The Drax Power (Generating Stations) Order

Land at, and in the vicinity of, Drax Power Station, near Selby, North Yorkshire

Combined Heat and Power Statement

The Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulation 5(2)(q)

Drax Power Limited

Drax Repower Project

Applicant:	DRAX POWER LIMITED
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Glossary

Abbreviation	Description
Above ground installation (AGI)	The Minimum Offtake Connection (MOC) which will be operated by National Grid Gas and the PIG Trap Launching station (PTF-L) which will be operated by Drax. The AGI is described as Work No. 6 in Schedule 1 of the draft DCO submitted with the DCO Application.
The APFP Regulations	The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009.
Application	The DCO Application.
The Applicant	Drax Power Ltd.
Associated Development	Associated development is defined by section 115(2) of the Planning Act 2008 as development which is associated with a Nationally Significant Infrastructure Project (NSIP). In the case of the Proposed Scheme, the term Associated Development includes: - the up to two gas insulated switchgear banking buildings (described as Work No. 4 in Schedule 1 of the draft DCO); - the natural gas receiving facility and natural gas compression building (described as Work No. 5 in Schedule 1 of the draft DCO); - the AGI (described as Work No. 6 in Schedule 1 of the draft DCO); - the Gas Pipeline (described in Work No. 7 in Schedule 1 of the draft DCO); - the electrical connections to the existing 400 kilovolt National Grid substation (described in Work No. 8 in Schedule 1 of the draft DCO); - temporary construction laydown areas (described in Work No. 9 in Schedule 1 of the draft DCO); - landscaping and biodiversity enhancement measures (described in Work No. 11 in Schedule 1 of the draft DCO); - decommissioning and demolition of sludge lagoons and construction of replacement sludge lagoons (described in Work No. 12 in Schedule 1 of the draft DCO); - removal of existing 132 kilovolt overhead line and associated towers and foundations (described in Work No. 13 in Schedule 1 of the draft DCO); - passing place on Rusholme Lane (described in Work No. 14 in Schedule 1 of the draft DCO); - the Site Reconfiguration Works (described in Work No. 15 in Schedule 1 of the draft DCO); and - further associated development as set out in Schedule 1 of the draft DCO. These developments are associated with the NSIP i.e. Unit X and Unit Y and the battery storage facilities (described in Work Nos. 1-3 in Schedule 1 of the draft DCO).

BAT Assessment Process	The human ear can detect sound over a wide range of frequencies, from 20 Hz to 20 kHz, but it is more sensitive to some frequencies than others. Generally, the ear is most sensitive to sounds with frequencies in the range 1 to 4 kHz. The A-weighting is a filter that can be applied to measured SPL at varying frequencies, to mimic the frequency response (or sensitivity) of the human ear, and therefore better represent the likely perceived loudness of the sound. SPL readings with the A-weighting applied are represented in dB(A).
Best Available Techniques (BAT)	'Best available techniques' (BAT) means the available techniques which are the best for preventing or minimising emissions and impacts on the environment. The European Commission produces 'best available technique' reference documents or BREF notes. They contain 'best available techniques' (BAT) for installations.
Carbon capture readiness (CCR)	Carbon Capture readiness, with respect to a combustion plant's emissions of CO_2, is achieved when the following conditions are met: (a) suitable storage sites are available (b) it is technically and economically feasible to retrofit the plant with the equipment necessary to capture that CO_2; and (c) it is technically and economically feasible to transport such captured CO_2 to the storage sites.
Carbon capture readiness reserve space	Space to be set aside to accommodate future carbon capture equipment, making the proposed plant in effect "carbon capture ready" for when the Carbon capture readiness state is achieved. The Carbon capture readiness reserve space is described as Work No. 10 in Schedule 1 of the draft DCO submitted with the DCO Application.
Carbon capture and storage (CCS)	Technology to facilitate the capture of carbon dioxide to prevent such gases entering the atmosphere.
CHP-R Guidance	CHP Ready Guidance for Combustion and Energy from Waste Power Plants' (Environment Agency, 2013) – Guidance notes / series of tests which are required to be proven before design or build of a plant to ensure it is 'CHP ready'.
Combined Cycle Gas Turbine (CCGT)	A combined cycle gas turbine is an assembly of turbines that convert heat into mechanical energy. Combustion of a fuel within a gas turbine produces hot gases that expand over a complex series of blades that cause the turbine to rotate which in turn drives an electrical generator. The principle of combined cycle is that the exhaust gases from the turbine are used as a heat source in a heat recovery steam generator (HRSG), increasing the system's overall efficiency by utilising energy from the fuel that would otherwise be wasted.

Combined Heat and Power (CHP)	Combined Heat and Power is the simultaneous generation of electrical power and usable heat in a single process, and is also known as co-generation. A CHP station may either supply steam direct to customers or capture heat from low-pressure steam after it has been used to drive electricity generating turbines for hot water or space heating purposes.
DCO Application	The application for a DCO in respect of the Proposed Scheme.
Development Consent Order (DCO)	A Development Consent Order (DCO) is made by the Secretary of State (SoS) pursuant to the Planning Act 2008 (PA 2008) to authorise a Nationally Significant Infrastructure Project (NSIP).
Drax Power Station	The existing biomass and coal fired power generation facility at the Existing Drax Power Station Complex.
Electrical Connection	In respect of Unit X, underground electrical cables connecting Unit X to the existing 400 kilovolt National Grid substation as described in Work No. 8A of the draft DCO. In respect of Unit Y, underground electrical cables connecting Unit Y to the existing 400 kilovolt National Grid substation and which may include a sealing end compound with overhead conductors and gantry as described in Work No. 8B of the draft DCO; and the removal of an existing 132 kilovolt overhead line and associated towers and foundations. The removal of the overhead line is described as Work No. 13 in Schedule 1 of the draft DCO submitted with the DCO Application.
Environment Agency	A non-departmental public body sponsored by the United Kingdom government's Department for Environment, Food and Rural Affairs (DEFRA), with responsibilities relating to the protection and enhancement of the environment in England.
Environmental Statement	A statement that includes the information that is reasonably required to assess the environmental effects of a development and which the applicant can, having regard in particular to current knowledge and methods of assessment, reasonably be required to compile, but that includes at least the information required in the EIA Regulations 2017 and which is prepared in accordance with the latest Scoping Opinion adopted by the Secretary of State (where relevant).
Existing Drax Power Station Complex	The facilities comprising the existing Drax Power Station, and the land upon which it is situated.
Gas Pipeline	The approximately 3 km underground pipeline which connects the Gas Receiving Facility to the National Transmission System. The Gas Pipeline is described as Work No. 7 in Schedule 1 of the draft DCO submitted with the DCO Application.
Gas Receiving Facility (GRF)	This is required to receive the natural gas from the Gas Pipeline. The GRF is described as Work No. 5 in Schedule 1 of the draft DCO submitted with the DCO Application.

Gas Turbine	Gas turbines produce electricity. Air is drawn into the compressor of the gas turbine and is compressed. The fuel is then injected into the combustion chamber. The mixture of fuel and compressed air is ignited, producing gases at high temperatures. As the gas expands, it rotates the turbine to produce electricity. The gas turbines form part of Work No. 1A (which includes up to two gas turbines in connection with Unit X) and Work No. 2A (which includes up to two gas turbines in connection with Unit Y) in Schedule 1 of the draft DCO submitted with the DCO Application.
Heat Recovery Steam Generators (HRSG)	HRSGs recover the hot flue gases from the Gas Turbines. The heat is used to produce steam that will drive the existing steam turbines. HRSGs are required where the generating station is operating in CCGT mode. The HRSGs form part of Work No. 1A (up to two HRSGs in connection with Unit X) and Work No. 2A (up to two HRSGs in connection with Unit Y) in Schedule 1 of the draft DCO submitted with the DCO Application.
Large Combustion Plant Directive (LCPD)	Directive 2001/80/EC of the European Parliament and of The Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants. The Directive provides limits for flue gas emissions from combustion power plants greater than 50 MW.
Minimum Offtake Connection (MOC)	The Minimum Offtake Connection will be part of the AGI to be owned and operated by National Grid. The MOC will provide the gas connection to the National Grid Natural Transmission System. The MOC is described as Work No. 6A in Schedule 1 of the draft DCO submitted with the DCO Application.
Minimum Environmental Stable Load (MESL)	The load in which the gas generating stations can operate at and still be within environmental limits (air emissions, noise, etc.)
National Policy Statement (NPS)	Overarching policy designated under the Planning Act 2008 concerning the planning and consenting of NSIPs in the UK.
Nationally Significant Infrastructure Project (NSIP)	A project meeting the criteria for a “nationally significant infrastructure project” set out in section 14 of the Planning Act 2008, and therefore requiring authorisation under the PA 2008 by way of a DCO. The Proposed Scheme constitutes a Nationally Significant Infrastructure Project (NSIP) by virtue of s.14(1)(a) and s.15 of the PA 2008 as it is an onshore generating station in England of 50 MW capacity or more.
Open Cycle Gas Turbine (OCGT)	An open cycle gas turbine converts heat into mechanical energy.

