reduction in CO2 by about 57%.

Combined Heat and Power (CHP)
Combined Heat and Power (CHP) is the simultaneous generation of usable heat and power (usually electricity) in a single process. CHP is a highly efficient way to use both fossil and renewable fuels and can therefore make a significant contribution to the UK's sustainable energy goals, bringing environmental, economic, social and energy security benefits.

CHP systems can be employed over a wide range of sizes, applications, fuels and technologies. In its simplest form a gas turbine, an engine or a steam turbine drive an alternator, and the resulting electricity can be used either wholly or partially on-site. The heat produced during power generation is recovered, usually in a heat recovery boiler and can be used to raise steam

for a number of industrial processes, to provide hot water for space heating, or with appropriate equipment installed, cooling.

CHP systems are typically installed onsite, supplying customers with heat and power directly at the point of use, therefore helping avoid the significant losses (estimated at about 40%) which occur in transmitting electricity from a large centralised plant to customer.

Barton Hill is one of several community heating schemes managed by Bristol City Council. The Barton Hill scheme supplies heat to 620 bedsits, flats and maisonettes housed in 10 blocks as well as ten shops and a local church. Barton Hill was part of an Estate Action scheme which aimed to improve the quality of the homes and to reduce energy costs to tenants. An important achievement has been the installation of a Combined Heat and Power unit, assisted by a £75,000 grant from the Residential CHP Programme.

The blocks at Barton Hill were built between 1957 and 1966. Tenants were experiencing increasing problems with low tenant comfort levels, condensation, mould growth and fuel poverty. After a major review of the site in 1992 the Council initiated a comprehensive package of measures to tackle the problems.

The CHP project was commissioned in December 1995 and the total CHP project cost was approximately £300,000. This is made up of the following:

- CHP plant £200,000
- Site preparation and building work £21,000
- Electrical works and REC charges £22,000
- Gas supply £7,000
- Controls £21,000
- Other cost including consultancy £29,000

As CHP produces electricity and heat more efficiently the Barton Hill CHP estimated the following environmental savings:

- Annual primary energy saving of 5,550,000 kwh
- Annual carbon dioxide saving of 2,500 tonnes

Furthermore the electricity generated by the CHP unit was originally intended for transmission across the local electricity distribution system for use at the main council offices. However the economic situation has changed and sales of electricity directly to the local electricity company may be more financially attractive than supplying the council offices. Bristol City Council is currently reviewing the various financial options.

ESCO

An energy service company (ESCO or ESCo) is a professional business,/industrial and provident society/trust, providing a broad range of

comprehensive energy solutions including designs and implementation of energy savings projects, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management. Though an ESCO is not a type of sustainable energy it is a method in which cost effective, carbon reducing sustainable energy can be provided.

The ESCO performs an in-depth analysis of the development, designs an energy efficient solution, installs the required elements, and maintains the system to ensure energy savings during the payback period. After installing energy conservation measures ESCOs often determine the energy savings resulting from the project and present the savings results to their customers.

Conclusion

There are many potentially suitable sustainable technologies that the stadium could employ to reduce the amount of CO2, have the potential to 'pay back' installation and maintenance costs and even make savings compared to more traditional fuels. However if a multitude of these different sustainable technologies were used collectively they could enable York to create a ground breaking, exemplary carbon neutral Community Eco Stadium.

Some technologies are more cost effective than others and therefore have a quicker payback. The extent and use of some types of sustainable energy will be site sensitive, for example a wind turbine. However in order to achieve the aim of opening the first Community Eco Stadium it would be important to use as many technologies as possible to set an example to York, the UK and potentially globally.

There are possible ways of financing these technologies. Some of the case studies above have been funded through grants. This shows that finance could be available to help offset the initial capital costs of generating sustainable energy. There is the question of naming rights for the stadium. A Community Eco Stadium maybe something that major companies are keen to associate themselves with. Also there might be potential opportunities to sell any excess energy generated back to the grid or to other tenants of the stadium development.

Additionally, site dependent, any excess energy generated could be used to heat affordable housing, similar to the Bristol City Council Barton Hill case study. This would enable further community benefit from the stadium.

The next step of this process is to commission a detailed feasibility study to a specialist consultant. Research into all possible sustainable technologies should be undertaken reviewing, for example, cost, potential financial and carbon savings, viability, grant funding availability, feed-in tariff options coupled with successful and unsuccessful case studies. The findings from this study will then inform the overall business case and options for a Community Eco Stadium in York.

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