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Trident Park Energy Recovery Facility

Review of Combined Heat and Power (CHP) opportunities at Trident Park ERF

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Quality Assurance

This report has been prepared with all reasonable skill, care and diligence. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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1. Introduction

1.1. Background

Viridor Waste Management (Viridor) is the Operator of an Energy Recovery Facility (ERF), known as Trident Park. The ERF is located immediately north of Cardiff Docks and was formally occupied by Nippon Electric Glass (UK), off Glass Avenue, Cardiff.

Trident Park ERF will treat approximately 350,000 tonnes per annum (tpa) of municipal and commercial solid waste. The combustion of waste will result in the release of heat, which is used to raise steam. The high pressure steam is transferred to a turbo-generator set that generates electricity.

As well as electricity generation there is the potential to extract heat from the steam, either before or from the turbine. In order for this to occur the extracted steam is converted back into hot water for use in industrial processes or for heating buildings.

It is recognised that the overall efficiency of the energy recovery process can be improved by operating as a combined heat and power (CHP) plant; reducing carbon dioxide emissions attributable to the heat consumer and making better use of the energy available in the waste.

To this end efforts have been made prior to construction and commissioning the Plant; and continue to be made to secure outlets for residual heat produced by Trident Park ERF.

1.2. Purpose of this note

This note has been prepared to address the requirements of Permit Condition 1.2.3 of Permit EPR/LP3030XA, in relation to the potential to recover and use waste heat from Trident Park ERF.

It also address Item 4 of the Section 106 Agreement for the development which requires best endeavours to use and market any energy generated from the operation of the facility.

2. Combined Heat and Power (CHP)

The concept of CHP is relatively simple; steam is extracted from a turbine (for Trident Park it would be at two locations from the installed turbine) and transferred via a dedicated pipeline to a primary heat exchanger unit. An Energy Supply Company (ESCo) would then manage the business of distributing and selling the heat to end users.

A return pipeline coming from the primary heat exchanger runs parallel to the steam line and transports condensate back to the ERF. Back-up boilers installed in the heat station would supply extra heat to the system when demand exceeds the ERF's capacity or the ERF is offline.

Feasibility of a CHP scheme relies on a regular market for the heat supplied by the facility. Five key considerations need to be taken into account when assessing a CHP scheme. They are as follows:

a) Potential heat users
b) Retrofitting
c) Feasibility of obtaining planning permissions for connection
d) Potential costs
e) Disruption

The most viable heat users are those situated within close proximity to the site and which use fairly large amounts of heat, preferably with a constant 24 hour annual demand. Short pipelines carrying more heat are generally more cost effective and cause the least disruption during installation compared to large numbers of pipelines. The cost and ease of retrofitting are also important considerations. Large centrally heated buildings are often better placed for retrofitting as it is easier and cheaper to install into an existing large central heating system compared to several smaller heating systems. Although, installation into a new development as it is being built remains the preferred option. The following list ranks the more favourable heat users in order.

1. Industry
2. Educational facilities
3. Amenity facilities (including leisure centres, swimming pools and hospitals)
4. Commercial properties and Offices
5. Hotels and communal residences
6. High density residential areas

Although it must be noted that there are very few, if any, successful examples of retrofitting terraced residential properties.

3. Previous Scoping Study

From the initial stages of the Trident Park ERF project, CHP has been an integral part of the development process. A Heat Plan to determine the potential market for heat in the Cardiff area was carried out by SLR in 2010 and 2011, followed by a feasibility study conducted by Fichtner in 2012.

Each assessment demonstrated scope for heat to be supplied via a district heating network of highly insulated underground pipes to nearby heat users.

Trident Park ERF has a potential power output of up to 30 MW of electrical energy per year, based on a current waste input of 350,000 tpa, which is exported to the National Grid. However, heat from the facility could be piped in a heat main to various end users. Each end user would take heat from the main via heat exchangers connected to meters to measure their usage. The heat in the heating network would be set at temperatures between 80^{o}C – 125^{o}C, from which the user would extract as much as necessary. No water would be removed from the system, only the heat extracted from it. The maximum amount of heat that could be generated from the turbine installed at Trident Park is approximately 20MWth.

To implement a district heating network the following essential elements have been identified:

a) District heating pre-insulated piping
b) Primary heat exchanger managed by either Trident Park ERF or an ESCo to transfer heat from steam delivered by the facility to the district heating circuit
c) A district heating circulation pump set consisting of pumps arranged in a duty/standby configuration to provide 100% redundancy
d) Condensate pumps required to return the condensate to the ERF in a duty/standby configuration with 100% redundancy
e) Heat meters and control equipment. One set at the main line, one set at the outlet of any package boilers and one set at each end user
f) A pressurisation system
g) A back-up boiler system to ensure a continuous heat supply

In order to minimise initial investment and demonstrate to other potential heat users the benefits of utilising such a system, it is anticipated that the development would take place over a number of years and/or phases.

The initial scoping work identified five phases that correspond to clusters of buildings and facilities that could be potential users of heat. This initial scope assumed that the district heating network would be developed by supplying the closest users to the site first, expanding outwards over time. It was also identified that the first phase would need to include a sufficient number of end users to make any initial investment viable.

As mentioned previously, the services of an ESCo is vital in making a district heating scheme a reality. As a result, Viridor has been in discussion with a community heating operator concerning the purchase of heat from Trident Park ERF.

4. Current status

At the time of writing, Trident Park ERF is fully operational and is approaching the two year anniversary of hand-over from the construction Contractor.

The turbo generator unit (TGU) is a Siemens SST 400 model, whose function is to convert thermal energy produced by the two steam boilers into electrical power. The TGU is also designed with three separate bleed extraction points that can provide steam at required pressures to defined plant consumers. Two out of the three bleed extraction points have the additional capability for heat export, in that steam extraction from these bleeds could supply heat to a heat station managed by either Trident Park ERF or an ESCo.

During December 2016 Viridor took part in further discussions with a community heating operator concerning the potential to develop a district heating network using heat produced from Trident Park. The community heating operator agreed to carry out a new survey to assess the current and future potential users within the vicinity of Trident Park. A process of gathering energy data from potential customers is required and following an analysis of the heat load information; a business case may be developed, that would subsequently need to derive likely tariffs. Ultimately an ESCo will require substantial commitment from all potential end users to trigger the release of capital investment that is essential to initiate any such scheme.

There is no change to the estimated time required to develop the necessary infrastructure for the district heating network, which would take approximately 18 – 24 months to complete.

Looking ahead, there are a number of future developments planned for Cardiff, which may be in a position to connect into a heat network. Viridor will continue to review all opportunities for a district heating network supplying heat within the vicinity of Trident Park and beyond.

5. Summary

The review of CHP opportunities is on-going and the aim of this report is to discharge Viridor's obligations under Condition 1.2.3 of Environmental Permit EPR/LP3030XA and Item 4 of the Section 106 agreement.