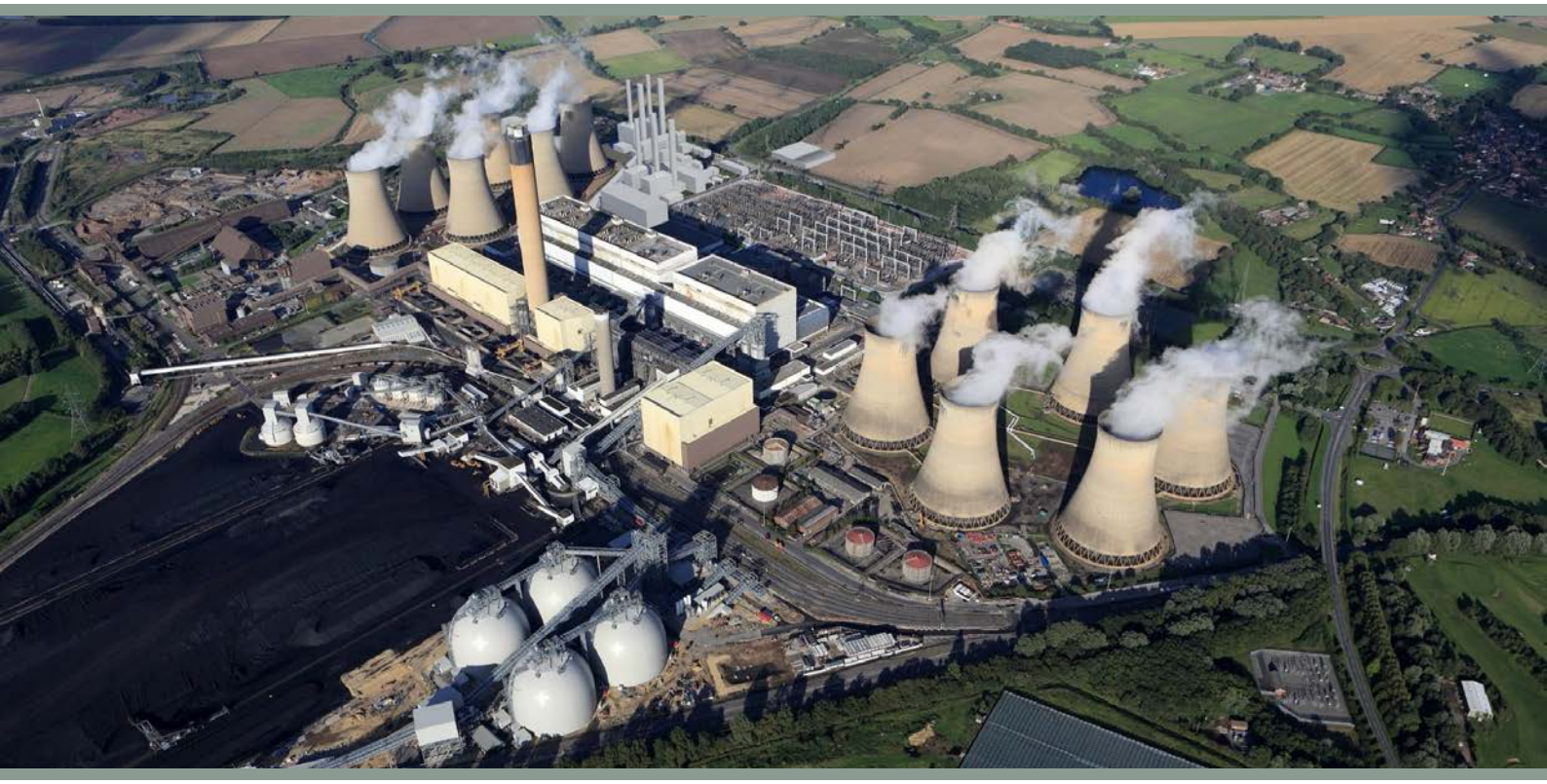
The Drax Power (Generating Stations) Order

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

Environmental Statement
4 – Consideration of Alternatives



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

Drax Power Limited

Drax Repower Project

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4 CONSIDERATION OF ALTERNATIVES

4.1 Introduction

4.1.1. This chapter sets out the consideration of alternatives in line with Regulation 14(2)(d) of the EIA Regulations 2017 which states that an ES should include:

"A description of the reasonable alternatives studied by the applicant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment".

