

Eco Bicester Strategic Delivery Board

Date of meeting: 12 April 2012	AGENDA ITEM NO: 5
Report title: Ardley Energy from Waste and Combined Heat and Power; making it a reality for Bicester	
Authors: Lesley Tims (Environment Agency) Linda Currie (Oxfordshire County Council) Jenny Barker (Cherwell District Council) Nicole Lazarus and Joanna Marshall-Cook (BioRegional) P3 Eco (Eco-Town facilitators) A2 Dominion (Development Partners) Email: lesley.tims@environment-agency.gov.uk Tel: 01491 828486	

1. Snap shot: key benefits of connecting North West Bicester to the Ardley Energy from Waste facility

- **Carbon savings:** this would automatically save 5,000 tonnes of CO₂ per year (equivalent to taking 2,500 cars off the road). There is additional potential to save a further 50,000 tonnes of CO₂ if more of the waste heat can be utilised (equivalent to 25,000 cars off the road or 1/6th of Bicester's total carbon emissions)
- **Potential lower energy prices for residents:** waste heat from Ardley is likely to be lower than wholesale gas prices with the potential for long term supply and price security¹
- **Reduced fossil fuel use**

2. Purpose of the Report

- 2.1 To ensure Combined Heat and Power (CHP) from the Ardley Energy from Waste (EfW) facility is thoroughly considered as an option for providing low grade heat to NW Bicester by understanding the current status, opportunities and key parties required to deliver this option. The benefits in terms of delivering the aspirations of the NW Bicester Eco-Town as well as those of 'Eco-Bicester – One Shared Vision' to make Bicester a better place to live, work and bring up a family should not be under estimated. This option has the potential to deliver social and economic outcomes as well as benefits for the environment and is an opportunity for the Town of Bicester to lead the way on pushing for the highest standards of sustainability.

¹ Potential savings subject to commercial agreements between relevant parties

2.2 Combined Heat and Power

- 2.3 CHP means generating power in the form of electricity and at the same time utilising the heat, and in some cases excess electricity, which would otherwise be wasted e.g. heating homes, businesses and public buildings via a district heating scheme.
- 2.4 Most EfW plants of the type proposed for Ardley have traditionally produced electricity by raising steam (heating water) from the incineration process, with the lower grade heat going unused (discharged to atmosphere) after the electricity has been generated. Often this is due to the lack of a suitable end user of the heat within close proximity and prohibitive costs involved in laying the necessary infrastructure.
- 2.5 This is a waste of increasingly valuable heat. By capturing and using this heat the overall energy efficiency of the process can rise significantly from about 25-30% without heat recovery; to 80% with heat recovery and use (80% of the calorific value of the fuel being used).
- 2.6 In a district heating network consumers are still able to control how warm their home/building is – they would have a control panel similar to the one provided with a modern boiler. In addition, heat is charged according to how much is used.

3. **General benefits of using waste heat from energy from waste facilities**

3.1 As well as the more efficient use of waste as a resource there are a number of other benefits of CHP:

3.2 *Environmental*

- **Replacing the need to burn other fossil fuels to generate the heat.** In a case study in Sheffield where 2,800 homes and 140 commercial and municipal buildings are heated via a CHP scheme up to 60MW of heat and 20MW of electricity is generated, reducing CO₂ emissions by an average of 21,000 tonnes per year.
- **Reduced CO₂ emissions:** Replacing traditional gas heating with waste heat from an EfW facility can reduce CO₂ emissions from the home by 52%². This will help achieve the Governments carbon reduction targets.
- **Potential to connect to other buildings:** Once a district heating network is established it can quickly grow. The availability of attractively priced heat encourages others to connect and the network to grow so increasing the benefits. New network suppliers who produce waste hot water can also hook up. The financial incentives will play an important role as will the planning process highlighting and encouraging commerce with significant heating/cooling demand to locate in a particular location.

3.3 *Social/economic*

- **Potentially significant cost saving to users** compared with heating via more conventional means. This can help deliver the fuel poverty improvements as the cost of heating can become disconnected from the fluctuation in commodity prices. It can

² Source: Retrofitting District Heating Systems (2012) BioRegional

also reduce the heating/cooling costs for business and public buildings as well as helping them reduce carbon footprints¹.

