CONTENTS

6.0 CONSIDERATION OF ALTERNATIVES

6.1 Background

6.1.1 This chapter of the Preliminary Environmental Information (PEI) Report sets out the alternatives that have been considered during the evolution of the Proposed Development design as presented in **Chapter 4:** The Proposed Development and **Chapter 5**: Construction and Management (PEI Report Volume I), up to this latest round of statutory consultation (Stage Two).

6.1.2 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations') (HMSO, 2017) state that an Environmental Statement (ES) should contain *'A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen, option, including a comparison of the environmental effects'* (Regulation 14(2)(e)). This PEI Report presents the results of preliminary environmental assessments and alternatives considered, prior to publication of the final ES.

6.1.3 National Policy Statement (NPS) EN-1 (DECC, 2011) paragraphs 4.4.1 and 4.4.2 state that *'This NPS does not contain any general requirement to consider alternatives or to establish whether the proposed project represents the best option. However, applicants are obliged to include in their ES, as a matter of fact, information about the main alternatives they have studied. This should include an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects and including, where relevant, technical and commercial feasibility.'*

6.1.4 Taken together with EN-1, the NPS for Fossil Fuel Electricity Generating Infrastructure (EN-2) (DECC, 2011b) provides the primary basis for decisions on applications for fossil fuel electricity generating stations, including gas fired power stations (such as the Proposed Development). Section 2.2 of EN-2 outlines the factors influencing site selection for fossil fuel power stations. These include land use and size of site; transport infrastructure for the delivery and removal of construction materials, fuel, waste and equipment; and water resources, for example, some power stations have very high water demands for cooling; and grid connection. However, in outlining such factors, paragraph 2.2.1 states that '*…it is for energy companies to decide what application to bring forward and the Government does not seek to direct applicants to particular sites for fossil fuel generating stations'.*

6.1.5 It is considered that a '*Do Nothing*' scenario is not appropriate given the established national need for new low carbon energy generation to meet the UK's Net Zero targets (refer to **Chapter 7**: Legislative Context and Planning Policy Framework). Another key disadvantage of a '*Do Nothing*' scenario would be the lack of additional investment in the local economy since the Proposed Development would not be developed.

6.1.6 The Keadby Power Station site has been selected by the Applicant for the development of a low carbon generating station, as opposed to other potentially available sites for the following reasons:

- the Keadby Power Station site has a long history of power generation;

- the Proposed Development Site has excellent existing electrical grid, gas, water and transport links, specifically the National Grid electricity and gas transmission networks;
- The Proposed Development Site is in close proximity to the Humber Low Carbon (HLC) cluster and discussions with National Grid Ventures have determined that the proposed carbon dioxide pipeline can directly connect into the Proposed Development Site to enable the transport of captured CO_2 from the Proposed Development to permanent geological storage;
- the Proposed PCC Site is a brownfield site which is considered more attractive to redevelop for large scale power generation than a greenfield one;
- the Proposed PCC Site (and the majority of the Proposed Development Site) is wholly in the ownership of the Applicant; and
- the Proposed PCC Site is located in close proximity to the existing Keadby 1 and proposed Keadby 2 Power Stations, providing opportunities for synergies, efficiencies and thus economic and environmental benefits for the Proposed Development.

6.1.7 The consideration of alternatives and design evolution has been undertaken with the aim of preventing or reducing adverse environmental effects (following the mitigation hierarchy of avoid, reduce and, if possible, remediate) while maintaining operational efficiency and cost-effectiveness. The design including options for cooling water supply and the location of construction laydown has evolved in response to consultation feedback and the findings of surveys and technical studies. Preliminary mitigation measures that have been included within the design of the Proposed Development are referenced in each topic specific chapter and will be confirmed in the final ES.