	Combustion of a fuel within a gas turbine produces hot gases that expand over a complex series of blades that cause the turbine to rotate which in turn drives an electrical generator.
Pipeline Area	The area required in connection with the construction, operation and maintenance of the Gas Pipeline, the AGI and the GRF, comprising the Pipeline Construction Area and the Pipeline Operational Area.
Pipeline Construction Area	The extent of land needed for the construction phase of the Gas Pipeline, the AGI, the GRF and the Rusholme Lane Area.
Pipeline Inspection Gauge (PIG) Trap Facility (PTF)	System to allow remote cleaning of long stretches of pipeline. Will have a launching (PTF-L) and a receiving (PTF-R) either side of the pipeline stretch.
Pipeline Operational Area	The area within which the Gas Pipeline, the AGI and the GRF will be situated once constructed.
Planning Inspectorate (PINS)	The government agency responsible for examining applications for development consent for NSIPs under the Planning Act 2008 on behalf of the SoS.
Power Station Site	Areas within the Existing Drax Power Station Complex where: 1. The Site Reconfiguration Works are proposed to take place; 2. The temporary construction Laydown Area is to be located described in Work No. 9A in Schedule 1 of the draft DCO submitted with the DCO Application; 3. The Generating station equipment is proposed to be located; 4. The Electrical connection is proposed to be located; and 5. The decommissioning and demolition of sludge lagoons and construction of replacement sludge lagoons is proposed to take place, described as Work No. 12 in Schedule 1 of the draft DCO submitted with the DCO Application.
Primary Energy Saving (PES)	Calculation used in the CHP Statement to calculate the percentage energy saved with introduction of a CHP scheme.
Proposed Scheme	Drax Power Limited is proposing to repower up to two existing coal-powered generating units (Units 5 and 6) at the Existing Drax Power Station Complex with new gas turbines that can operate in both combined cycle and open cycle modes. The term "repower" is used as existing infrastructure, such as the steam turbine and cooling towers, that are currently used for the coal fired units would be reutilised for the new gas fired generating units/stations. The repowered units (which each constitute a new gas fired generating station) would have a new combined capacity of up to 3,600 MW in combined cycle mode (1,800 MW each), replacing existing units with a combined capacity to generate up to 1,320 MW (660 MW each). This is explained further below:

Each gas generating station would have up to two gas turbines, with each gas turbine powering a dedicated generator of up to 600 MW in capacity. The gas turbines in each generating station (or unit), therefore, would have a combined capacity of up to 1,200 MW. The gas turbines in each generating station (or unit), in combined cycle mode, would provide steam to the existing steam turbine (through Heat Recovery Steam Generators (HRSGs)) which would generate up to 600 MW per unit. Each unit would have up to two HRSGs. This results in a capacity for each generating station of up to 1,800 MW and, should both units be repowered, a combined capacity of up to 3,600 MW. The new gas turbine generating units have been designated the terms "Unit X" and "Unit Y". In OCGT mode, the combined capacity would be up to 2,400MW (as in OCGT mode, there would be no HRSG capacity).

Each unit would have (subject to technology and commercial considerations) a battery energy storage facility with a capacity of up to 100 MW per unit, resulting in a combined battery energy storage capacity of up to 200 MW. All battery units would be stored in a single building.

The total combined capacity of the two gas fired generating stations and two battery storage facilities (i.e. the total combined capacity of the Proposed Scheme) is therefore 3,800 MW.

Drax is seeking consent for the flexibility to either:

Repower one unit (either Unit 5 or 6) and construct Unit X as a gas fired generating station; or

Repower both Units 5 and 6 and construct Unit X and Unit Y as two gas fired generating stations.

In the single unit scenario, up to two gas turbines and up to two HRSGs and (subject to technology and commercial considerations) a battery energy storage facility of up to 100 MW storage capacity would be constructed. The size of the building housing the battery storage facility would not change, as the building could house one larger battery which would allow the 100 MW output to be sustained for a longer duration. However, the fuel gas station and gas insulated switchgear would be smaller.

In the event that two units are repowered and two new generating stations are constructed, then construction works would be undertaken consecutively rather than concurrently.

In order to repower to gas, a new Gas Pipeline would be constructed from the Existing Drax Power Station Complex to the National Transmission System (NTS) operated by National Grid. Pipeline infrastructure would be the same for both one and two unit scenarios.

A gas receiving facility (GRF) comprising Pipeline Inspection Gauge (PIG) Trap Facility (PTF), Pressure Reduction and Metering Station (PRMS) and compressor station is proposed south of woodland to the east of New Road.

At the connection to the NTS there will be an AGI comprising - a Pig Trap Launching station (PTF-L) which will be operated by Drax, and a

	Minimum Offtake Connection (MOC), which will be operated by National Grid. The Proposed Scheme includes the Site Reconfiguration Works and the Electrical connection. Drax's Proposed Scheme is described in more detail in Chapter 3 (Site and Project Description) of the ES Volume 1 (document reference .6.1). Schedule 1 of the draft DCO submitted with the DCO Application lists out the elements comprised within the Proposed Scheme.
Rusholme Lane Area	Area required for passing places during the construction of the Gas Pipeline (described as Work No. 14 in Schedule 1 to the draft DCO submitted with the DCO Application).
Site	The Site refers to the Power Station Site, the Carbon capture readiness reserve space (which is also the location of temporary construction laydown described as Work No. 9B in Schedule 1 to the draft DCO submitted with the DCO Application) and the Pipeline Area.
Site Boundary	The Site Boundary refers to the outer perimeter of the Site.
Site Reconfiguration Works / Stage 0	The Site Reconfiguration Works or Stage 0 refers to the works described below that are necessary to prepare the Power Station Site for the construction of the generating station equipment and the electrical connection. The works comprise: 1. Demolition of the private squash court (no replacement), Learning Centre (consolidated into existing facilities); and 2. Demolition of and reconstruction of car parking, turbine outage stores, contractor's compounds and welfare facilities. 3. Construction of a cooling water spray screen between relocated facilities and the southern cooling towers. The Site Reconfiguration Works are the subject of a separate planning application under the TCPA (applied for in February 2018 and given reference no. PP-06688208v1) and are also included as part of the Proposed Scheme in the DCO Application, and may be carried out under either: 1. Any TCPA planning permission that may be granted; or 2. The Order. The Site Reconfiguration Works are described in Work No. 15 in Schedule 1 of the draft DCO submitted with the DCO Application.
Unit X	The construction of a gas fired generating station capable of operating in CCGT and OCGT modes and which would have a generating capacity of up to 1,800 MW. Unit X would be connected

	to a battery storage facility, with a capability of up to 100MW. The total output from Unit X would be 1,900MW. Unit X is described in Work No. 1 of Schedule 1 to the draft DCO submitted with the DCO Application.
Unit Y	The construction of a gas fired generating station capable of operating in CCGT and OCGT modes and which would have a generating capacity of up to 1,800 MW. Unit Y would be connected to a battery storage facility, with a capability of up to 100MW. The total output from Unit Y would be 1,900MW. Unit Y is described in Work No. 2 of Schedule 1 to the draft DCO submitted with the DCO Application.

Abbreviation

Abbreviation	Term in full
AGI	Above Ground Installation
BAT	Best Available Techniques
BEIS	Department of Business, Energy and Industrial Strategy
BREF	Best Available Technique Reference documents or BREF notes.
CCGT	Combined Cycle Gas Turbine
CCR	Carbon Capture Readiness
CCS	Carbon Capture and Storage
CHP	Combined Heat and Power
CHP-R	Combined Heat and Power Ready
CRH	Cold Reheat
DCO	Development Consent Order
DECC	Department for Energy and Climate Change
EA	Environment Agency
EC	European Commission
EIA	Environmental Impact Assessment
EN-1	The Overarching National Policy Statement for Energy
EN-2	NPS for Fossil Fuel Electricity Generating Infrastructure
EP	Environmental Permit
GIS	Gas Insulated Switchgear
GRF	Gas Receiving Facility
GW	Gigawatts (1000 MW)
GWh	Gigawatt hour (Measurement Unit for Energy)
Ha or ha	Hectare
HRSGs	Heat Recovery Steam Generators
kV	Kilovolt
LP	Low Pressure
m	Meters
MESL	Minimum Environmental Stable Load
MOC	Minimum Offtake Connection
MW	Megawatts
MWh	Megawatt hour (Measurement Unit for Energy)
NPS	National Policy Statement

NSIP	Nationally Significant Infrastructure Project
NTS	National Transmission System
OCGT	Open Cycle Gas Turbine
PA 2008	Planning Act 2008 (as amended)
PES	Primary Energy Saving
PIG	Pipeline Inspection Gauge
PINS	Planning Inspectorate
PRMS	Pressure Reduction and Metering Station
PTF	PIG Trap Facility
PTF-L	PIG Trap Launching Station
SoS	Secretary of State
t/h or t/hr	Tonnes per hour

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EXECUTIVE SUMMARY

1. This Combined Heat and Power (CHP) assessment has been prepared by WSP UK Limited on behalf of Drax Power Limited (Drax or the Applicant), to support an Application for a Development Consent Order (DCO).

2. The Applicant is proposing to repower up to two existing coal-fired units (known as Unit 5 and Unit 6) with gas – this means the existing coal-fired units would be decommissioned and replaced with newly constructed gas-fired units utilising some of the existing infrastructure. Each unit, which is a new gas fired generating station in its own right and are termed Unit X and Unit Y, would comprise combined cycle gas turbine (CCGT) and open cycle gas turbine (OCGT) technology. Each new gas generating unit would use existing infrastructure, including the cooling system and steam turbines, and would each have a new capacity of up to 1,800 MW, replacing existing units each with a capacity of up to 660 MW. Each unit would also have a battery storage capability of up to 100 MW (subject to technology and commercial considerations). Should both units be repowered, the new gas-fired units / generating stations would have a combined capacity of up to 3,600 MW and a combined battery storage capacity of up to 200 MW (totalling a capacity of up to 3,800 MW).

3. The Applicant is seeking consent for the flexibility to either repower one unit (i.e. construct a single generating station known as Unit X) (with up to 1,800 MW generating capacity and an up to 100 MW battery storage capacity) or to repower two units (two generating stations (Unit X and Unit Y) each with an up to 1,800 MW generating capacity and each with its own up to 100 MW battery storage capacity). The decision as to whether Drax repowers two units and constructs two gas fired generating stations as opposed to a single unit is a commercial decision that can only be taken post any consent being granted.

4. A connection to the electrical network via the existing National Grid (NG) Substation on the Power Station Site will be provided.

5. In order to repower to gas, a new Gas Pipeline needs to be constructed from Drax Power Station to the National Transmission System (NTS).

6. The 200 MW battery storage project is not a thermal power plant producing waste heat, and so is not suitable for inclusion in the CHP assessment.

7. In line with the requirements of the 2006 CHP Guidance (Ref. 1.1) and the CHP-R Guidance (Ref. 1.2), this CHP Statement has been prepared to support the DCO Application.

8. Given the uncertainty of future heat loads, the lack of currently available suitable heat loads, and the undefined operating scheme of the Proposed Scheme, the Proposed Scheme will not be CHP from the outset. Therefore, in accordance with the second Best Available Technology (BAT) test, the Proposed Scheme will be developed as "CHP Ready" (CHP-R). The term “CHP-R” in this context represents a plant which is initially configured to generate electrical power only but is designed to be ready, with minimum modification, to supply heat in the future.

