

# FICHTNER

Consulting Engineers Limited



## Teesside Renewable Energy Plant



### Port Clarence Energy Limited

Application for EP Variation – Supporting Information

## Document approval

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## Non-technical Summary

Port Clarence Energy Limited (PCEL) was granted an Environmental Permit (EP) (Ref: MP3333WX) by the Environment Agency (EA) for the Port Clarence Sustainable Energy Plant (the Facility) in May 2015, and a variation to the EP was subsequently granted by the EA in March 2016.

The EP permits the Facility to operate as a waste incineration plant, combusting non-exempt waste wood as a fuel. On this basis, the Facility is currently permitted to operate as a co-incineration plant.

Having achieved financial close for the Facility in August 2015, on-site construction commenced in October 2015. The project was subject to a 24-month construction programme, with commissioning expected to commence in August 2017. Due to delays in the construction programme, it became clear that the construction of the Facility would not achieve the key milestones to secure Renewable Obligation Certificates. In 2019 construction ceased and the Facility was placed into a state of preservation.

PCEL is now applying to the Environment Agency (EA) to enable the conversion of the Facility to the combustion of refuse derived fuel (RDF).

As the majority of the fuel handling, combustion and flue gas treatment systems have already been constructed, the majority of changes required to enable the Facility to combust RDF as a fuel are relatively minor with minimal requirements for the installation of 'new' equipment. The key modifications to the EP to facilitate the proposed changes to the combustion of RDF as a fuel are as follows:

- Additional EWC codes to allow for the processing of RDF as the primary fuel;
- Modifications to the fuel handling and storage arrangements to facilitate processing of RDF as the primary fuel;
- De-rating of the boiler and reduced maximum capacity due to the processing of RDF as the primary fuel;
- Modifications to the boiler and combustion control setting and the flue gas cleaning systems to facilitate the processing of RDF as the primary fuel; and
- Modifications to the ash handling systems.

As presented within the document, the proposed changes are not expected to result in any significant environmental impacts.

This application is being submitted as a Normal Variation.

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# 1 Introduction

## 1.1 Background

Port Clarence Energy Limited (PCEL) was granted an Environmental Permit (EP) (Ref: MP3333WX) by the Environment Agency (EA) for the Port Clarence Sustainable Energy Plant (the Facility) in May 2015, and a variation to the EP was subsequently granted by the EA in March 2016.

The EP permits the Facility to operate as a waste incineration plant, combusting non-exempt waste wood as a fuel. On this basis, the Facility is currently permitted to operate as a co-incineration plant.

Having achieved financial close for the Facility in August 2015, on-site construction commenced in October 2015. The project was subject to a 24-month construction programme, with commissioning expected to commence in August 2017. Due to delays in the construction programme, it became clear that the construction of the Facility would not achieve the key milestones to secure Renewable Obligation Certificates. In 2019 construction ceased and the Facility was placed into a state of preservation.

PCEL is now applying to the Environment Agency (EA) to enable the conversion of the Facility to the combustion of refuse derived fuel (RDF).

Section 1 of this document provides a brief overview of the applicant/application, including the proposed changes and type of variation, whilst section 2 describes the proposed changes in further detail. Section 3 summarises the environmental impacts associated with the proposed changes. A number of supporting Appendices are also included within the Application pack to support the information presented within this document.

## 1.2 Proposed changes

As the majority of the fuel handling, combustion and flue gas treatment systems have already been constructed, the majority of changes required to enable the Facility to combust RDF as a fuel are relatively minor with minimal requirements for the installation of 'new' equipment. The key modifications to the EP to facilitate the proposed changes to the combustion of RDF as a fuel are as follows:

- Additional EWC codes to allow for the processing of RDF as the primary fuel;
- Modifications to the fuel handling and storage arrangements to facilitate processing of RDF as the primary fuel;
- De-rating of the boiler and reduced maximum capacity due to the processing of RDF as the primary fuel;
- Modifications to the boiler and combustion control setting and the flue gas cleaning systems to facilitate the processing of RDF as the primary fuel; and
- Modifications to the ash handling systems.