6.1.8 The design of the Proposed Development is at a preliminary stage and will continue to evolve up to the point of the Development Consent Order (DCO) application submission, in response to consultation feedback and with reference to ongoing surveys and technical studies. Detailed design work will proceed once the project moves into the Front End Engineering Design (FEED) stage, which is due to commence in 2021, although any changes that result from the FEED work will remain within the design parameters set by the DCO.

6.2 Alternative Technologies

6.2.1 The UK Government is currently developing its policy and investment framework to support low carbon technologies. Therefore, within the EIA Scoping Report (**Appendix 1A**, PEI Report Volume II), the Applicant confirmed that two alternative low carbon technology pathways were under consideration for the Proposed Development:

- firing of natural gas supplied by National Grid Gas with post-combustion capture of the carbon dioxide (CO_2) emitted from the process. In this case, the CO_2 would be sent into the HLC Cluster for Keadby for end usage and sequestration; and
- hydrogen-firing of the generating station, with hydrogen generation and associated carbon capture carried out off-site by others.

6.2.2 The Applicant has now decided that its preferred low carbon technology option is a low carbon enabled CCGT equipped with carbon capture and compression (CCP) equipment and is progressing with this single technology option within the DCO Application. One reason for this decision is that the location of the Proposed Development will allow for connection into the emerging proposals for the HLC Cluster CO_2 pipeline, whereas hydrogen supply options to the Proposed Development Site by third parties are currently less well developed. For this reason, the alternative low carbon pathway initially considered (hydrogen-firing) has been discounted and the option to fire on hydrogen is no longer under consideration. The Rochdale Envelope is therefore being narrowed accordingly, to focus on the single low carbon (CCP) enabled technology option.

6.3 Alternative Design Options

6.3.1 As part of the on-going design process, consideration has been given to a range of design options. Decisions taken regarding the concept design of the Proposed Development have, where relevant and possible, been informed by environmental appraisal and assessment work and by consultation with stakeholders.

6.3.2 Aspects of design that have been determined to date include:

- the Applicant would not build or operate the CCGT without the CCP as the Applicant is fully committed to building a generating station which has a clear route to decarbonisation;
- the Applicant will work collaboratively with its partners within the HLC Cluster to facilitate installation and operation of a CO_2 pipeline by National Grid to connect to the Proposed Development's CO_2 compression equipment;
- there will be no bulk CO_2 storage within the Proposed Development Site;
- once operational, in certain temporary scenarios (e.g. during CCP outages) it may be necessary to run the CCGT without carbon capture. The CCGT configuration will therefore allow the CCGT to run independently of the CCP with emissions exiting via the HRSG stack rather than via the CCP absorber stack;
- a single CCGT unit and integrated CCP would be installed in defined areas in the Proposed PCC Site, north of the existing overhead power lines, whilst auxiliary plant, buildings and facilities would be located south of the overhead lines;
- the main construction and operational access to the Proposed Development Site will be to the south of Keadby Common, with access via North Pilfrey bridge from the A18. There will be no access via Trent Road, alleviating the need for traffic to pass through Althorpe and Keadby villages;
- the Proposed Development will make use of existing assets and connections from Keadby 1 Power Station which is not expected to operate in parallel with the Proposed Development (nominally reaching end of life in 2025/6);
- hybrid cooling will predominantly be used for the cooling of the CCGT and carbon capture equipment, rather than direct cooling or using an air cooled condenser; and

- an emergency access will be required to the north of the Proposed Development Site to be used in the event of an emergency; no routine traffic would use this route.

6.3.3 By contrast, the following aspects have not yet been determined, so options have been included and assessed within this PEI Report:

- the choice of cooling water supply is subject to ongoing studies and stakeholder dialogue. The size and location of the cooling towers would be broadly similar for all options. Options under consideration are:
  - abstraction from the Stainforth and Keadby Canal for integrated hybrid cooling of the CCGT and CCP (if sufficient additional abstraction from the canal is available);
  - abstraction from the Stainforth and Keadby Canal for hybrid cooling of the CCGT, supplemented by fin fan air cooling of the CCP; and
  - abstraction from the River Trent for integrated hybrid cooling of the CCGT and CCP (subject to agreement from the Environment Agency to construct a modified intake).
- the absorber tower could comprise either a single tower or multiple smaller towers and the towers could vary in shape;
- the Proposed Development may use generated power to supply the CCP auxiliary plant and equipment. An alternative 132kV Northern Powergrid option may also be used, with the cables routed either north via the Keadby Wind Farm access road, or south-west across land adjacent to the existing 400kV National Grid Substation;
- a new gatehouse and security will be developed; this could either be located on the existing site access road from the A18 in the vicinity of the junction with the skewed access road; or within the Proposed PCC Site;
- the manufacturer of the GCGT unit and CCP technology licensor, therefore the final dimensions of the proposed structures and any buildings may change but would remain within the parameters of the Rochdale Envelope assessed;
- final stack heights and locations may change but would remain within the parameters of the Rochdale Envelope assessed;
- the need or otherwise for certain buildings and/ or enclosures; and
- the preferred surface water drainage strategy and discharge point.

6.3.4 The design will continue to evolve and be refined through a continuous process of environmental assessment, consultation and development to the point of submission of the Application.

6.3.5 The Rochdale Envelope approach has been applied to address these options and the approach taken has been described within each topic specific chapter (**Chapters 8-18**).

6.4 Alternative Layouts

6.4.1 Within the EIA Scoping Report (**Appendix 1A** – PEI Report Volume II), an area was included in the Proposed Development Site boundary to the south-west of the Proposed PCC Site for 'construction laydown and biodiversity'. This area is currently unused and vegetated, with mounds and spoil heaps which are anticipated to contain Pulverised Fuel Ash (PFA) associated with historic coal-fired power use. Over time, semi-natural habitat has become established on this disturbed ground. In view of the value of this area of land for biodiversity (refer to **Chapter 11**: Biodiversity and Nature Conservation), the Applicant has chosen to investigate alternative areas for temporary construction laydown and to leave these areas undisturbed, The alternative laydown areas under consideration include brownfield site and land under intensive agricultural management as described in **Chapter 3**: The Site and Surrounding Areas and shown on **Figure 3.2** (PEI Report Volume III).

6.4.2 A number of different locations within the wider Keadby Power Station Site boundary were considered for the Proposed Development but have been discounted for various environmental and technical reasons including contiguous space availability and presence of existing infrastructure.

6.4.3 An option was presented in the EIA Scoping Report (**Appendix 1A**, PEI Report Volume II) to site the Proposed Development on land currently used for Keadby 2 laydown area which has been allocated for future carbon capture readiness (CCR), with the CCP co-located in this area or the former tank farm. This has now been discounted to minimise impact on the future use of this land.

6.5 Conclusions

6.5.1 The Proposed PCC site was identified as being the most suitable for the following key reasons:

- absence of major structures requiring demolition, treatment and removal on the main (CCGT) site footprint;
- the plot minimises interference with the Landscape and Conservation Plan for Keadby 2 Power Station and specifically, the Habitat Management Areas secured via Conditions 31-34 inclusive for Keadby 2 Power Station. It also avoids areas of highest biodiversity value within the wider site;
- sufficient space is available within the plot to accommodate the power generation and carbon capture equipment, without encroaching on the exclusion areas for the Keadby Wind Farm turbines to the north and the existing overhead lines to the south and east;
- The Proposed Development Site enables connections to be developed to electrical, gas and, in the future, CO_2 pipeline infrastructure; and
- adequate supplies of cooling water can be provided via the nearby Stainforth and Keadby Canal or River Trent, whilst existing infrastructure for discharge of the treated effluent into the River Trent can also be utilised.

6.6 References

HM Government (2017) Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Department of Energy and Climate Change (DECC) (2011) *National Policy Statement for Energy (NPS EN-1).*

Department of Energy and Climate Change (DECC) (2011) *National Policy Statement for Fossil Fuels (NPS EN-2).*