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INTRODUCTION

8.1 Annex B to TAN 21 requires an explanation of how energy recovered from the incineration process will be maximised (e.g. through combined heat and power, district heating or the supply of steam/hot water to neighbouring industrial users. It also requires evidence that the proposal would or would not meet the R1 energy efficiency calculation.

COMBINED HEAT AND POWER

8.2 Combined Heat and Power (CHP) is the generation of usable heat and electricity in a single process. A CHP plant may either supply steam direct to customers or capture waste heat for low-pressure steam, hot water or space heating purposes after it has been used to drive electricity generating turbines. The heat can also be used to drive absorption chillers, thereby providing cooling.

8.3 In conventional thermal generating stations, the heat that is raised to drive electricity generation is subsequently emitted to the environment as waste. Supplying steam direct to industrial customers or using lower grade heat, such as in district heating networks, can reduce the amount of fuel otherwise needed to generate the same amount of heat and power separately. CHP is technically feasible for all types of thermal generating stations, including energy from waste, although the majority of CHP plants in the UK are currently fuelled by gas.

Relevant guidance

8.4 The ERF has been designed from an early stage to ensure that the requirements of European and domestic legislation have been met. As such, reference is made to a number of guidance documents (primarily in relation to the application for an Environment Permit) which have been referred to throughout the design of the facility in seeking potential heat users for the ERF:

- Defra Environment Permitting Guidance: The Waste Incineration Directive (March 2010);
- Environment Agency: EPR5.01 - How to Comply with your Environmental Permit – Additional Guidance for the Incineration of Waste (February 2009); and
- Technical Advice Note 21: Waste (February 2014)

Defra Environmental Permitting Guidance: The Waste Incineration Directive (March 2010)

8.5 This report offers guidance on the requirements of the WID (now consumed within Industrial Emissions Directive, IED) within the context of the Environmental Permitting Regulations (EPR). Whilst the requirements of the

WID have now been transposed into the IED, this report offers the most up to date guidance to operators on the incineration of waste.

8.6 Sections 4.37 and 4.38 of the document refer to the requirements of Article 6(6) of the WID (now consumed within IED) with regard to heat recovery for incineration processes:

"Article 6(6) requires that any heat generated by the incineration or the coincineration process should be recovered as far as practicable. It will, therefore, be necessary for all operators of incineration plants to demonstrate that this condition has been met or explain why it is not possible to recover energy."

"Opportunities to maximise the potential for improving heat recovery through the provision of district heating or process steam should be carefully considered, and tie-ins included in the design to enable link up in the future should the opportunity arise. This should be considered at the early planning stage, when sites are being identified for such facilities, to ensure that maximising energy recovery through the use of CHP is included as a factor in the decision."

Environment Agency: EPR5.01

8.7 EPR5.01 refers to the indicative best available techniques (BAT) for consideration during the design of incinerators to meet the requirements of the EPR and WID. The following techniques are considered BAT to increase efficiency through heat recovery and CHP:

- *"use of the heat generated for electricity generation for on-site or off-site use is expected for the majority of new installations. At existing plant the capital expenditure and logistics (e.g. availability of an outlet for the electricity generated) may remain prohibitive."*
- *"use of steam from boilers in on-site or off-site applications."*
- *"use of waste heat for CHP or district heating (potential to increase overall thermal efficiencies from approx. 20% to 75%)."*
- *"use of waste heat for preheating combustion air, boiler feed water or plume reheat."*

8.8 Also included in the EPR 5.01 guidance are sub-sector BAT. For municipal waste incineration, the following techniques are considered BAT:

- *"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."*
- *"The siting of plant near to potential or actual energy users will aid the maximisation of recovery potential. Consideration should be given to joint venture projects wherever possible."*
- *"If waste heat is not recovered, provision should be made for future installation e.g. the provision of tie-ins."*

Technical Advice Note 21: Waste

8.9 The provisions of Technical Advice Note (TAN) 21 have been considered in Chapter 5 above. In the context of CHP, paragraphs 4.34 and 4.35 are of note. Firstly, the TAN advises that:

"Local planning authorities should take account of the energy efficiency of any energy from waste proposal, ensuring that any such facility operates or is capable of operating, at high efficiencies that minimise the environmental impacts and maximise the benefits of recovering energy from waste. This will involve consideration being given to the way in which heat is recovered from the installation. Local planning authorities should support the development of appropriate energy recovery options for the optimal recovery of energy from residual waste in Wales, including the development of markets for heat output and processed combustion residues, as well as electricity. Combined heat and power, and heat only options, should be considered favourably where they meet high energy efficiencies".