9. A review of potential heat loads in a 15 km radius from the Proposed Scheme has been completed, the following was noted;

- The majority of the local heat load can be attributed to domestic users. This load is spread across the area and the demand is generally low. Existing domestic dwellings are difficult to integrate with CHP schemes due to the amount of retrofit required.
- Three large heat loads were identified. Of these, two were considered not feasible, due to technical constraints. The remaining heat load is currently partly served by a CHP scheme, however, this may be considered as a future user for a CHP scheme if the current scheme ends.
- Small industrial makes up around 6 % of the local heat load. The largest small industrial heat loads are based in Selby to the north of the River Ouse. Due to the large width of the River Ouse, horizontal directional drilling underneath the river would be required which adds complexity and cost to the route. The largest small industrial heat load was therefore discounted on technical and commercial feasibility grounds. One other small industrial heat load has been identified south of the River Ouse at the village of Barlow. The required heat load for the village is only 29,000 MWh and due to its isolation from any other potential heat loads, it is not deemed viable for setting up a CHP Scheme for a comparably low load. If other industrial heat loads become apparent in or around Barlow, it may be considered in the future for a joint CHP Scheme.

10. A review of the local planning portals has not highlighted any future development that could be considered for a CHP scheme.

11. It is therefore considered based on the low heat demand in the surrounding area and taking into account the distance and sparse nature of heat users resulting in technical and commercial challenges for proposed routes, the Proposed Scheme will be designed as CHP Ready and will not be developed as a CHP scheme until such loads become available that running with CHP is considered economically feasible.

12. To satisfy the third BAT test, the Applicant will continue with periodic reviews commencing 12 months from full commissioning of Unit X. The following technical and commercial aspects will be considered during these reviews:

    - Economic viability of any proposed CHP Scheme;
    - Review of technical assessment if any viable heat load is identified.

13. This review is secured by a requirement in the draft DCO submitted as part of the DCO Application (document reference 3.1).

1 INTRODUCTION

1.1 Overview

1.1.1. This Combined Heat and Power (CHP) assessment has been prepared by WSP UK Limited on behalf of Drax Power Limited (Drax or the Applicant), to support an Application for a Development Consent Order (DCO).

1.1.2. The Applicant is proposing to repower up to two existing coal-fired units (known as Unit 5 and Unit 6) with gas – this means the existing coal-fired units would be decommissioned and replaced with newly constructed gas-fired units utilising some of the existing infrastructure. Each unit, which is a new gas fired generating station in its own right and are termed Unit X and Unit Y, would comprise combined cycle gas turbine (CCGT) and open cycle gas turbine (OCGT) technology. Each new gas generating unit would use existing infrastructure, including the cooling system and steam turbines, and would each have a new capacity of up to 1,800 MW, replacing existing units each with a capacity of up to 660 MW. Each unit would also have a battery storage capability of up to 100 MW (subject to technology and commercial considerations). Should both units be repowered, the new gas-fired units / generating stations would have a combined capacity of up to 3,600 MW and a combined battery storage capacity of up to 200 MW (totalling a capacity of up to 3,800 MW).

1.1.3. The Applicant is seeking consent for the flexibility to either repower one unit (i.e. construct a single generating station known as Unit X) (with up to 1,800 MW generating capacity and an up to 100 MW battery storage capacity) or to repower two units (two generating stations (Unit X and Unit Y) each with an up to 1,800 MW generating capacity and each with its own up to 100 MW battery storage capacity). The decision as to whether Drax repowers two units and constructs two gas fired generating stations as opposed to a single unit is a commercial decision that can only be taken post any consent being granted.

1.1.4. A connection to the electrical network via the existing National Grid (NG) Substation on the Power Station Site will be provided.

1.1.5. In order to repower to gas, a new Gas Pipeline needs to be constructed from Drax Power Station to the National Transmission System (NTS).

1.1.6. The 200 MW battery storage project is not a thermal power plant producing waste heat, and so is not suitable for inclusion in the CHP assessment.

1.2 Application for a Development Consent Order

1.2.1 In England and Wales, under section 15 of the Planning Act 2008 (PA 2008) (Ref. 1.3), an onshore electricity generating station is considered to be a Nationally Significant Infrastructure Project (NSIP) if the electrical power generating capacity is more than 50 MW. As the electrical power generating capacity of the Proposed Scheme will exceed this threshold, it will be a NSIP.

1.2.2 Under section 31 of the PA 2008, a DCO is required to authorise the construction and operation of a NSIP.

1.2.3 A DCO may only be granted pursuant to an application under section 37 of the PA 2008. To inform decisions upon such applications, the PA 2008 required the development and

implementation of new national policy regarding NSIPs which is set out in National Policy Statements (NPSs). Those NPSs that are relevant to the Proposed Scheme and this CHP assessment, are:

- The Overarching National Policy Statement for Energy (NPS EN-1) (Ref. 1.4); and
- The National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (NPS EN-2) (Ref. 1.5).

1.2.4 NPS EN-1 states (at paragraph 4.6.6) that:

"Under Guidelines issued by DECC (then DTI) in 2006 [the CHP Guidance, Ref. 1.1)], any application to develop a thermal generating station under Section 36 of the Electricity Act 1989 must either include CHP or contain evidence that the possibilities for CHP have been fully explored to inform the [Secretary of State's] consideration of the application. This should be through an audit trail of dialogue between the applicant and prospective customers. The same principle applies to any thermal power station which is the subject of an application for development consent under the Planning Act 2008. The [Secretary of State] should have regard to DECC's Guidance, or any successor to it, when considering the CHP aspects of applications for thermal generating stations."

1.3 Purpose and Structure of this Document

1.3.1 In line with the requirements of NPS EN-1 and the CHP Ready Guidance for Combustion and Energy from Waste Power Plants (Environment Agency, 2013) (CHP-R Guidance) (Ref. 1.2) a CHP assessment has been prepared to support the DCO Application.

1.3.2 This document comprises:

- **Section 1** – A brief introduction;
- **Section 2** – A description of the Proposed Scheme;
- **Section 3** –The context and methodology of the CHP assessment, and a review of the relevant policies;
- **Section 4** – A discussion of the potential opportunities for the implementation of CHP;
- **Section 5** – A review of the compatibility of a CHP plant
- **Section 6** – Best Available Technology (BAT) assessment
- **Section 7** – Summary and conclusions of the CHP assessment.

1.3.3 Additional supporting information is provided in the Appendices to this document, which comprise:

- **Appendix 1** – Summary of Consultation Responses from the 2014 White Rose CCS Project CHP Assessment; and
- **Appendix 2** – Information provided by Drax's plant technology partner, Siemens, to inform the CHP envelope.

2 PROJECT DESCRIPTION

2.1 The Applicant

2.1.1 The Applicant is Drax Power Limited. Drax Power Station is owned and managed by the Applicant, who is part of the Drax Group Plc, one of the UK's largest energy producers.

2.2 Site Description

Existing Drax Power Station Complex

2.2.1 Drax Power Station is a large power station, comprising originally of six coal-fired units. It was originally built, owned and operated by the Central Electricity Generating Board and had a capacity of just under 2,000 MW when Phase 1 was completed in 1975. Its current capacity is 4,000 MW after the construction of Phase 2 in 1986.

2.2.2 Three of the original six coal-fired units are now converted to biomass (Units 1-3) and this is assessed as the current baseline in the Environmental Statement (ES) (document reference 6.1). By the latter half of 2018, four units (Units 1-4) will run on biomass with only two units (Units 5 and 6) running on coal. One or both of Units 5 and 6 will be repowered as part of the Proposed Scheme, this means the existing coal-fired units would be decommissioned and replaced with newly constructed gas-fired units utilising some of the existing infrastructure. The area within the Existing Drax Power Station Complex where development is proposed is referred to as the Power Station Site and is approximately 53.4 ha.

Pipeline Area

2.2.3 The Gas Pipeline route is approximately 3 km in length and crosses agricultural land to the east of the Existing Drax Power Station Complex. The land within the Pipeline Construction Area is 25.4 ha and the land within the Pipeline Operational Area is 2.4 ha.

2.2.4 An additional area is located on Rusholme Lane (Rusholme Lane Area) to accommodate a potential passing place for traffic during construction of the Gas Pipeline. This is considered to be part of the Pipeline Area.

Site Boundary

2.2.5 The Site is approximately 78.9 ha and lies approximately 4 m Above Ordnance Datum (AOD).

2.2.6 The Site Boundary (depicted with a red line in Chapter 1 (Introduction) Figure 1.1 of the ES) represents the maximum extent of all potential permanent and temporary works required as part of the Proposed Scheme.

2.2.7 The Power Station Site, the Carbon capture readiness reserve space and the Pipeline Area (including the Rusholme Lane Area) have been divided into a number of Development Parcels shown on Chapter 1 (Introduction) Figure 1.3. of the ES.

2.2.8 The current land uses at these development parcels are described in Table 3-1 of the ES Chapter 3 (Site and Project Description).

2.3 The Proposed Scheme

2.3.1 The Proposed Scheme is to repower up to two existing coal-powered generating units (Units 5 and 6) at the Existing Drax Power Station Complex with new gas turbines that can operate in both combined cycle and open cycle modes. The term "repower" is used as existing infrastructure, such as the steam turbine and cooling towers, that are currently used for the coal fired units would be reutilised for the new gas fired generating units/stations.

2.3.2 The repowered units (which each constitute a new gas fired generating station) would have a new combined capacity of up to 3,600 MW in combined cycle mode (1,800 MW each), replacing existing units with a combined capacity to generate up to 1,320 MW (660 MW each).

2.3.3 Each gas generating station (or unit) would have up to two gas turbines, with each gas turbine powering a dedicated generator of up to 600 MW in capacity. The gas turbines in each generating station (or unit), therefore, would have a combined capacity of up to 1,200 MW. The gas turbines in each generating station (or unit), in combined cycle mode, would provide steam to the existing steam turbine (through Heat Recovery Steam Generators (HRSGs)) which would generate up to 600 MW per generating station (or unit). Each generating station (or unit) would have up to two HRSGs. This results in a capacity for each generating station of up to 1,800 MW and, should both Units 5 and 6 be repowered, a combined capacity of up to 3,600 MW. The new gas turbine generating stations (or units) have been designated the terms "Unit X" and "Unit Y".

2.3.4 Each of Unit X and Unit Y would have (subject to technology and commercial considerations) a battery energy storage facility with a capacity of up to 100 MW per Unit, resulting in a combined battery energy storage capacity of up to 200 MW. The two battery energy storage facilities would be stored in a single building.

2.3.5 The total combined capacity of the two gas fired generating stations, Unit X and Unit Y, and two battery storage facilities (i.e. the total combined capacity of the Proposed Scheme) is therefore 3,800 MW.

2.3.6 The DCO seeks consent for the following flexibility:

- Repowering of either Unit 5 or 6 and construction of Unit X as a gas fired generating station (this would leave either Unit 5 or 6 (depending on which had been repowered) as a coal-fired unit); or
- Repowering of both Units 5 and 6 and construction of Unit X and Unit Y as two gas fired generating stations.