- **Financial drivers helping to incentivise the use of CHP** e.g. availability of Renewable Obligation Certificates (ROCs), Climate Change Levy exemption and the Renewable Heat Incentive.
- Greater space available in each home as the heat interface unit that is required in place of a boiler is smaller than a traditional boiler. In addition, hot water storage tanks may not be required.

4. Comparison with the alternative gas CHP option proposed for North West Bicester

4.1 CO₂ savings

The table below considers two options:

- NW Bicester meets its heat demands from Ardley waste heat
- NW Bicester meets its heat demands from a gas CHP

4.2 The table compares CO₂ emissions from both Ardley and NW Bicester in both options. Both options are capable of delivering ‘zero carbon’ for NW Bicester but the Ardley heat option offers greater CO₂ savings for the town overall.

	Using Ardley waste heat	Gas CHP for NW Bicester with Ardley producing electricity only
Carbon associated with fuel input (tonnes CO ₂ /yr)	97,968	124,142
Heat output MWh/yr	25,075	25,075
Electricity output MWh/yr	199,528	224,603
Carbon emissions if using gas boilers and grid elec	176,184.53	197,122.16
Total energy output (MWh/yr)	224,603	249,678
Total carbon emissions saved (tonnes/year)	78,216	72,980

4.3 As seen from the table, using the waste heat from Ardley instead of putting in a gas CHP system at NW Bicester would save 5,236 tonnes of CO₂ every year. In comparison to the CO₂ emissions from Ardley this may not seem significant. However, when one considers that the CO₂ emissions from all of NW Bicester would have been 20,000 tonnes if gas boilers had been installed; this becomes a significant saving.

4.4 By building the pipe-work to the boundary of Bicester it will be possible to extend the heat pipe to supply other buildings in Bicester. If all of the heat from Ardley was used to heat buildings this would save 55,000 tonnes of carbon. This is equivalent to the carbon footprint of 5,000 people (1/6th of the whole of Bicester’s carbon footprint).

4.5 Cost benefit

4.6 Preliminary cost estimates have been made for both connection to Ardley and using gas CHP. These preliminary calculations indicate that the long term profitability of connecting to Ardley is greater than using gas CHP. This cost estimate included the requirement of a ‘back up’ to

cover for planned and unplanned non-availability of the EfW plant. The plant is designed to have two separate incineration lines, enabling planned maintenance on one line whilst the other remains operational. This can ensure a constant supply of heat except in instances of a total unplanned shut down.

5. Background and drivers

5.1 Planning update for Ardley

5.2 Planning permission has been granted for the EfW facility to be built and operated by Viridor, on land adjacent to the existing landfill site at Ardley. Details that needed to be approved before development could commence have been approved and Viridor started construction in December. The build, including commissioning, should take approximately 3 years and the facility is expected to become operational in Q4 2015.

5.3 The facility has been designed to burn up to 300 000 tonnes of residual household, commercial and industrial waste each year. It will have the potential to generate approximately 26MW of electricity (enough to serve around 25,000 people) and be designed to enable the export of low grade heat to nearby end users.

5.4 Planning drivers

5.5 The planning permission is subject to a condition requiring that before the EfW facility is commissioned Viridor should undertake a CHP Feasibility Review, assessing potential commercial opportunities for the use of heat from the plant; this will need to be submitted to the County Council as Waste Planning Authority for approval.

5.6 The Review must provide for the ongoing monitoring and full exploration of potential commercial opportunities to use heat from the plant as part of a good quality CHP scheme and for the provision of subsequent reviews of such commercial opportunities as necessary. Where the Review identifies viable opportunities for the use of heat, Viridor must submit a scheme for the provision of the necessary plant and pipe work to the boundary of the site to the County Council for approval and any scheme that is approved must be implemented.

5.7 In addition, NW Bicester as an Eco-Town should meet PPS1 (Eco-towns supplementary); Policy ET 7 requires Eco-Towns to be zero carbon and ET8.1 requires climate change adaptation. These policies are still in place and have not been replaced by the recently published National Planning Policy Framework.