## 1.3 Type of variation

The Environment Agency's guidance on Charging Schemes states that there are four types of variations – administrative, minor technical, normal and substantial.

PCEL acknowledges that the proposed changes will not constitute either an administrative or minor technical variation.

The Environment Agency has published guidance (Regulatory Guidance Note 8 – Substantial Change) which defines a substantial change. It is acknowledged that the guidance has subsequently been withdrawn but any replacement guidance is not as prescriptive. The guidance defined a substantial change as:

*‘... a change in operation of installations or mining waste facilities, which in our opinion may have significant negative effects on human beings or the environment. Certain changes are automatically regarded as substantial, namely:*

*a. a change in operation of a Part A installation which in itself meets the thresholds, if any, set out in Part 2 of Schedule 1 EPRs; or*

*b. a change in operation of an incineration or co-incineration plant for non-hazardous waste which would involve the incineration or co-incineration of hazardous waste.’*

During pre-application discussions, the EA confirmed that the EP application would not be classified as a substantial variation. Therefore, this application is being submitted as a Normal Variation.

## 2 Proposed design and operational changes

As set out in section 1.2, PCEL is applying for the following changes to the design and operation of the Facility to facilitate the processing of RDF as the primary fuel:

- Additional EWC code added to the [EP];
- Modifications to the fuel handling and storage arrangements;
- De-rating of the boiler and reduced maximum capacity;
- Modifications to the boiler and combustion control setting and the flue gas cleaning systems; and
- Modifications to the ash handling systems.

### 2.1 Additional EWC Codes

PCEL is proposing to process fuels derived from residual municipal and commercial waste. The proposed wastes will all be non-hazardous wastes. PCEL proposes to combust the following EWC Codes as fuel within the Facility:

*Table 1: EWC Codes to be processed at the Facility*

EWC Code	Waste Description
<b>Waste from agriculture horticulture aquaculture forestry and fishing</b>	
02-01-07	Wastes from Forestry
02-01-09	Agrochemical waste other than those mentioned in 02 01 08
<b>Wastes from wood processing and the production of panels and furniture pulp paper and cardboard</b>	
03-01-01	waste bark and logs
03-01-05	sawdust, shavings cuttings wood particle board and veneer other than those mentioned in 03-012-04
03-03-01	waste bark and wood
03-03-08	Waste from sorting of paper and cardboard destined for recycling
<b>Wastes form leather, fur and textile industries</b>	
04-02-21	Wastes from unprocessed textile fibres
04-02-22	wastes from processed textile fibres
<b>Wastes form the photographic industry</b>	
09-01-08	Photographic film and paper free of silver or silver compounds
<b>Waste packaging absorbents wiping cloths filter materials and protective clothing not otherwise specified</b>	
15-01-01	Paper and cardboard packaging
15-01-02	plastic packaging
15-01-03	Wooden packaging
15-01-05	Compositae packaging
15-01-06	Mixed packaging

EWC Code	Waste Description
<b>Construction and demolition wastes including excavated soil from contaminated sites</b>	
17-02-01	Wood
<b>Wastes from waste managements facilities off site waste water treatments plants and preparation of water intended for human consumption and water for industrial use</b>	
19-12-01	Paper and Card
19-12-04	Plastic and rubber
19-12-07	Wood other than that mentioned in 19-12-06
19-12-08	Textiles
19-12-10	Combustible wastes (refuse derived fuel)
19-12-12	Other waste (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19-12-11
<b>Municipal wastes (household wastes or similar commercial industrial and institution wastes including separately collected fractions.</b>	
20-01-01	Process waste from segregated clean sources of paper
20-01-11	Textiles
20-01-38	Wood other than that mentioned in 20-01-37
20-01-39	Process waste form segregated clean sources of plastics
20-03-01	Mixed municipal waste (no black bag waste)

## 2.2 Modifications to the fuel handling and storage arrangements

The existing fuel reception and storage building will be extended. The southern facing wall of the building will be partially removed, and the existing crane tracks extended into the extended fuel storage hall and over the new tipping bunker.