2.3.7 In the event that a single unit is repowered and Unit X constructed, up to two gas turbines and up to two HRSGs and (subject to technology and commercial considerations) a battery energy storage facility of up to 100 MW storage capacity would be constructed. The size of the building housing the battery storage facility would not change, as the building could house sufficient battery capacity to allow the 100 MW output to be sustained for a longer duration. However, the fuel gas station and gas insulated switchgear required for the Gas Pipeline would be smaller.

2.3.8 In the event that two units are repowered and both Unit X and Unit Y are constructed, then construction works would be undertaken consecutively rather than concurrently. It is assumed for the purposes of the ES that there would be a gap of a year between construction periods, but this could be longer depending on commercial considerations. Unit Y would mirror Unit X, with up to two gas turbines and up to two HRSGs and (subject to technology and commercial considerations) a battery energy storage facility of up to 100 MW storage capacity which would be housed in the building constructed for the battery for Unit X.

2.3.9 In order to repower to gas, a new Gas Pipeline would be constructed from the Existing Drax Power Station Complex to the National Transmission System (NTS) operated by National Grid. Pipeline infrastructure would be the same whether Unit X was constructed or whether Unit X and Unit Y was constructed.

2.3.10 A gas receiving facility (GRF) comprising Pipeline Inspection Gauge (PIG) Trap Facility (PTF), Pressure Reduction and Metering Station (PRMS) and compressor station is proposed south of woodland to the east of New Road.

2.3.11 At the connection to the NTS there will be an above ground installation (AGI) south of Rusholme Lane. The AGI involves a PIG Trap Launching station (PTF-L) which will be operated by Drax, and a Minimum Offtake Connection (MOC), which will be operated by National Grid.

2.3.12 A full description of the Proposed Scheme and the Site is contained in Chapter 3 (Site and Project Description) of the ES.

3 CHP CONTEXT AND ASSESSMENT METHODOLOGY

3.1 Introduction

3.1.1 CHP is the simultaneous generation of electrical power and usable heat in a single process, and is also known as co-generation. A CHP station may either supply steam direct to customers or capture heat from low-pressure steam after it has been used to drive electricity generating turbines, for hot water or space heating purposes. The heat can also be used to drive absorption chillers, thereby providing cooling.

3.1.2 CHP is considered advantageous as generating electrical power and heat together is more efficient than generating them separately. Therefore it can deliver a reduction in both primary energy usage and carbon emissions.

3.2 Policy Review

3.2.1 In accordance with the PA 2008, the Secretary of State is required to determine an application for a DCO for an energy NSIP in accordance with the Overarching National Policy Statement for Energy (EN-1) and the relevant technology-specific national policy statement, in this case the National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2).

3.2.2 The requirement or otherwise for the consideration and / or implementation of CHP, is detailed within section 4.6 (Consideration of Combined Heat and Power (CHP)) of EN-1.

3.2.3 EN-1 states (at paragraph 4.6.6) that "*[u]nder guidelines issued by DECC (then DTI) in 2006 (Ref. 3.1), any application to develop a thermal generating station under Section 36 of the Electricity Act 1989 must either include CHP or contain evidence that the possibilities for CHP have been fully explored to inform the [Secretary of State]'s consideration of the application" and that the, "same principle applies to any thermal power station which is the subject of an application for development consent under the Planning Act 2008.*"

3.2.4 EN-1 continues: "*The [Secretary of State] should have regard to DECC's guidance, or any successor to it, when considering the CHP aspects of applications for thermal generating stations.*"

3.2.5 The CHP Guidance (at paragraph 24) acknowledges, "*that decisions on major new power station investments, including the location and anticipated load duty of the station (e.g. base load, mid-merit, peak-lopping, support to local industry, etc), will primarily be driven by the market*".

3.2.6 Paragraph 4.6.7 of EN-1 requires that developers should "*consider the opportunities for CHP from the very earliest point and it should be adopted as a criterion when considering locations for a project.*" The value of early consultation is also emphasised, in respect of the process of identification of potential heat users (customers), with bodies such as the Homes and Communities Agency (now Homes England), Local Enterprise Partnerships and Local Authorities.

3.2.7 In addition, as part of the examination process for the DCO Application, the Environment Agency (EA) will be consulted on the details of the Proposed Scheme and the content of the Application, including the Applicant's consideration of CHP.

3.2.8 EN-1 (at paragraph 4.6.8) states: "*If the proposal is for thermal generation without CHP, the applicant should:*

- *explain why CHP is not economically or practically feasible for example if there is a more energy efficient means of satisfying a nearby domestic heat demand;*
- *provide details of any potential future heat requirements in the area that the station could meet; and*
- *detail the provisions in the proposed scheme for ensuring any potential heat demand in the future can be exploited."*

3.2.9 Since publication of the CHP Guidance, the EA has published its own CHP Ready Guidance for Combustion and Energy from Waste Plants (2013) (CHP-R Guidance). This guidance states (in section 3.3) that: "*When consulted by [the Planning Inspectorate on a DCO application] for new plants, the Environment Agency will highlight the need for the plant to be CHP or CHP-R and will make reference to [the CHP-R Guidance].*"

3.2.10 Applications for Environmental Permits (EPs) through the EA require demonstration BAT. One of the criteria that falls under BAT is energy efficiency, which may be improved via the use of CHP. The EA therefore requires the applicant for an EP to satisfy the three BAT tests for CHP and CHP-R (set out in the CHP-R Guidance). Insert 1 of the CHP-R Guidance illustrates the recommended BAT assessment process for CHP and CHP-R, and how this guidance should be used.

3.2.11 It is recommended that a CHP assessment should be completed prior to application for consent, as the results of the first and second BAT tests may impact the layout, space requirements, building design and implementation of the proposed developed. Where CHP opportunities are not present the CHP-R guidance states that;

"The Environment Agency will not object to applications for new plants where they are located in areas where there are no opportunities for heat supply. However, where relevant, the Environment Agency will highlight the lack of opportunities to the Planning

Authorities and this may influence the Planning Authority in its consideration of the suitability of the proposed location. When consulted on applications for modifications to existing plants (which will also require a variation to the Environmental Permit), the Environment Agency will highlight the need for the plant to be CHP or CHP-R (where relevant), but is unlikely to provide comments in the suitability of the location of the plant for CHP."

3.2.12 The requirements for the provision of information identified in the above policies and guidance are addressed in the remainder of this document.

3.3 CHP Assessment Methodology

3.3.1 This Statement will cover both the CHP and CHP-R assessments. A holistic approach has been used to combine the assessments for CHP and CHP-R. The approach and methodology undertaken is discussed below (amended from the CHP-R Guidance).

- **Step 1:** Assess design concept for development and establish whether CHP and CHP-R is relevant for the proposal.
- **Step 2:** Establish if there are any opportunities for the supply of heat.
- **Step 3**: Review opportunities for supply of heat and identify the most appropriate heat load.
- **Step 4**: Generate a CHP envelope and review if the requirements of the heat load can be met.
- **Step 5**: Establish the effect of the selected heat load on the proposed development.
- **Step 6:** Based on the work completed in steps 3 – 5, identify provisions and space requirements for CHP / CHP-R.
- **Step 7:** Where appropriate identify the costs associated with the provision of CHP / CHP-R
- **Step 8:** Justify the degree to which the proposed development will be CHP-R.

3.3.2 The developer will be required to carry out periodic reviews of opportunities for the supply of heat as per the CHP-R Guidance.

3.4 CHP Assessment Checklist

3.4.1 The various guidance and requirements outlined above infer a range of requirements for developers for inclusion within a CHP assessment. These requirements have been fulfilled for the Proposed Scheme.

3.4.2 Table 1 below, lists each of these requirements, together with references to where the relevant information is presented within this document.

Table 1 – CHP Assessment Requirements

Guidance Document	Evidence / Information Required	Location in this CHP Assessment
National Policy Statements	Consultation with identified organisations / bodies	Section 4.3.1 – 4.3.3 and Appendix 1

Guidance Document	Evidence / Information Required		Location in this CHP Assessment
	Identification as to whether CHP is economically or practically feasible from the outset		Section 4
	Explanation as to why CHP is not economically or practically feasible from the outset (if applicable)		Section 4
	Details of any potential future heat requirements in the area that the station could meet		Section 42.7 and Table 3
	Detail the provisions in the proposed scheme for ensuring any potential heat demand in the future can be exploited		Section 5.2
	Explanation of how the development can be ready to provide CHP in the future or set out any constraints which would prevent this (if applicable)		Section 5.2
CHP Guidance	Demonstrate proper consultation of the results of the UK heat mapping exercise		Section 4.3.1 – 4.3.3 and Appendix 1
	Demonstrate exploration of a number of potential heat markets, either singly or in combination		Section 4
	Demonstrate contact with identified organisations that can assist developers in identifying potential CHP customers		Appendix 1
	Explanation of the choice of project location, including the potential viability of the site for CHP		Section 4
	Report on the exploration carried out to identify and consider the economic feasibility of local heat opportunities and how to maximise the benefits from CHP		This document (and, principally, Section 4)
	The results of the exploration carried out		Section 4
	A list of organisations contacted		Appendix 1
	The basis for the developer's conclusion that it is not economically feasible to exploit existing regional heat markets (if applicable)		Section 5
	A description of potential future heat requirements in the area		Section 4.2.5 – 4.2.7 and Table 3
	The provisions in the proposed scheme for exploiting any potential heat demand in the future		Section 5.2
CHP-Ready Guidance *	Will the plant be CHP at the outset?	(FIRST BAT TEST)	Section 6.2.1

Guidance Document	Evidence / Information Required		Location in this CHP Assessment
	Justify the degree the Proposed Scheme will be CHP-R	(SECOND BAT TEST)	See below
	Identification of opportunities for the supply of heat	(Requirement 1)	Sections 6.3.1 – 6.3.2
	Identification of the CHP Envelope	(Requirement 2)	Section 6.3.3
	The effect of selected heat load	(Requirement 3)	Section 6.3.4
	Identify technical provisions and space requirements for CHP-R	(Requirement 4)	Section 6.3.5
	Identify technical provisions and space requirements for CHP-R	(Requirement 5)	Section 6.3.6 – 6.3.7
	Identify costs associated with CHP-R	(Requirement 6)	6.3.8
	Periodic review	(THIRD BAT TEST)	Section 6.4.1

* *The approach to the CHP assessment and the preparation of this document has been undertaken with due regard paid to the CHP-Ready Guidance however this document does not seek (nor is it required) to address all of the requirements of the CHP-Ready Guidance*.