5.8 Environmental Permit drivers

5.9 The Environment Agency will be responsible for regulating this site once in operation. The site already has an Environmental Permit which was issued on 27 September 2010. There are a number of energy efficiency conditions on the Environmental Permit which the operator, Viridor, must meet including:

- taking appropriate measures to ensure energy is used efficiently and this is regularly reviewed with new identified opportunities implemented
- provision and maintenance of steam and/or hot water pass-outs so that opportunities for the further use of waste heat may be capitalised upon should they become practicable
- review the practicability of CHP implementation at least every 2 years

- guidance on Best Available Techniques (BAT) for Waste Incineration states that waste heat should be recovered unless to do so can be demonstrated not to represent BAT (this will require cost justification). All opportunities for CHP and district heating should be explored.

5.10 Key considerations

- Proposed Eco-Town is within 2.7km from the EfW plant. Well within range to enable the transfer of heat
- Need to have sufficient base load – constant demand for heating/cooling from a range of users e.g. leisure facilities, hotels, commercial, schools, hospitals, colleges, industrial as well as flats and houses (majority provided at NW Bicester)
- New build developments rather than retrofitting is significantly more cost effective
- Back up generation required in case of emergency shut down of the EfW plant
- Legal requirement for the EfW operator to fully evaluate the viability of CHP
- Proposals for end of facility life

5.11 Viridor – (progress update from Oxfordshire County Council)

5.12 Viridor has had some preliminary discussions with the Eco-Town promoters about Ardley being a possible option for providing low grade heat to NW Bicester. However to assess the feasibility in any detail Viridor require information from the developers on the likely scale and timing of demand; work will need to be undertaken to provide this information.

5.13 Progress update from P3 Eco and A2 Dominion

'As was stated at the last Strategy Board both P3 Eco as overall facilitator and A2D as master planning partner and first phase developer and affordable housing provider for the whole site going forward, are keen to establish whether heat from Ardley can be brought to the site as this has the potential to be of great benefit to owners and occupiers and assist in meeting the eco standards. Various options for energy supply including from Ardley are under consideration and will be reviewed in detail during the masterplanning phase. P3 Eco has already commissioned a detailed study which Metropolitan have completed and which will be made available for the detailed review stage, along with input from others for consideration. In tandem with this A2D have also been developing options with SSE particularly in connection with energy provision in the exemplar phase and the anticipated next residential phase beyond that. The exemplar phase will commence before Ardley comes on stream but please note SSE work closely with Viridor on projects elsewhere. P3 Eco have in the past had preliminary discussions with Viridor. Approximately 2.5km of district heating pipe would be needed to connect the development to Ardley. The connection to Ardley could remove the need to install stand alone CHP engines on site. Whilst subject to detailed design and costings, it is hoped that it will prove to be the most viable solution going forward. Hence the long term and low cost supply of heat could potentially be accessed in a viable and sustainable way. Heat could be available from Ardley in 2015/2016. A supply in the order of 10 to 20 MWth has been provisionally discussed with Viridor as this would provide all of the base load heat demand of the Bicester development, without adversely effecting electricity production. All approaches will need to be considered in detail at the masterplanning stage. Finally, a meeting is in the diary to start to explore in more detail with SSE, with Bioregional in attendance, as their focus up until now has been on the exemplar and the anticipated next residential phase beyond that, but it is hoped their multi utility approach and existing relationship with Ardley will help facilitate the process. Hyder Consulting, who are the multi disciplinary practice working with A2D and P3 on all technical aspects of the project, will steer the technical discussions as the masterplan moves forward.'

6. Recommendations/conclusions

- 6.1 The Environment Agency supports CHP because more efficient energy use will reduce greenhouse gas emissions, and in turn will help support our commitment to reducing climate change. This paper further highlights some of the social and economic benefits which could be achieved for the Town.
- 6.2 EfW and CHP delivered through a DHS is successful all over Europe and is a tried and tested process. One of the world's largest district heating networks is the Copenhagen network, stretching more than 50km, using three waste-to-energy plants to supply heat to the network which results in more than 30% of the total district heating in the Greater Copenhagen area being generated by waste. More case studies can be found on the Confederation of European Waste to Energy Plants here <http://www.cewep.eu/information/energyclimate/goodpractice/index.html>.
- 6.3 We would like the Board to be aware of the exciting opportunities and benefits this option can deliver for Bicester and to do what they can through their work to promote and facilitate this option in becoming a reality for the town.