4.1.2. Drax's objectives for the Proposed Scheme are to:

A. Reduce the reliance of Drax Power Station on coal as a source of power for electricity generation and replace that source with one that meets the Government's aims of creating a diverse energy mix that maintains security of supply as well as providing flexible back up for intermittent renewable energy.

B. Ensure that Drax Power Station maintains its position as one of the UK's main power generators, playing an important role in helping the UK transition to a low carbon economy through the re-utilisation of as much existing infrastructure as possible (such as cooling systems, cooling towers and steam turbines) which would otherwise be potentially redundant despite the infrastructure remaining within its operating life and capable of contributing to more efficient energy production and a lower carbon footprint (given it is already constructed).

C. Utilise as much existing operational land within the Existing Drax Power Station Complex as possible so as to maximise the use and efficiency of existing infrastructure.

D. Maximise the efficiency of Drax Power Station; and

E. Increase the flexible, response generating capacity of Drax Power Station to meet increasing demand across the UK by;

a) Providing additional support services to manage the stability of the national grid, such as frequency response and inertia, to support weather-dependent renewables like wind and solar; and

b) Increasing reliable large scale capacity on the system (i.e. large amount of capacity that can be called on at any time).

4.1.3. The consideration of the reasonable alternatives by the Applicant, has been undertaken only for the alternatives could realistically achieve these objectives.

4.1.4. The Proposed Scheme has gone through several iterations and evolutions in its design. The following alternatives have been considered for the Proposed Scheme:

- Do nothing scenario.
- Alternative development sites.
- Alternative layouts.
- Alternative technologies.
- Alternative emissions abatement.

- Alternative stack heights.
- Alternative fuels for electricity generation.
- Alternative options for the gas pipeline.
- Alternative construction transport routes.

4.2 Do Nothing Scenario

4.2.1. The 'Do Nothing' scenario is considered to be the continued operation of the coal-fired Units 5 and 6 at the Drax Power Station with emissions reductions in line with the government's proposed restrictions on unabated coal fired power generation from 2025. These emissions reductions could be achieved by Drax under its existing Environmental Permit and no further consents would be required.

4.2.2. Emissions are assumed to be reduced to 450 g CO_2 per kWh of electricity generated by 2025, in line with the government consultation response on this issue[1]. This scenario is considered further in Chapter 6 Air Quality and Chapter 15 Climate.

4.2.3. It is considered that the 'Do Nothing' alternative is not appropriate given the established national need for new energy that is of lower carbon intensity (less CO_2 per MWh).Chapter 2 (Planning Policy) sets out how gas generation power stations contribute to reducing national carbon emissions as part of a mix of new energy generation technologies.

4.2.4. This alternative would not achieve any of the stated project objectives. Whilst continued coal-fired power generation at Drax would meet the emissions standards set by the UK Government, it would not meet Drax's objectives for the project.

4.2.5. The continued use of coal would not reduce reliance on the more carbon-intense coal power and, although coal would only continue with lower carbon emissions, it would be less effective in helping a transition to a lower carbon economy.

4.2.6. Continuing coal use would only maintain the existing power generation capacity of the Drax Power Station; it would not increase the capacity of the existing power station and would not maximise the use of available land or maximise the efficiency of existing infrastructure.

4.2.7. The "do nothing" alternative would not provide the flexibility and responsiveness that the UK's energy system requires, which would be provided by new gas-fired units and the proposed battery storage facility.

4.2.8. However, the impact of the 'Do-Nothing' scenario is considered as the future baseline throughout this ES as it is technically possible without any additional consents. However, it is not considered the most appropriate way forward for Drax Power Station, does not meet Drax's objectives for the reasons set out above and would not be helping the Government move to a low carbon energy mix.