4 IDENTIFICATION OF POTENTIAL HEAT USERS

4.1 Introduction

4.1.1 This chapter summarises the findings of the potential heat users assessment. As per the CHP-R guidance a radius of 15 km from the Site has been used when identifying potential users. The guidance indicates a maximum radius of 15 km because over this radius, CHP schemes become technically and economically impractical. Publicly available datasets have been used to assess potential heat users in the area, including the UK CHP Development Map, online planning portals and previous consultation under the White Rose CCS Project.

4.1.2 In general, CHP is more attractive in cases when the heat load is large and constant throughout the year. This is typically the case with chemical plants, refineries and factories which depend upon continuous processes and use large amounts of heat (usually supplied as steam).

4.1.3 CHP is less attractive in cases where the heat load is seasonal or intermittent. This is typically the case for district heating in countries (such as the UK) which have a relatively

short winter heating season (compared to Scandinavian or Eastern European countries). As such, there is a general absence of significant district heating schemes in the UK and where they are developed, district heating schemes have generally been associated with new-build publicly funded and often high-rise housing where the heat loads can be readily combined and the heat distribution piping is compact. Furthermore, it is recognised that there are limited (and not economically viable) opportunities to provide CHP to domestic users other than part of district heating schemes.

4.1.4 CHP is unattractive where demand is for high-temperature heat. This is because generating stations can supply their waste heat (low temperature) with minimal impact to the power output or efficiency. This is compared with generating stations supplying heat from within the power cycle (high temperature) which has a greater impact to power output and efficiency. High temperature users such as glass furnaces and cement kilns, which require heat at >1,000°C are therefore considered not feasible for a CHP scheme of this type. The usual practice for high temperature heat users would be to have their own heat generating source – typically direct-firing with natural gas in glass furnaces and with solid fuels in cement kilns.

4.2 UK CHP Development Map

4.2.1 The Department for Energy and Climate Change's (DECC, now Department for Business, Energy and Industrial Strategy (BEIS)) online heat map tool (Ref. 4.1) was used to investigate likely heat demands in the local area. A 15 km search radius was used as per the recommendations in the CHP-R guidance, for plants over 300 MW. Figure 1 and Table 2 below show the results of the search.

Figure 1 – Results of Heat Demand Search

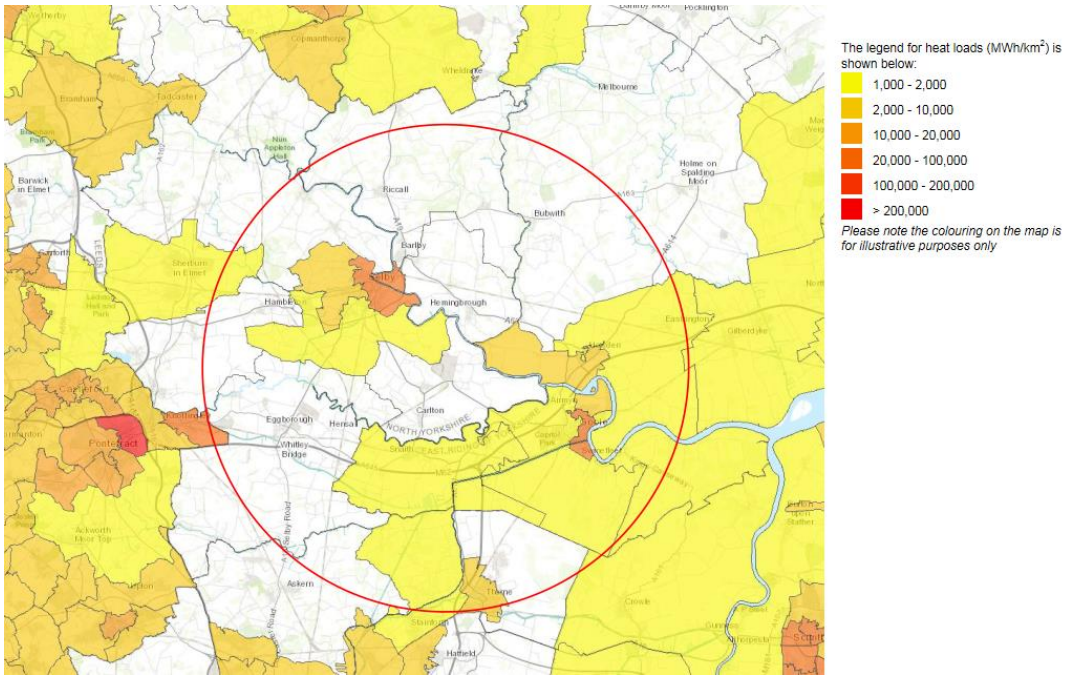


Table 2 – Results of Heat Demand Search

Sector	Share	Total MWh
Communications and Transport	0.07%	890.7
Commercial Offices	0.28%	3782.5
Domestic	77%	1,032,545.8
Education	1.34%	18,020.9
Government Buildings	0.28%	3763.7
Hotels	0.24%	3198.1
Large Industrial	13.89%	186,265.9
Health	0.20%	2712.3
Other	0.08%	1042.5
Small Industrial	5.99%	80,272.9
Retail	0.29%	3926.8
Sport and Leisure	0.12%	1561.8
Warehouses	0.22%	3005.3
Total heat load in area		**1,340,989**

4.2.2 The largest heat load within the 15 km radius of the Site is domestic at 77% of the total heat load; this is followed by large industrial at 13.9 % and small industrial at 6 %. These potential heat loads are discussed further in the following sections.

Domestic

4.2.3 The domestic heat load appears to be spread across the CHP search area with most areas showing low heat requirements. The largest domestic heat loads are in Selby, 6.5 km to the North West and Goole, 9 km to the South East.

4.2.4 Section 4.6.5 of the Overarching National Policy Statement for Energy (EN-1) does not recommend using existing housing to be part of new CHP Schemes:

"the provision of CHP is most likely to be cost-effective and practical where it is included as part of the initial design and is part of a mixed-use development. For example, retrofitting a district heating network to an existing housing estate may not be efficient."

4.2.5 For this reason, utilisation of existing domestic housing has been deemed non-viable but a search of the local planning portals was completed to determine if there is any viable future heat load for a district heating scheme. The results of this search are shown in Table 3 below.

Table 3 – Results of Search of Domestic Planning Applications

Address	Application Date	No. of Dwellings	Approx. Distance from Power Station	Application Decision	Notes
Street Record Flaxley Road Selby	17/07/2017	Circa 200	8.19 km	Awaiting Decision	
Land South Of Main Street Church Fenton Tadcaster North Yorkshire	30/06/2017	100	17.35 km	Awaiting Decision	Outside of 15 km radius
Manor Farm 21 Chapel Street Hambleton Selby North Yorkshire YO8 9JG	16/05/2017	Up to 150	11.64 km	Awaiting Decision	
Bowmans Mill Selby Road Whitley Goole East Yorkshire DN14 0LQ	09/05/2017	Up to 120	10.41 km	Awaiting Decision	Would need to pass the M62 and the River Ayre
Street Record Barff Lane Brayton Selby North Yorkshire	21/04/2017	125	7.10 km	Awaiting Decision	
Street Record Main Road Hambleton Selby North Yorkshire	01/02/2017	115	11.44 km	Awaiting Decision	
Street Record Low Street Sherburn In Elmet North Yorkshire	21/06/2016	498	17.7 km	Permitted	Outside of 15 km radius

Address	Application Date	No. of Dwellings	Approx. Distance from Power Station	Application Decision	Notes
Phase 2 Redrow Low Street Sherburn In Elmet North Yorkshire	11/05/2016	498	17.7 km	Permitted	Outside of 15 km radius
Land Near Crossing At Leeds Road Thorpe Willoughby Selby North Yorkshire	26/02/2016	276	9.58 km	Permitted	

4.2.6 Of the applications submitted within the past two years only three have recent planning consent and of those only one is within the 15 km radius. The development at the Leeds Road, Thorpe, has been under construction for 10 months, due for completion in September 2022. This is therefore not considered as a viable consumer for CHP from the outset, as works for the CHP scheme would already need to be underway.

4.2.7 Of the developments which are still awaiting decision, even if they receive consent in the near future, the number of dwellings is deemed too small (all less than 200) to support a CHP scheme that would be required to make it economically viable for the Proposed Scheme. This is because the capital cost to construct the required infrastructure and the operating / maintenance costs would outweigh the income received from the scheme. There would be potential to combine the schemes but they would have to be within close proximity of each other and be consented at a similar time. An assessment of the location of the new domestic developments still awaiting decision has been carried out and it was determined that they are almost all spread out more than 1 km away from each other. The potential for future domestic heat loads (single or combining) should be investigated further in the periodic CHP reviews to be completed after consent has been granted and the Proposed Scheme has been constructed and fully commissioned.

Large Industrial

4.2.8 Three large heat loads in particular were identified as shown in Table 4.

Table 4 – Summary of Large Industrial Heat Loads

Operator	Total MWh
Unknown Operator	94,879.7
Unknown Operator	30,326.3
Unknown Operator	21,233.0
Total heat load for all large heat load sites	146,439.0

4.2.9 The CHP Development tool marks these loads as “unknown operator”, however from further investigation it is assumed the 94,879.7 MWh load is associated with the Shipyard Industrial Estate, the 30,326.3 MWh is associated with the Greencore Grocery and the 21,233.0 MWh load is associated with Saint Gobain Glass.

4.2.10 Greencore Grocery is located approximately 6.5km to the north west of the Proposed Scheme and requires multiple road crossings, 2 railway crossings, multiple stream crossings and crossing of the River Ouse. In particular, crossing of the River Ouse is challenging and expensive due to its width, as horizontal directional drilling would be required. To avoid the multiple crossings of the River Ouse, then the distance to Greencore Grocer’s increases even further, becoming counter-intuitive. Although technically feasible, the added complexity and commercial costs associated with the multiple crossings, alongside the relatively low heat load required for the end user means Greencore Grocery is considered currently as a non-viable option for provision of CHP.

4.2.11 Glassworks rely on natural gas-fired furnaces supplying heat at >1,000°C combined with extensive heat recovery equipment which eliminates their need for low grade heat and steam. For this reason Saint Gobain Glass is considered as a non-viable option for provision of CHP.