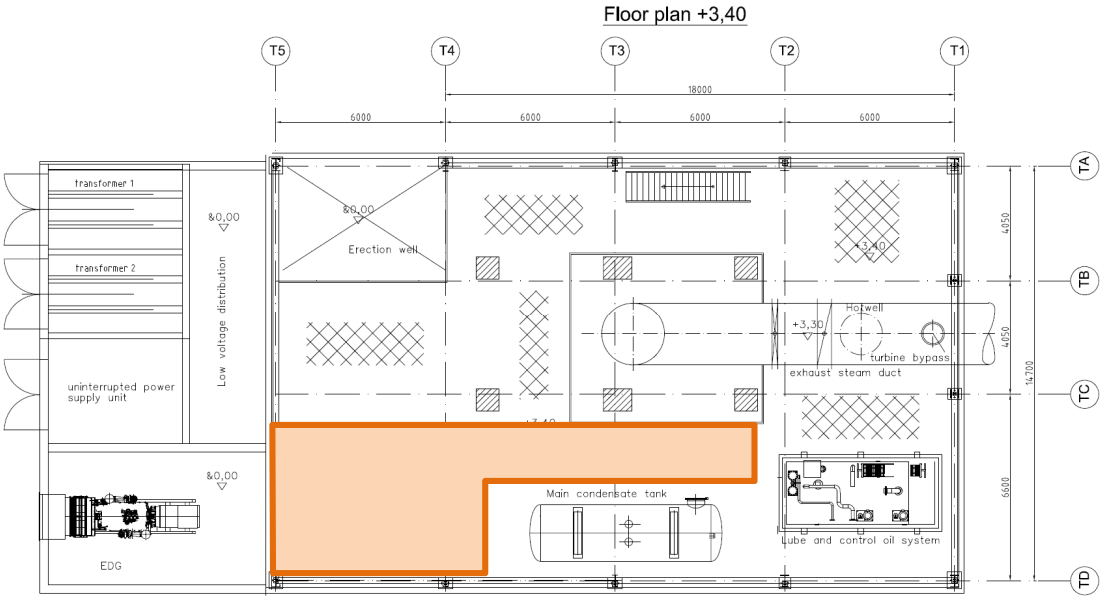
8.10 The TAN then goes on to add that the spatial relationship between energy from waste facilities and heat users is an important factor in site choice.

Design

8.11 Parc Adfer would initially operate in an electricity only mode, exporting around 15MW of renewable and low carbon energy to the national grid. However, it is recognised that the most efficient energy from waste plants are those which use the waste heat from the high pressure steam, after it has been used to generate electricity. This waste heat can be harnessed by a CHP facility to transfer the heat to water. In view of this, Parc Adfer has been designed to allow for a heat offtake should a suitable end user be identified; this is often referred to as being "*CHP ready*".

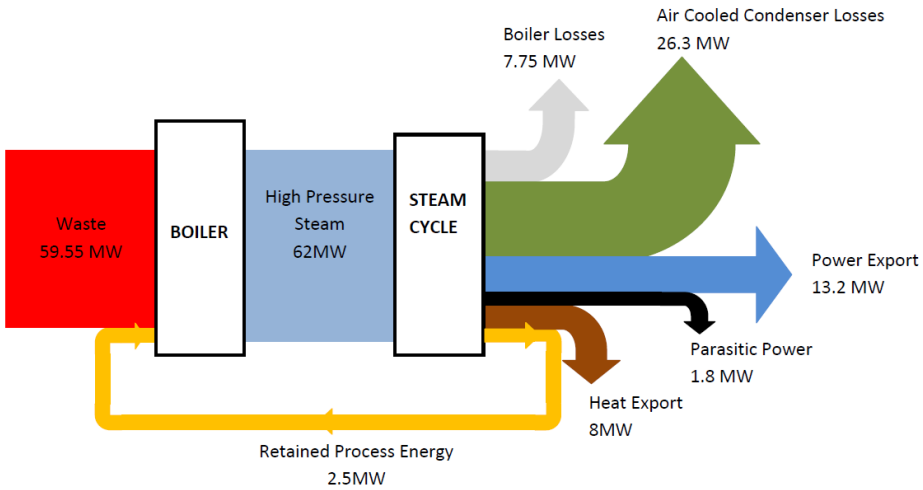
8.12 The required footprint for the equipment needed to provide a heat offtake has been allocated in the turbine building layout, further demonstrating the applicants commitment to realising the heat export potential of Parc Adfer. This space within the turbine building is shown in Figure 8-1 below. Any offsite or backup heat generating equipment would be considered based on the scope of heat supply agreements.

Figure 8-1
Allocated district heating equipment location in the turbine building



8.13 When operating in CHP-mode, the ERF will produce 15MW of electricity of which it would export around 13MW of electricity along with 8MW of heat (see Figure 8-2). Therefore in CHP-mode the export of energy from the site increases to around 21MW. The gross net calorific value efficiency in this mode is enhanced to 37.2% (as opposed to 26.4% in electric only mode). The ERF has been be designed with the ability to export up to 10MW (80,000MWh) of heat per annum. This would be in the form of either hot water or steam.

Figure 8-2
Sankey diagram demonstrating the plant efficiency



Opportunities

8.14 To be economically viable as a CHP plant, a generating station needs to be located close to industrial or domestic customers with heat demands. For industrial purposes, customers are likely to be intensive heat users such as chemical plants, refineries or paper mills. CHP can also be used to provide lower grade heat for light industrial users such as commercial greenhouses, or more commonly for hot water and space heating, including supply through district heating networks.

8.15 Integration of CHP into new developments is generally considered to be better than retrofitting to buildings that are already in place, as the communal heating system can be incorporated into the design of a building, and disruption to the normal operation of the buildings and extra costs are avoided.

8.16 Consideration has been given to identifying suitable end users of heat in the locality. This is set out in the 'Heat Plan' prepared as part of the application for an Environmental Permit; a copy of the Heat Plan is included in Appendix 8/1 to this volume.

R1 CALCULATION

8.17 The applicant has undertaken a calculation to determine that Parc Adfer would meet the R1 criteria defined by the revised Waste Framework Directive and described in TAN21[1]. Evidence of this calculation is set out in Appendix 8/2 of this volume. From this, it can be seen that Parc Adfer achieves a coefficient of 0.76: to be considered as recovery, plants are required to be greater than 0.65.

[1] Section 2.7.4 and paragraphs 4.31 to 4.35 refer