[1] Department for Business, Energy and Industrial Strategy (2018) Implementing the End of Unabated Coal by 2025

4.3 Alternative Development Sites

4.3.1. The alternative of developing a similar project at a geographically distant alternative power station site was considered. However, a whole-sale new site would not meet Drax's stated objectives:

- Finding a new, lower carbon fuel source for Drax Power Station - effectively, a new site would mean closing down Units 5 and 6 completely rather than finding a new fuel source;
- Maintaining Drax Power Station's position as one of the UK's main power generators and helping the UK transition to a low carbon economy through the re-utilisation of existing infrastructure – effectively, closing down Units 5 & 6 completely would mean such existing infrastructure would be redundant;
- Re-using as much existing operational land within the Existing Drax Power Station Complex as possible, in other words using an existing site that is already a power station rather than finding a new site and converting that new site to power generation use;
- Maximising the efficiency of Drax Power Station.

4.3.2. The only objective a new site would potential satisfy, would be Objective E, as any generating station developed on a new site could provide flexible and responsive energy, albeit this would be separate to Drax Power Station.

4.3.3. Drax Power Limited has previously considered developments adjacent to the Existing Drax Power Station Complex, for example the White Rose Carbon Capture Project to the north of the Existing Drax Power Station Complex and a new gas-fired power station on land to the east of the Existing Drax Power Station Complex, for which no application was submitted. These sites were not considered appropriate for the Proposed Scheme for the reasons set out in Table 4-1.

Table 4-1 - Comparison of the Power Station Site (being the location of the proposed generating elements of the Proposed Scheme) and Greenfield Location

Selected Location	Greenfield Site
The location of the generating elements of the Proposed Scheme (the Power Station Site) is currently in the ownership of the Applicant.	Additional compulsory acquisition likely to be required.
There is a long history of power generation on the Power Station Site which is currently used for this purpose, meaning there will be little material change to the land use.	Change of use to power generation with significant changes to the landscape.
The majority of the Power Station Site is brownfield, meaning sterilisation of currently agricultural land will be minimised.	Loss of agricultural land and impacts on biodiversity
The Power Station Site has existing electrical and transport connections.	New electrical and transport infrastructure required

Selected Location	Greenfield Site
It allows for the reuse of existing infrastructure, such as steam turbines and cooling technology, therefore reducing the cost of the Proposed Scheme, and minimising the requirement for new infrastructure to be built, thereby avoiding such infrastructure potentially becoming redundant when it is still operational and capable of contributing to more efficient energy production and a lower carbon footprint.	New infrastructure for power generation and cooling towers would be required, increasing land take and impacts on the landscape. Connecting new infrastructure at a more distant site to the existing steam turbines and cooling system would reduce the efficiency of the power station.
It is in close proximity to the NTS.	Choice of site would be limited by the need to be close to the NTS or have a longer pipeline.
Utilising the existing 400 kV substation, which has two spare bays, will avoid the need for a new substation.	New substation required.

4.4 Alternative Layouts

Layout Options

4.4.1. The proposed new gas turbine Units X and Y have been placed as close as possible to the existing steam turbines. This was required to minimise the length of main steam pipework runs, as the length of these runs has a direct impact on the efficiency of the new Units X and Y, and to allow the continued, unaffected operation of coal Units 5 and 6 until such time as they are decommissioned. Sites further from the steam turbines would reduce the overall efficacy of the plant by about 0.05%, which would lead to a significant increase in CO_2 emissions (or equivalent reduction in power generated) over the lifetime of the Proposed Scheme. It would, therefore, fail to achieve Drax's stated objective of maximising efficiency.

4.4.2. Therefore, to maximise the efficiency of the existing infrastructure going forward (in accordance with objectives C and D in particular) only areas within the Existing Drax Power Station Complex that were not currently occupied or that could accommodate the new Units X and Y with minimal disruption to ongoing operations were considered as locations for the Units. Areas considered and discounted are discussed in Table 4-2 below.

Table 4-2 - Areas within the Existing Drax Power Station Complex Considered and Discounted

Location	Comments
Main storage building between turbine	Close to the old units but discounted due to the amount of demolition required and the lack of space to construct new Units X and Y.