The extended fuel reception and storage building will allow for waste delivery trucks to unload within the building and tip the incoming waste into a waste storage bunker. Whilst it is subject to detailed design, the waste reception area will include for up to 5 tipping bays for unloading of waste deliveries, 4 of these bays for tipping into the waste reception bunker and one for tipping onto a flat floor area for quarantined waste deliveries.

The incoming waste will be mixed within the waste reception bunker using the existing cranes. Fuel will be transferred using the existing cranes from the bunker into the fuel storage area and the second existing crane will be used to transfer waste from the fuel storage area into the loading hopper within the fuel storage building from where it will be transferred via enclosed conveyor to the existing boiler feed hopper. There will be six discharge points into the existing boiler feed hopper to ensure an even distribution of waste within the boiler feed hopper.

As per the existing arrangements, the fuel will be transferred from the fuel bunker to the boiler via enclosed conveyor.

As the storage and handling of RDF will introduce a potential for odour, an odour abatement system will be installed to extract the potentially odorous air from the fuel reception and storage building. The extracted air from the enclosed fuel reception and storage building will be passed through a carbon filter system prior to release to atmosphere via a dedicated stack. The odour abatement



system will be designed to operate continuously with the ability to change out the activated carbon once spent.

## 2.3 De-rating of the boiler and reduced maximum capacity

The firing diagram submitted with the [original] EP application, refer to Appendix B.1, identified that the boiler would have a design capacity of 150 MWth processing fuel with an NCV of between 10.8 MJ/kg and 15.4 MJ/kg and a design fuel of 13.1 MJ/kg.

Due to the constraints associated with the fuel handling system, the boiler has been de-rated to 102 MWth processing fuel with an NCV of between 9.0 MJ/kg and 14 MJ/kg and a design fuel of 11 MJ/kg. The firing diagram for the proposed design is provided in Appendix B.2.

Allowing for the constraints associated with the waste handling systems, the maximum throughput of the Facility will be 38 tonnes per hour. Therefore, allowing for the maximum theoretical availability (8,760 hours per annum), the Facility will have a maximum annual capacity of approximately 333,000 tonnes per annum.

## 2.4 Modifications to the combustion control settings and the flue gas cleaning systems

To optimize the combustion controls, PCEL assumes that there will need to be changes to the split between primary, secondary and tertiary air systems within the boiler. Whilst this is not expected to require the installation of additional equipment or mode of operation of the Facility, it needs to be defined and implemented during commissioning of the Facility on RDF.

The steam conditions for the current design allow for 500°C and 80 BarA. It is not practicable to operate the Facility with these steam conditions when operating on RDF as it will result in high levels of corrosion within the boiler. Therefore, PCEL is proposing to operate the Facility with steam conditions which are more closely aligned with an energy from waste facility, namely 450°C and 80 BarA.

To facilitate operating at these lower steam conditions, PCEL is proposing to make modifications to the arrangements to the superheaters installed within the boiler, with superheaters only being installed in the 3<sup>rd</sup> pass of the boiler.

In addition to the changes to the steam conditions, PCEL is proposing to install a hydro-jet cleaning system in the first pass of the boiler and a soot blower on the 2<sup>nd</sup> pass.

The facility has been designed with a Selective Non-Catalytic Reduction (SNCR) system for the abatement of NOx. Whilst the SNCR system should be able to achieve the BAT-AELs for compliance with the requirements of the Waste Incineration BREF, additional reagent injection levels may need to be installed, with additional nozzles installed at the existing levels. This is subject to the detailed design of the Facility.

Due to the higher sulphur and chlorine content of the fuel, the consumption of lime will be higher than when processing waste wood. Therefore, the lime dosing system will be updated.