4.2.12 The final large heat load is an unknown user in the Shipyard Industrial Estate. It is known that the user is currently partly served by an existing CHP scheme, which provides circa 54,000 MWh, which leaves 41,000 MWh heat load requirement. At this time, the 41,000 MWh size of the heat load is considered too low when considering the distance and complexity of the route and the substantial infrastructure required. It is however noted that this could be a potential future user for CHP if the user's existing CHP scheme ends or if it can be combined with another nearby user and should therefore be considered in future periodic reviews.

Small Industrial

4.2.13 6 % of the total heat load within the 15 km area is attributed to small industrial at 80,300 MWh. The largest small industrial heat loads are based in Selby to the north of the River Ouse; these are therefore discounted from further consideration due to the technical and commercial limitations discussed previously in this Statement, being:

1. Crossing the River Ouse is challenging and expensive due to its width, as horizontal directional drilling would be required;
2. To avoid the multiple crossings of the River Ouse, then the distance increases even further, becoming counter-intuitive;
3. The added complexity and commercial costs associated with the multiple crossings, alongside the relatively low heat load required for the end user means these users are considered currently as a non-viable option for provision of CHP.

4.2.14 A smaller heat load of approximately 29,000 MWh has been identified in the village of Barlow just to the north-east of the Proposed Scheme. The heat load of 29,000 MWh is considered to be too small of a load to be economically viable for a dedicated CHP opportunity from the Proposed Scheme. However, it is considered this may present a potential viable option as part of a future CHP scheme with other heat loads that in aggregate represent a sufficiently large heat load to make a CHP scheme viable.

4.3 Consultation

4.3.1 In 2014, Capture Power Limited undertook a consultation to identify CHP opportunities as part of their White Rose CCS Project. The proposed project location was at Drax Power Station, therefore, considering the proximity to the Proposed Scheme and the recent date of consultation the results will be used to support this CHP assessment. (A review of the consultees has been carried out in 2018 and no new consultees within the region have been identified). The results of this consultation are presented in Appendix 1.

4.3.2 The following provides a summary of the consultation and potential CHP opportunities identified:

- 14 consultees were contacted;
- 12 consultees did not provide a response;

- 1 consultee (Confederation of Paper Industries) provided a response which stated that there were no CHP opportunities relevant to their work; and,
- 1 consultee (Energy Saving Trust) provided a response which stated that they were able to supply information regarding typical heat and overall energy demand profiles though no specific CHP opportunities were identified.

4.3.3 The results from the consultation indicate that, at this time, there are limited specific CHP opportunities and limited CHP interest.

4.4 Summary

4.4.1 From the review of potential heat loads in a 15 km radius, the following can be noted;

- The majority of the local heat load can be attributed to domestic users. This load is spread across the area and the demand is generally low. Existing domestic dwellings are difficult to integrate with CHP schemes due to the amount of retrofit required. Potential new domestic loads are considered too small and there is uncertainty on when the new developments will begin to combine into joint schemes.
- Three large heat loads have been identified. Of these two are considered not feasible, due to technical constraints. The third heat load is currently partly served by a CHP scheme, with the remaining heat load considered too small to be viable. Consideration may be given for this heat load in the future if the existing CHP Scheme ends or other heat loads become apparent in the vicinity.
- Small industrial makes up around 6 % of the local heat load. The largest small industrial heat loads are based in Selby to the north of the River Ouse. These are therefore discounted on technical and commercial feasibility. Another small industrial heat load south of the river has been identified but deemed too small to be viable on its own. It may however be considered alongside any new small industrial loads in the area for a CHP scheme in the future.

4.4.2 A review of the local planning portals has not highlighted any future development that could be considered for a CHP scheme.

5 COMPATIBILITY WITH PROVISION OF CHP

5.1 Introduction

5.1.1 This section summarises the technical and economic feasibility of operating with CHP.

5.2 CHP Provision in the Proposed Scheme

5.2.1 Section 4 provides an explanation as to why CHP is not economically or practically feasible from the outset. However, demonstration is provided in this sub section that the Proposed Scheme can be CHP-R through provisions during the construction of the plant.

5.2.2 The Proposed Scheme is made up of up to four new gas turbines and up to four HRSGs. The exhaust from the gas turbines is used to heat water to steam in the HRSGs (in combined cycle mode). The steam is then sent to the existing steam turbines and condensed in the existing steam turbine condensers. There are three viable points for heat extraction:

1. Extraction from the hot condensate;
2. Low Pressure (LP) Steam extraction from the HRSG; and
3. Cold reheat steam extraction.

5.2.3 The highest potential for heat extraction is determined to be from cold reheat steam extraction as indicated in Appendix 2. To enable provision for this, the steam turbine will be equipped with a reheat line (where steam from the high pressure turbine is reheated prior to going into the intermediate / low pressure turbines). If the opportunity for CHP arises in the future, a steam extraction line would be required to be installed off the reheat line. Requirement 4 of the CHP-R Guidance states that provision for a CHP scheme can be either built into the design or included at a later stage. Unless a CHP opportunity becomes apparent at the point of design, it is recommended to not build anything into the design but to allow future provision for modification of the design if required. This will allow the plant to be optimised from the onset to maximise power output and efficiency.

5.2.4 Depending on the commercial arrangement for any future CHP Scheme and the operating regime of the Proposed Scheme, there may be a requirement to have an auxiliary boiler on the Power Station Site to enable heat load to still be provided to the user in the event that the Proposed Scheme is not in operational due to maintenance. It is noted that there is adequate space provision on the Existing Drax Power Station Complex to install an auxiliary boiler if required.

5.3 Feasibility of Heat Extraction

5.3.1 Heat extraction from three points as identified in section 5.2 has been considered;

5.3.2 The potential CHP efficiency at 100 % (full load) and Minimum Environmental Stable Load (MESL) have been investigated for all three cases and are included in Appendix 2. For the purpose of this report it is assumed heat will be extracted from the cold reheat as this gives the highest potential for heat extraction.

5.4 CHP Envelope

5.4.1 The CHP-R Guidance states that *"…consideration needs to be given to the ability of the new plant to meet future heat loads within its likely operational profile. This consideration allows for the identification of a 'CHP Envelope'."*

5.4.2 The CHP envelope has been developed from plant performance information provided by Drax's plant technology partner for the Proposed Scheme, Siemens, and is included in Appendix 2. Two CHP envelopes have been created; a CHP envelope for the scenario if just Unit X is constructed to provide a total output up to 1,800 MW and a CHP envelope for the scenario where both Unit X and Unit Y are constructed to provide a total output of up to 3,600 MW. The 200 MW battery storage project is not a thermal power plant producing waste heat, and so is not suitable for inclusion in the CHP assessment.

5.4.3 CHP efficiency is defined by the following equation.

$$CHP_{\eta} = \frac{Gross\ Process\ Heat\ Output + Gross\ Electrical\ Power\ Output}{Fuel\ Input}$$

5.4.4 The Primary Energy Saving (PES) for CHP Mode is defined by the following equation;

$$PES\ (\%) = \left[1 - \frac{1}{\frac{CHP_\eta}{H+E}\left[\frac{H}{Ref\ H_\eta} + \frac{E}{Ref\ E_\eta}\right]}\right].100$$

Where:

CHP_η: CHP Efficiency
Ref H_η: Reference Heat Efficiency
Ref E_η: Reference Electrical Efficiency
H: Heat Load Extraction
E: CHP Mode Net Electrical Output

5.4.5 The four limits of the CHP envelope are defined as;

A: 100% load, no heat extraction
B: 100% load, maximum heat extraction
C: Minimum environmental stable load, no heat extraction
D: Minimum environmental stable load, maximum heat extraction

CHP Envelope if just Unit X is Constructed

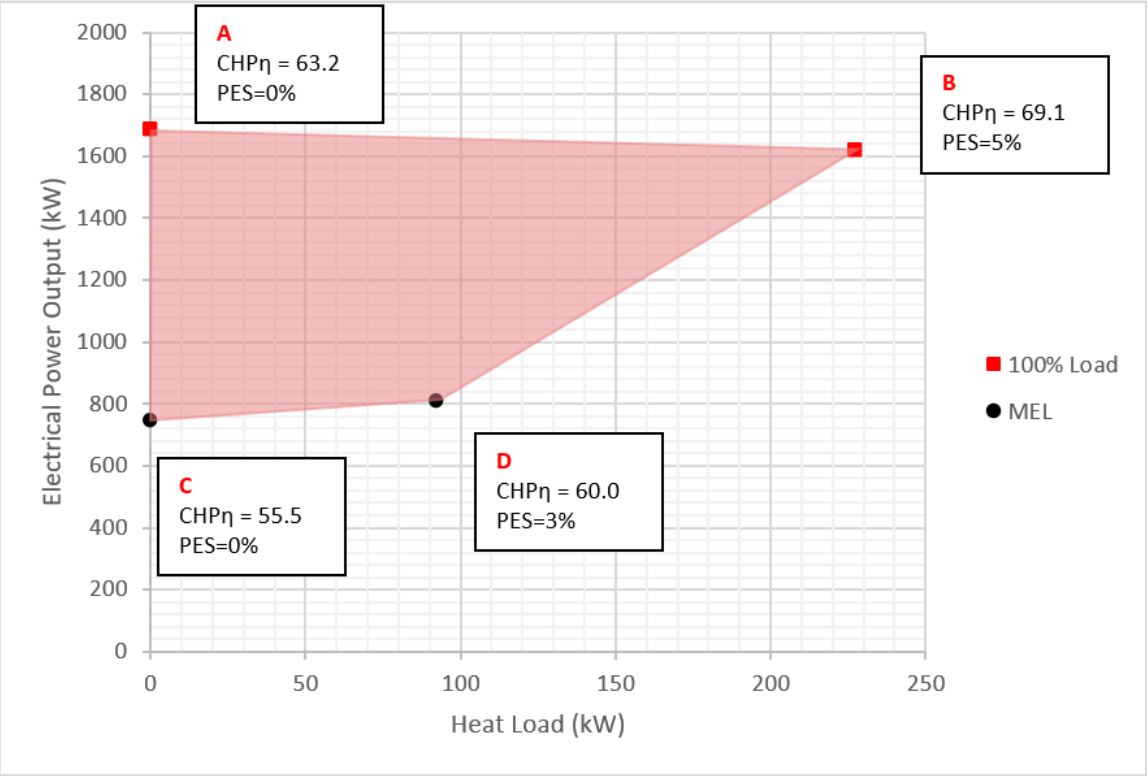
5.4.6 Extracting the performance information received from Siemens, outlined in Table 5 below, the CHP envelope for just Unit X can be determined. The CHP envelope for just Unit X is presented in Figure 2 and includes the CHP Efficiency and Primary Energy Saving (%) for each point on the envelope. The maximum heat extraction from just Unit X is considered to be 227.4 MW.