Location	Comments
houses and 400 kV substation.	
Absorber buildings units 4-6, north fuel tank farm.	This was a potential location for the battery storage facilities or one gas turbine unit but was discounted due to the amount of demolition required. In addition, construction would have an impact on remaining units as cable routing from the battery installation in this area would have had to run through operational plant.

4.4.3. The selected sites for Unit X, Unit Y and the battery storage facility provide sufficient space that is close enough to existing infrastructure to ensure no loss of efficiency. Whilst the area presents a constraint on the choice of technology for the HRSGs, the land can be made available for the Proposed Scheme without compromising the ongoing operation of the Drax Power Station.

4.5 Alternative Technologies

Gas Turbine Selection

4.5.1. Drax and Siemens are working in partnership to install Siemens gas turbines and battery technology at the Site. To achieve objective D, of maximising the efficiency of Drax Power Station, the new gas turbines will likely be Siemens SGT5-9000HL machines. This is a new generation gas turbine, which operates at a higher combustion temperature than machines currently in operation in the UK. This results in higher efficiency electricity production and lower emissions of CO_2 per MW, particularly when used in conjunction with the existing steam turbines in combined cycle mode. However, emissions of nitrogen oxides (NOx) are increased at these higher temperatures.

4.5.2. Previous generations of gas turbine, such as the Siemens SGT5-8000H, are not considered suitable for the Proposed Scheme. The lower combustion temperature results in less efficient combustion and the steam raised would be insufficient to drive the existing steam turbines. Objectives B and D would, therefore, not be achieved with previous generation gas turbines.

4.5.3. Siemens was selected as a supplier on the basis of its expertise with the existing Drax steam turbines, which are an intrinsic part of the Proposed Scheme.

Heat Recovery Steam Generators

4.5.4. The Proposed Scheme will make use of vertical type HRSGs; vertical HRSGs offer a number of benefits to the Proposed Scheme when compared to horizontal type units. The primary benefit is that a vertical boiler is compact and has a much smaller footprint. This allows the plant layout to be optimised and the new generating Units X and Y to be located close to the existing steam turbines, and as a result helps achieve objectives B, C and D. Proximity to the steam turbines increases the overall efficiency of the plant: reducing its environmental impact and improving its commercial competiveness and ability to operate in the market. In conjunction with their once-

through design the HRSGs selected for the Proposed Scheme will allow the plant to provide fast, flexible and responsive energy to the market, which is one of the Proposed Scheme's objectives (see objective E).

4.5.5. A horizontal boiler design would not fit in the available space close to the existing steam turbines. This would result in either a longer steam pipework run or the need to build new gas turbines. Both of these options would reduce the overall efficiency of the Proposed Scheme and, therefore, not achieve objectives B, C and D.

4.6 Alternative Emissions Abatement

4.6.1. A variety of measures can be employed to reduce NOx emissions from gas fired power stations. The following measures have been considered and discounted:

- Flue gas recirculation. Flue gas recirculation requires additional equipment capable of dealing with significantly larger flue gas volumes; this may result in the concentration of NOx decreasing but would not change the mass load of NOx being generated. It would also reduce efficiency due to the parasitic load and would therefore fail to meet objective D.
- Selective non-catalytic reduction (SNCR). SNCR would require a significant volume of ammonia and, without a catalyst, would result in a greater ammonia slip and greater environmental impact than SCR (Selective catalytic reduction).
- Steam injection. Steam injection has a high cost and negatively affects efficiency by lowering combustion temperature and it would therefore fail to meet objective D.

4.6.2. The Proposed Scheme assumes low NOx emissions through combustion control in CCGT mode in order to meet the limit set in the Industrial Emissions Directive (see Chapter 6 (Air Quality)). Whilst this would reduce the maximum efficiency of Units X and Y slightly, it would negate the need for any of the above measures, whilst still achieving the objective of maximising efficiency of Drax Power Station. Due to the high firing temperatures required to achieve the desired high efficiency of the new turbines, SCR is the other option being considered (should such reduction of NOx emissions in CCGT mode be required, which Drax considers it is not). SCR would enable objective D to be achieved, unlike several of the above measures, which would impact on efficiency. Accordingly, this ES assess the Proposed Scheme without SCR and with SCR (the latter with various assumptions as set out in Chapter 6 (Air Quality)). All other options have therefore been discounted as they either fail to meet project objectives or offer no advantage over low-NOx burners or SCR.