The bag filters were designed for a lower ash content fuel (5% ash content) and also with a lower consumption of lime. As RDF is a higher ash content fuel (up to 30% ash content), although the majority of this reports as bottom ash, the quantity of fly ash in the fuel will be higher than when using waste wood. Therefore, the combustion of RDF will result in a higher volume of Air Pollution Control residue (APCr) being generated by the Facility. In the event of failure of the bag filters requiring one or more banks of bag filters to be isolated, to maintain operation of the Facility in

accordance with the BAT-AELs the boiler loading will be required to be reduced. In addition, the bag filter system includes an emergency bagging system to enable the APCr to be transferred into an FIBC in the event of a blockage with the bag filters being replaced whilst the Facility maintains operation.

No modifications will be required to be made to the handling and/or dosing systems for activated carbon.

## 2.5 Modifications to the ash handling systems

As RDF is a higher ash content fuel, as stated previously, there will be larger quantities of bottom ash generated from the combustion of fuel. This will require some of the ash handling systems to be upgraded to allow for the higher quantities of ash generation. Incinerator Bottom Ash (IBA) from combustion will be conveyed to an enclosed IBA storage and handling building. The IBA storage and handling building will be designed for the storage of up to 500 tonnes of IBA. The IBA will be loaded into trucks within the building for transfer off-site to a licenced suitably managed waste management facility.

Due to the higher quantities of fly ash generation and lime consumption, the Facility will generate higher quantities of APCr. To allow for the additional quantities of APCr, a second silo for the storage of APCr will be installed. The two silos will provide capacity for the storage of up to 200 tonnes of APCr. The arrangements for the unloading of APCr from the second silo will be the same as the existing silo.

## 2.6 Revised operating techniques

The Operating Techniques for the Facility are set out in Table S1.2 of the EP. Taking into consideration the proposed changes to the design of the Facility presented in section 2.1 to 2.5, PCEL has reviewed the Operating Techniques referenced in the 'original' EP application documents and proposed a number of changes/amendments to align with the proposed changes to the design, refer to Appendix C.

## 2.7 Raw materials and residues

### 2.7.1 Raw material consumptions

Whilst the same raw materials will be consumed at the Facility with the proposed combustion of RDF as a fuel; the quantities of raw materials consumed are expected to be different refer to Table 2. It should be noted that the proposed conversion will not result in any changes to the arrangements for the storage and handling of raw materials.

*Table 2: Estimated raw material consumption*

Raw material	Unit	Assumed consumption within EP application	Estimated consumption following conversion
Ammonia	tpa	1,530	1,530
Activated Carbon	tpa	150	150
Lime	tpa	2,400	6,000
Fuel oil/Gas oil	tpa	2,340	2,340

Raw material	Unit	Assumed consumption within EP application	Estimated consumption following conversion
Activated carbon (odour control)	tpa	-	60

### 2.7.2 Residue generation

The proposed increase in waste processing capacity will result in the generation of additional quantities of residues. Estimates are provided in Table 3 of the increased quantities of residues generated as a result of operating at the increased capacity. It should be noted that:

1. the Facility will not include for metals recovery from the incoming fuel or the resultant ash; and

Therefore, neither of these residues will be generated following conversion.

*Table 3: Estimated residue generation*

Residue	Unit	Assumed generation within EP application	Estimated consumption following conversion
Incinerator Bottom Ash (IBA)	tpa	15,600	52,600
Air Pollution Control Residues (ACPr)	tpa	7,600	11,910

Any changes to the arrangements associated with the storage and handling of residues are detailed in section 2.5.

## 3 Environmental Risk Assessment

There are a number of different environmental impacts to consider as a result of the change in fuel to be combusted at the Facility. These are discussed further in the sections below.

### 3.1 Air Quality

A Dispersion Modelling Assessment (Appendix D) has been undertaken to determine the changes in impact of emissions to air associated with operating at the increased capacity. Furthermore, a Dioxin Pathway Assessment (Appendix E) and Abnormal Emissions Assessment (Appendix F) have been undertaken in support of the application.