Table 5 – CHP Envelope – Unit X

	No Heat Extraction	Maximum heat extraction (Cold Reheat (CRH) Steam Extraction)
100% Load		
Fuel Input	2667	2667
Gross Process Heat Output (MW)	0	227.4
Gross Electrical Power Output (MW)	1686.4	1616.8
Total Heat and Power Output (MW)	1684.4	1844.2
CHP Efficiency (%)	63.2	69.1
Minimum Environmental Stable Load		
Fuel Input	1344	1344

	No Heat Extraction	Maximum heat extraction (Cold Reheat (CRH) Steam Extraction)
Gross Process Heat Output (MW)	0	92.8
Gross Electrical Power Output (MW)	746.1	713.3
Total Heat and Power Output (MW)	746.1	806.2
CHP Efficiency (%)	55.5	60

Figure 2 – CHP Envelope – Unit X



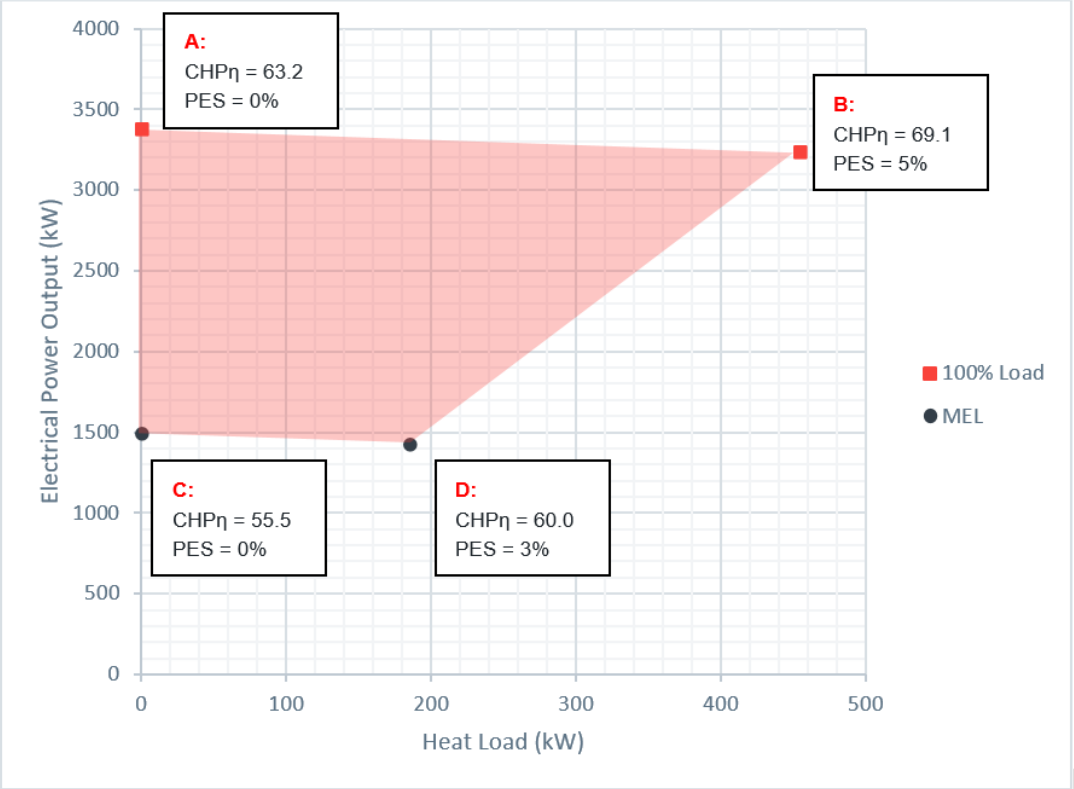
CHP Envelope if both Unit X and Unit Y are Constructed

5.4.7 Extracting the performance information received from Siemens, outlined in Table 6 below, the CHP Envelope for both Unit X and Unit Y can be determined. The CHP Envelope for both Unit X and Unit Y is presented in Figure 3 below and includes the CHP Efficiency and Primary Energy Saving (%) for each point on the envelope. The maximum heat extraction from both Unit X and Unit Y is considered to be 454.8 MW.

Table 6 – CHP Envelope – Unit X and Unit Y

	No Heat Extraction	Maximum heat extraction (CRH Steam Extraction)
100% Load		
Fuel Input	5334	5334
Gross Process Heat Output (MW)	0	454.8
Gross Electrical Power Output (MW)	3372.8	3233.6
Total Heat and Power Output (MW)	3368.8	3688.4
CHP Efficiency (%)	63.2	69.1
Minimum Environmental Stable Load		
Fuel Input	2688	2688
Gross Process Heat Output (MW)	0	185.6
Gross Electrical Power Output (MW)	1492.2	1426.6
Total Heat and Power Output (MW)	1492.2	1612.4
CHP Efficiency (%)	55.5	60.0

Figure 3 – CHP Envelope – Unit X and Unit Y



CHP Potential with Addition of Carbon Capture and Storage

5.4.8 A separate report has been produced for the Proposed Scheme looking at the future potential for a carbon capture and storage (CCS) plant to be built alongside the Proposed Scheme (document reference 5.7). The report has been written in line with the Carbon Capture Readiness (CCR) Guidance (Ref. 5.1). The report outlines the requirements for a CCS plant, including the need for a significant steam load (916 MW for the 3,600 MW case) and large auxiliary power load (168 MW for the 3,600 MW case). The large steam load required for the CCS plant means there is minimal steam load available for CHP and the additional auxiliary load required results in lowering the plant efficiency. Supplementary firing the HRSGs could be considered to increase the steam load although again this would reduce the plant efficiency and would require significant modifications to the HRSGs to provide only minimal heat load on top of the requirement for CHP. It can therefore be concluded that running a CHP scheme alongside a CCS plant is not economically viable and as such, it is not further explored as part of this report.

5.5 Economic Assessment

5.5.1 EN-1 states (at paragraph 4.6.5) that "*To be economically viable as a CHP plant, a generating station needs to be located close to industrial or domestic customers with heat demands. The distance will vary according to the size of the generating station and the nature of the heat demand.*"

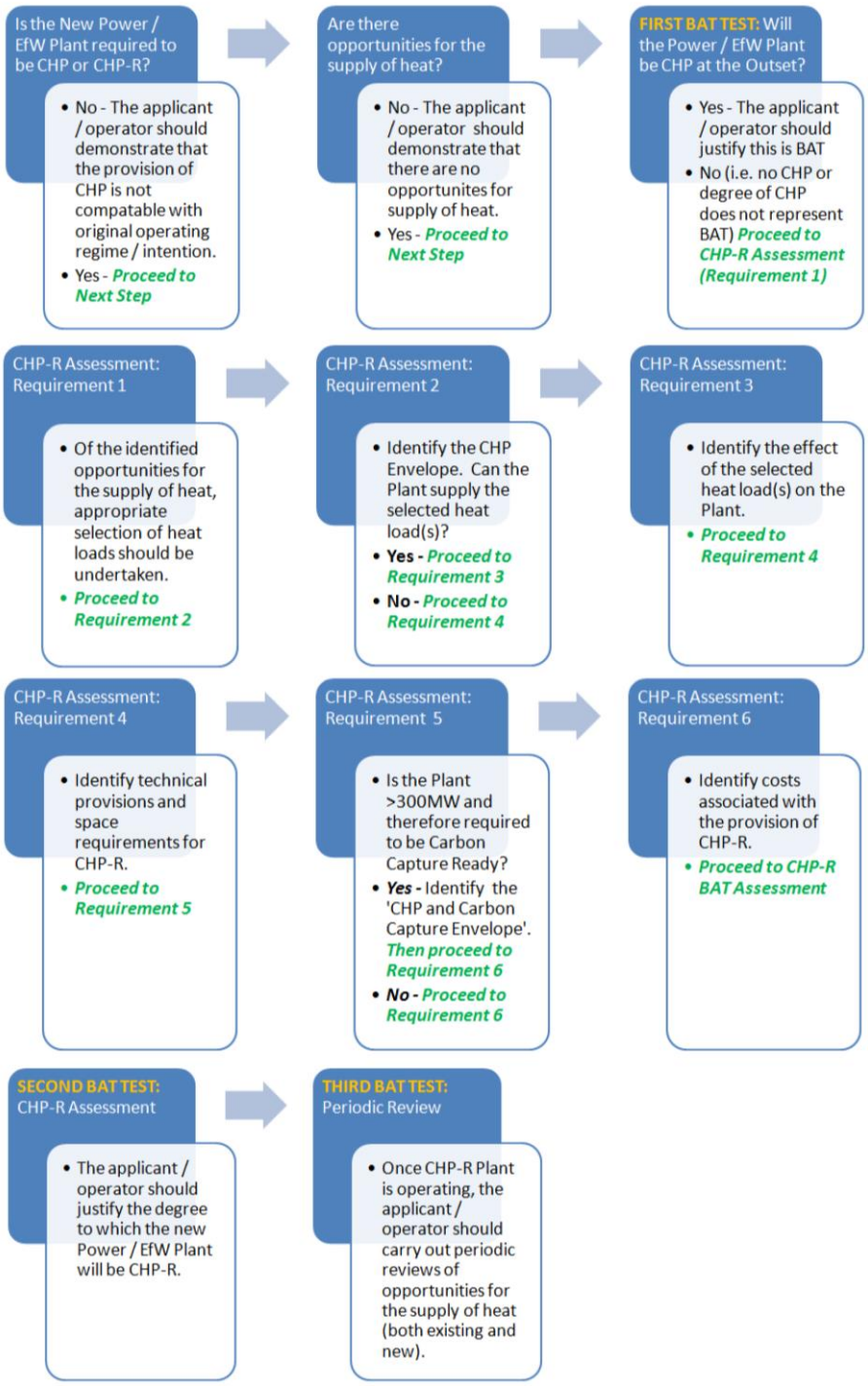
5.5.2 Table 4 identifies three large industrial heat loads within a reasonable proximity to the Proposed Scheme. It is understood that the industrial heat loads come from Shipyard Industrial Estate, Greencore Grocery and Saint Gobain Glass. Due to the reasons outlined in section 4, all three options have been deemed unviable for a new CHP scheme. It is however noted that the Shipyard Industrial Estate could be a potential future user for CHP and should be considered in future periodic reviews.