4.7 Alternative Stack Configurations

4.7.1. The EIA Scoping Report for the Proposed Scheme stated that each unit would require main and bypass stacks of up to 70 m. However, as explained in the PEIR, stack height sensitivity modelling has since been carried out to investigate the air quality impact of the Proposed Scheme. This identified that, although no air quality objectives would be exceeded with the proposed stack height of 70 m, air quality impacts would be reduced by increasing the stack height to up to 120 m. This compares to a height of 259 m for the existing stack and 114 m for the existing cooling towers.

4.7.2. The proposed 120 m stack height is required to avoid adverse effects on pollution dispersion from downwash created by the large cooling towers. Sensitivity testing has confirmed that it is not possible to avoid this effect within the Existing Drax Power Station Complex. Therefore, alternative locations on site would not allow lower stack heights to be considered. The reasons for rejecting alternative locations for the Proposed Scheme are discussed above.

4.7.3. Stack heights of greater than 120 m are not structurally possible with the proposed vertical HRSGs. As noted above, the alternative horizontal HRSGs that would be required for greater stack heights are not considered viable for the Proposed Scheme as there is insufficient space for them without affecting the overall efficiency of the Proposed Scheme (objective D).

4.7.4. A preliminary assessment of the environmental effects of stacks up to 120 m was included in the PEIR. Details of the stack height sensitivity study are provided in Chapter 6 (Air Quality). Specific consultation was also undertaken in relation to the increase of the stack height up to 120 m, and comments received from North Yorkshire County Council, Selby District Council, Doncaster Council and East Riding of Yorkshire Council on this change, concentrated on visual impact and the setting of heritage assets. The comments from those authorities have been incorporated into the assessment approach for the stacks in this ES.

4.7.5. The Applicant has also considered whether it would be viable to connect the new Units X and Y to the existing 259 m main stack. This has been discounted as it is not possible with the proposed vertical HRSGs (the benefits of which are explained above). Even if a solution could be found to connect the Units to the main stack, the exhaust flue would have to be over 1000 m in length, which would cause significant temperature and pressure drops by the time it reached the main stack. This would affect the gas buoyancy and velocity, making dispersion of gases from the main stack less effective. This would also adversely affect the efficiency of Units X and Y and, therefore, not achieve objective D.

4.8 Alternative Fuels for Electricity Generation

4.8.1. Alternative fuel types which would allow the reuse of existing infrastructure on the Existing Drax Power Station Complex were considered, in the context of all the project objectives and in particular A, B and E. Only biomass and gas were considered to be technically viable.

4.8.2. As discussed above, in January 2018 the UK Government announced plans to restrict the CO_2 emissions and harmful air pollution from all unabated coal-fired power stations by 2025. It is in this context that the Applicant has been assessing options for future generation at the Existing Drax Power Station Complex which do not include coal (see objective A and B in this respect).

4.8.3. Drax assessed alternative fuel types which would allow the reuse of existing infrastructure on the Existing Drax Power Station Complex. The alternative fuel types that were technically feasible were biomass and natural gas. Other potential fuels to make use of existing infrastructure would be waste and nuclear. Waste was not

considered viable to generate a suitable amount of power, while nuclear was not considered appropriate for this site. Other technology (such as wind or solar) would make use of the existing infrastructure.

4.8.4. Following the decision to convert Unit 4 to biomass in late 2018, biomass was found not to be financially viable for the remaining coal fired units. This was the result of a response from the UK Government in January 2018 which applies a cap on renewable obligation units (ROCs) at a power station level. This means biomass was not an economically viable option for Units 5 and 6.

4.8.5. Natural gas was assessed as an economically viable fuel choice that achieved all project objectives. Further, gas-fired power generation is in line with national planning policy as described in Chapter 2 (Planning Policy).