As concluded in the Dispersion Modelling Assessment:

*the change in impact as a result of varying the EP to change the Facility from a waste co-incineration plant to an incineration plant would not have a significant impact on local air quality, the general population or the local community.*

Furthermore, the Dioxin Pathway Assessment concludes that:

*the impact of emissions of dioxins and dioxin-like PCBs from the proposed increase in capacity of the Facility on human health is predicted to be not significant.*

Finally, the AEA concludes that:

*during periods of abnormal operation as permissible under the IED (Article 46) is not predicted to give rise to an unacceptable impact on air quality or the environment.*

### 3.2 Odour

As explained in section 2.2, the Facility will include a dedicated odour abatement system to treat potentially odorous air from the waste reception area. The extracted air from the enclosed fuel reception and storage building will be passed through an odour abatement system (carbon filter system) prior to release to atmosphere via a dedicated stack. The stack for the odour abatement system has been included as an additional point source emission to air (A2), refer Appendix A.

The impact of odour from the Facility has been considered in the Dispersion Modelling Assessment, refer to Appendix D. In addition, an Odour Management Plan has been developed to support this application, refer to Appendix G.

### 3.3 Noise

The Facility is located in a predominantly industrial area, and the nearest noise sensitive receptors are located approximately 900m from the Facility. As set out in the noise assessment submitted with the original EP application, the Facility was predicted to have a negligible impact on sensitive receptors. The proposed conversion, and associated design changes, are not expected to result in any additional noise impacts associated with the operation of the Facility.

### 3.4 Energy efficiency

As explained in section 2.3, the proposed conversion will result in a reduction in the thermal capacity of the Facility. In addition, the gross electrical output and parasitic load will reduce. As set out in the revised Operating Techniques, refer to Appendix C:

- the Facility will generate approximately 32.4 MWe; and
- will have a parasitic load of approximately 3.5 MWe.

Therefore, the Facility will be capable of exporting approximately 28.9 MWe to the National Grid. A revised Sankey Diagram for the proposed design is provided within Appendix C.

Allowing for the design waste throughput the efficiency of the Facility against the Environment Agency Sector Guidance Note EPR5.01 and WI BREF (2006) has been undertaken, refer to Table 4.

*Table 4: Energy efficiency parameters comparison table*

Parameter	Unit	Teesside REP	Benchmark	Source
Net electrical efficiency	%	28.34	>23	BREF LCP
Gross power generation, nominal design	MWh/t waste	0.87	0.415-0.644	BREF WI
Net power generation, nominal design	MWh/t waste	0.87	0.279-0.458	BREF WI
Internal power consumption, nominal design	MWh/t waste	0.10	0.062-0.257	BREF WI
Power generation (assumed net) for 100,000 tpa of waste	MW	11.0	5-9	EPR 5.01

The Facility has been designed to export 11MWth. This will not change from the proposed change in fuel. Therefore, for the purposes of this application the CHP Assessment has not been reviewed/updated. PCEL will continue to investigate opportunities for heat export following completion of commissioning in accordance with the requirements of the EP.

### 3.5 Fire prevention plan

It is acknowledged by PCEL that the proposed changes to the fuel which will be stored and combusted at the Facility will change the risk profile. Therefore, a Fire Prevention Plan has been developed for the Facility to support this application, refer to Appendix H.

### 3.6 Environmental management systems

The proposed conversion will not result in any changes to the management systems associated with the operation of the Facility.

### 3.7 Additional assessments

It should be noted that the Facility is classified as an 'existing plant' for BREF compliance purposes. PCEL has chosen to defer the BREF Review process to a later date, and understands that the EA has inserted a condition requiring report to be submitted to demonstrate compliance with BATCs and for a variation to be issued before operation of the Facility can be commenced.

Therefore, PCEL is proposing to submit the relevant information to the EA to demonstrate compliance with the requirements of the WI BREF (2019) prior to commencement of commissioning. For the purposes of this EP application, it has been assumed that the relevant

information will be submitted during the determination process for this application. This approach was discussed with the EA during pre-application discussions.

## A Plans & Drawings

## B Firing Diagrams

### B.1 Original Firing Diagram

### B.2 Proposed Firing Diagram



## C Review of Operating Techniques

## D Dispersion Modelling Assessment

## E Dioxin Pathway Assessment

## F Abnormal Emissions Assessment

## G Odour Management Plan

## H Fire Prevention Plan

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