6 BAT ASSESSMENT SUMMARY

6.1 Methodology

6.1.1 Insert 1 of the 2013 CHP-R Guidance describes the BAT assessment process for CHP and CHP-R, reproduced as Figure 4 below. This section will carry out the three BAT tests in line with this assessment process.

Figure 4 – BAT Assessment Process



6.2 First BAT test

Will the Power/ EfW Plant be CHP at the Outset?

6.2.1 The Proposed Scheme will not be operated as a CHP unit from the outset as no viable heat loads have been identified for a CHP unit to be commercially and technically feasible.

Further, the operating scheme of the Proposed Scheme is yet to be fully defined, which is integral for the integration of a CHP scheme. For these reasons the Proposed Scheme will not operate as a CHP from the outset, the plant will therefore need to be designed as CHP ready as per the second BAT test.

6.3 Second BAT test

Requirement 1

Of the identified opportunities for the supply of heat, appropriate selection of heat loads should be undertaken.

6.3.1 A number of heat loads were identified in section 4. However, of the heat loads identified, no currently commercially and technically feasible large heat loads were found. The largest percentage of heat demand in the local area is domestic, this is currently made up of sparse existing properties that would be difficult to tie in to a district heating scheme. A review of the local planning portals identified a number of proposed domestic developments within the 15 km search radius, but these were all considered to be too small to support a CHP scheme. The opportunities for domestic heating schemes should be reviewed periodically as part of the third BAT test, and potential future domestic schemes should be considered through this review process.

6.3.2 No currently feasible large industrial loads were identified for potential CHP schemes. One industrial heat load was identified that may present a possible future opportunity for a CHP scheme; however, it is currently partly served by an existing CHP scheme, supplying circa 54,000 MWh out of a total of around 95,000 MWh. A smaller heat load of approximately 29,000 MWh has been identified in the village of Barlow just to the north-east of the Proposed Scheme. The heat load of 29,000 MWh is considered to be too small a load to be economically viable for a dedicated CHP opportunity from the Proposed Scheme. However, it is considered this may present a potential viable option as part of a future CHP scheme with other heat loads. Large and small industrial heat loads should be further investigated in future periodic reviews.

Requirement 2

Identify the CHP Envelope. Can the Plant supply the selected heat load(s)?

6.3.3 The CHP envelope has been identified in section 5.4 indicating that the maximum heat extraction from a single unit (Unit X) is 227.4 MW and from two units (both Unit X and Unit Y) is 454.8 MW, representing around 2,000 GWh and 4,000 GWh per annum, respectively, assuming baseload operation and 100 % availability (assuming an auxiliary boiler would provide heat load during power plant outage). The heat potentially available from the plant far exceeds the largest identified heat load.

Requirement 3

Identify the effect of the selected heat load(s) on the Plant.

6.3.4 The calculated heat load represent less than 15 % of the maximum heat extraction from a single unit (e.g. Unit X). Therefore, should such a CHP scheme be implemented, the effect on plant operation would be minimal.

Requirement 4

Identify technical provisions and space requirements for CHP-R.

6.3.5 Sufficient space will be allocated for future retrofit of the Proposed Scheme to allow for heat offtake, should CHP become a viable option. Whilst no connection corridor has been identified for the water and steam pipes required if a CHP opportunity was to be pursued, it is considered that provision of these would be feasible within the constraints of the Power Station Site.

Requirement 5

Is the Plant >300MW and therefore to be Carbon Capture Ready? If yes, identify the CHP and Carbon Capture Envelope.

6.3.6 The output of the Proposed Scheme will be up to 3,600 MW, it will therefore be required to meet Carbon Capture Ready (CCR) guidelines. As per the 2013 CHP-R Guidance, the Proposed Scheme should be designed to be both CCR and CHP-R.

6.3.7 Section 5.4.8 looks at the potential for operating the CCR and a CHP simultaneously and it is concluded that it is not economically viable due to the following:

- CS Plant requires a large auxiliary power load, reducing the efficiency of the repowered generating stations.
- CCS Plant requires a significant steam load meaning there is minimal steam load available for CHP.

Requirement 6

Identify costs associated with the provision of CHP-R.

6.3.8 As no heat load has been identified for provision of CHP from the outset, the Proposed Scheme will be developed as CHP-R. A cost estimation for provision of CHP will be completed if CHP becomes a viable option in the future.

6.4 Third BAT test

Once CHP-R Plant is operating, the applicant / operator should carry out periodic reviews of opportunities for the supply of heat (both existing and new).

6.4.1 To satisfy the third BAT test, the Applicant will continue with periodic reviews commencing 12 months from full commissioning of Unit X. The following technical and commercial aspects will be considered during these reviews;

- Economic viability of any proposed CHP Scheme;
- Review of technical assessment if any viable heat load is identified.

6.4.2 These commitments are secured through a requirement in Schedule 2 to the draft DCO (document reference 3.1).

7 CONCLUSION

7.1.1 In line with the requirements of the 2006 CHP guidance and 2013 CHP-R Guidance, this CHP Statement has been prepared to support the Application for a DCO for the Proposed Scheme.

7.1.2 Given the uncertainty of future heat loads, the lack of currently available suitable heat loads, and the undefined operating regime of the Proposed Scheme, the Proposed Scheme will not be CHP from the outset. Therefore, in accordance with the second BAT test, the plant will be developed as CHP Ready.

7.1.3 A review of potential heat loads in a 15 km radius has been completed, the following was noted;

- The majority of the local heat load can be attributed to domestic users. This load is spread across the area and the demand is generally low. Existing domestic dwellings are difficult to integrate with CHP schemes due to the amount of retrofit required.
- Three large heat loads were identified. Of these, two were considered not feasible, due to technical constraints. The remaining heat load is currently partly served by a CHP scheme, however, this may be considered as a future user for a CHP scheme.
- Small industrial makes up around 6 % of the local heat load. The largest small industrial heat loads are based in Selby to the north of the River Ouse. These were therefore discounted on technical and commercial feasibility. Other small industrial heat loads alongside newer heat loads in the vicinity may be considered as future users for a CHP scheme.

7.1.4 A review of the local planning portals has not highlighted any future development that could be considered for a CHP scheme.

7.1.5 It is therefore considered based on the low heat demand in the surrounding area that the plant will be designed as CHP Ready and will not be developed as a CHP scheme until such loads become available that running with CHP is considered economically feasible.

7.1.6 To satisfy the third BAT test the Applicant will continue with periodic reviews upon commencement of operation, which will be secured via a requirement attached to the draft DCO for the Proposed Scheme.

8 REFERENCES

- Ref. 1.1: Department of Trade and Industry. 2006. Guidance on Background Information to Accompany Notifications under Section 14 (1) of the Energy Act 1976 and Applications under Section 36 of the Electricity Act 1989.
- Ref. 1.2: Environment Agency. 2013. CHP Ready Guidance for Combustion and Energy from Waste Power Plants. V1.0.Ref. 1.3: The Planning Act 2008 (as amended).
- Ref. 1.4: Department for Energy and Climate Change (DECC, now BEIS). 2011. The Overarching National Policy Statement for Energy. (NPS EN-1).
- Ref. 1.5: Department for Energy and Climate Change (DECC, now BEIS). 2011. The National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (NPS EN-2).
- Ref. 4.1: Department for Energy and Climate Change (DECC, now BEIS). Online UK CHP Development Map. http://chptools.decc.gov.uk/developmentmap
- Ref. 5.1: Department for Energy and Climate Change (DECC, now BEIS). 2009. Carbon Capture Readiness (CCR). A Guidance Note for Section 36 Electricity Act 1989 Consent Applications" (November 2009). URN 09D/810.

5.6 Combined Heat and Power Statement

Appendix 1: Consultation Results

Table 1-1 – Consultation Responses

Organisation	Reference to NPS / Guidance	Response	Potential Heat Load Recipient
Department of Energy and Climate Change	CHP Guidance	n/a	×
CHP Policy: Renewables and Low Carbon Energy Team	CHP Guidance	n/a	×
Quality Assurance for Combined Heat and Power (CHPQA)	CHP Guidance	n/a	×
Combined Heat and Power Association	CHP Guidance (optional)	n/a	×
The Energy Saving Trust	CHP Guidance (optional)	*"We do have information that can assist with this including:* • *Type of building and use (industrial, school, hospital, restaurant etc.)* • *Size of building in m²* • *Typical heat and overall energy demand profiles for these types and sizes of buildings* • *Overall energy and heat demand in the areas concerned."*	×
The Carbon Trust	CHP Guidance (optional)	n/a	×
NHS Trust Development Authority		n/a	×

Organisation	Reference to NPS / Guidance	Response	Potential Heat Load Recipient
Confederation of Paper Industries Ltd.		*"…paper mills are relatively large users of heat and steam. However, none of the fifty UK paper mills are within 15 km of the proposed White Rose CCS Project site."*	✗
HM Prison Service: Property Services Group		n/a	✗
North East, Yorkshire and the Humber: Homes and Communities Agency	NPS EN-1	n/a	✗
York, North Yorkshire & East Riding Local Enterprise Partnership	NPS EN-1	n/a	✗
Selby District Council	NPS EN-1	n/a	✗
North Yorkshire County Council	NPS EN-1	n/a	✗
Hazlewood Grocery Ltd & Greencore Grocery		n/a	✓

5.6 Combined Heat and Power Statement

Appendix 2: Information provided by SIEMENS

Table 2-1 – Information provided by SIEMENS

		No Heat Extraction	Maximum Heat Extraction		
		Condensing Mode	Hot Condensate Extraction	LP Steam Extraction from HRSG	CRH Steam Extraction
100 % Load					
Fuel Input	MW	2667	2667	2667	2667
Steam Temperature Export	°C	n/a	130.9	255.2	380.9
Condensate Temperature Return	°C	n/a	29.9	30.1	26.6
Gross Process Heat Output	MW	0	100.6	56.0	227.4
Gross Electrical Power Output	MW	1686.4	1678.6	1675.5	1616.8
Totally Heat and Power Output	MW	1686.4	1779.2	1731.5	1844.2
CHP Efficiency	%	63.23	66.71	64.92	69.15
Minimum Environmental Stable Load					
Fuel Input	MW	1344	1344	1344	1344
Steam	°C	n/a	135.9	227.9	401.6

Temperature Export					
Condensate Temperature Return	°C	n/a	25.3	25.3	24.7
Gross Process Heat Output	MW	0	46.3	31.4	92.8
Gross Electrical Power Output	MW	746.1	741.9	739.9	713.3
Totally Heat and Power Output	MW	746.1	788.3	771.4	806.2
CHP Efficiency	%	55.51	58.64	57.39	59.96