4.9 Alternative Options for Gas Pipeline

4.9.1. Six pipeline routes were originally considered and these were subject to a gas pipeline feasibility study. These are shown on Figure 4.1. The feasibility study considered the following constraints, amongst others:

- Major and minor road crossings.
- Rail crossings.
- Major and minor water crossings.
- Overhead and buried utilities.
- Ecological constraints.
- Archaeological constraints.
- Flood risks.

4.9.2. Two options were dismissed early on in the study as they were not considered feasible. The first route was dismissed as the route utilised, in part, a narrow corridor owned by Drax which contains existing Drax Power Station utilities. This would incur extra construction cost by significantly reducing the constructability of the pipeline. The second option was dismissed for the following reasons:

- It had significant parallelisms with existing overhead lines.
- It required a large trenchless crossing of the River Aire.
- It connected to the feeder station close to Newlands AGI, where there were complicated land ownership issues.
- It required a crossing of Feeder 29.
- It was in close proximity to residential receptors.

4.9.3. A further two feasible options were discounted later in the study due to construction risks associated with areas of the route running parallel to existing overhead lines. Therefore, the two options taken forward for consultation in the PEI were Options A and B shown in Figure 4-1. Consideration of Option A included a further option for that route to either connect to the NTS at Feeder 7 or Feeder 29. A comparison of these three options (the 2 connection options for Option A, and Option B) is shown in Table 4-3.

Table 4-3 - Comparison of Gas Pipeline Route Options A (two connections options) and B

Constraint	Option A (Connection to Feeder 7 with an Above Ground Installation off Rusholme Lane)	Option A (Connection to Feeder 29 with an Above Ground Installation off Rusholme Lane)	Option B (Connection to Feeder 29 with an Above Ground Installation off Brier Lane)	Comparison
Land use of gas pipeline route	Predominantly arable with semi improved grassland	Predominantly arable with semi improved grassland	Predominantly arable	No difference
Hedgerows affected?	Yes	Yes	Yes	Option B (Feeder 29) will potentially result in the loss of more intact and species rich hedgerow
Ordinary watercourses / ditches affected?	Yes	Yes	Yes	No difference
Landscape and visual impact of the proposed Above Ground Installations	Yes	Yes	Yes	The Above Ground Installation within Option B (Feeder 29) may be visible from a greater number of residential properties
Public Rights of Way	Yes	Yes	Yes	No difference
Trees to be lost?	Likely	Likely	Likely	Option B (Feeder 29) may potentially result in the loss of trees with suitability

Constraint	Option A (Connection to Feeder 7 with an Above Ground Installation off Rusholme Lane)	Option A (Connection to Feeder 29 with an Above Ground Installation off Rusholme Lane)	Option B (Connection to Feeder 29 with an Above Ground Installation off Brier Lane)	Comparison
				for roosting bats
Heritage assets affected	Potentially	Potentially	Potentially	Option B (Feeder 29) has greater potential for buried remains based on geophysical survey results and effects an additional historic field boundary
Construction suitability of the proposed Above Ground Installations	Likely to be more health and safety issues due to proximity to the existing National Grid Above Ground Installation on Rusholme Lane.	Good – open field location, but will require a long construction and permanent access road off Rusholme Lane.	Good – open field location, with direct access off Brier Lane.	Option B (Feeder 29) and Option A (Feeder 29) more favourable.
Gas capacity, responsiveness and resilience	Feeder 7 is a smaller pipeline and already supplies a number of major gas connections. It is highly unlikely that Feeder 7 can deliver the capacity of gas, or the gas pressures required for the	Feeder 29 is most likely to deliver the capacity of gas and the gas pressures required for the Proposed Scheme to meet the need for flexible and responsive electricity generation.	Feeder 29 is most likely to deliver the capacity of gas, or the gas pressures required for the Proposed Scheme to meet the need for flexible and responsive electricity generation.	Option B (Feeder 29) and Option A (Feeder 29) are more favourable gas connections in terms of ensuring resilience of the gas supply in all demand conditions.

Constraint	Option A (Connection to Feeder 7 with an Above Ground Installation off Rusholme Lane)	Option A (Connection to Feeder 29 with an Above Ground Installation off Rusholme Lane)	Option B (Connection to Feeder 29 with an Above Ground Installation off Brier Lane)	Comparison
	Proposed Scheme to meet the need for flexible and responsive electricity generation.	Feeder 29 is also potentially more resilient as it connects to strategic gas reserves of both the east coast (Easington) and north west (Barrow) fields.	Feeder 29 is also potentially more resilient as it connects to strategic gas reserves of both the east coast (Easington) and north west (Barrow) gas fields.	

4.9.4. Taking into account consultation feedback from North Yorkshire County Council and Selby District Council, and on the basis of the information set out above, Option A with a connection to Feeder 7 and Option B were discounted. The route for Option B had a greater potential to impact on the environment including impacting on bats, historic assets and the visual character of the area. Option A with a connection to Feeder 7 was discounted due to an engineering preference to connect to Feeder 29.

4.9.5. The pipeline route (for part of the route that was the same for either Option A or B) described in the PEI has also been amended to avoid a woodland protected by a Tree Preservation Order along the disused railway south of Carr Lane and other ecological constraints.

4.10 Alternative Construction Transport Routes

4.10.1. Consideration has been given to the transportation of materials to site during construction. The use of the River Ouse and an existing Drax owned jetty was considered for the transportation of large plant and equipment up to 200 tonnes. However, this construction transport route was discounted following the PEIR and consultation.

4.10.2. Works including the location of at least one mobile crane landside of the jetty, associated security lighting, fencing, storage and welfare facilities, laydown areas and dredging would have been required to make the jetty suitable for use. These works would have given rise to significant environmental effects, particularly resulting from the dredging activity and affecting the existing otter population. Further, the works would have been cost prohibitive and had limited benefit as a result of the limited draught restricting the vessels that could be used and tidal restrictions on the hours of use.

4.10.3. The use of the nearby Port of Goole was preferred as it will allow the import of the largest loads without additional development work and associated environmental impact. Transportation of general construction materials by road from Goole and other locations was considered to have fewer environmental constraints than the use of the jetty.

4.11 Construction Laydown Areas

4.11.1. No alternative viable alternatives to the proposed laydown areas were identified. All other areas are fully utilised during normal operations when managing outages on operating units.

4.12 Conclusion

4.12.1. This Chapter has set out the main reasons for the options chose for the Proposed Scheme and the reasons for rejecting the alternatives that have been considered, including the “Do Nothing” alternative.

4.12.2. The Power Station site, layout of the Proposed Scheme, technology choices and emissions abatement were selected to allow the reuse of existing steam turbines and cooling infrastructure and maximise the efficiency of the Power Station. Gas powered units were considered to be the only economically viable choice to make use of the existing infrastructure.

4.12.3. The height of the stacks was determined based on a stack height sensitivity study to ensure adequate dispersion of pollutants while working within the constraints of the selected technology.

4.12.4. The gas pipeline route was selected following a thorough route selection exercise, environmental surveys and consultation. The selected option provides a technically preferred connection to the NTS and avoids constraints, such as potential archaeology.

4.12.5. No alternative laydown area was identified that was not already in for the normal operation of the Power Station.

4.12.6. Transportation via the Port of Goole was preferred to the alternative use of the Drax Jetty as it provides a reliable, nearby port for the largest loads, without creating additional environmental impacts on protected species.

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Key

- Site Boundary
- Gas Pipeline (Route A)

Gas Pipeline Route Options

- 1 Route Option 1
- 2 Route Option 2
- 3 Route Option 3
- 5 Route Option 5 (Route B)
- 6 Route Option 6

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)

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Three White Rose Office Park, Millshaw Park Lane, Leeds, LS11 0DL, UK
Tel: +44 113 395 6200 Fax: +44 113 395 6201
wsp.com

CLIENT: drax

PROJECT: The Drax Power (Generating Stations) Order

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Figure 4.1
Gas Pipeline Route Options

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