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Glossary

Application Site	The area within the red line Planning Boundary comprising the Onshore Transmission Works (OnTW), as defined.
EIA Report	Report presenting the findings of the Environmental Impact Assessment (EIA).
ICOL's Offshore Transmission Works (OfTW)	Offshore substation platforms (OSPs) and their foundations and substructures, interconnector cables and Offshore Export Cables. This refers to either the Consented OfTW or Revised OfTW, as defined.
ICOL's Offshore Wind Farm	This includes proposed wind turbine generators, foundations and substructures and inter-array cables. This refers to either the Consented Offshore Wind Farm or Revised Offshore Wind Farm, as defined.
Landfall	Point where up to two Offshore Export Cables from ICOL's Offshore Wind Farm will be brought ashore.
Offshore Export Cable	The subsea, buried or protected electricity cables running from ICOL's Offshore Wind Farm offshore substation to the Landfall.
Onshore Export Cables	Electricity cables from the Onshore Substation to the grid connection point.
Onshore Export Cable Corridor	The area within the Application Site where the proposed Onshore Export Cables will be laid.
Onshore Substation	The electrical substation comprising of all the equipment and associate infrastructure required to enable connection to the electrical transmission grid.
Onshore Substation Site/Substation Site	The indicative area within the Application Site where the Onshore Substation and screening will be located.
Onshore Transmission Works (OnTW)	All proposed works within the Application Site, typically including the Onshore Substation, cables transition pits, cable jointing pits, underground electricity transmission cables connecting to the Onshore Substation and further underground cables required to facilitate connection to the national grid. This includes all permanent and temporary works required. See <i>Chapter 5: Description of Development</i> for full details.
Original Onshore Substation	The electrical substation comprising of all the equipment and associate infrastructure required to enable connection to the electrical transmission grid as was granted planning permission in principle in September 2014, under ELC reference 14/00456/PPM.
Original OnTW	The OnTW, as was granted planning permission in principle in September 2014, under ELC reference 14/00456/PPM.
Scoping Opinion	The Scoping Opinion adopted by ELC as to the scope and information to be provided in support of an application for the OnTW, as defined.
Scoping Report	Report prepared as the first stage of the EIA process in support of a request for a Scoping Opinion from ELC, under Regulation 17 of the EIA Regulations. The Report was submitted in July 2017.
Substation Location Study Area	Based on the potential landfall locations identified, in mid-2012, ICOL identified a 'Substation Location Study Area', (Figure 4.1) within which it focused its principal efforts to identify a site capable of accommodating the various works associated with the OnTW

Abbreviations and Acronyms

AA	Alternating Current
CION	Connection Infrastructure Options Note
DC	Direct Current
EIA	Environmental Impact Assessment
ICOL	Inch Cape Offshore Limited
NETS	National Electricity Transmission System
OfGEM	Office of Gas and Electricity Markets
OfTO	Offshore Transmission Owner
OfTW	Offshore Transmission Works
OnTW	Onshore Transmission Works
PPP	Planning Permission in Principle

4 Site Selection and Alternatives

4.1 Background

- 1 Part 1 (2) of Schedule 4 of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (the EIA Regulations), require an Environmental Impact Assessment Report (EIA Report) to provide: *“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”*.
- 2 This chapter provides an overview of the process by which Inch Cape Offshore Limited (ICOL) identified the former Cockenzie Power Station as a suitable location for the Onshore Transmission Works (OnTW). Full details of the Application Site can be found in *Chapter 5: Description of Development*.

4.1.1 Need for the OnTW

- 3 The requirements for the OnTW in relation to ICOL's Offshore Wind Farm and Offshore Transmission Works (OfTW) are set out in *Chapter 1: Introduction* which confirms that the OnTW are required to connect ICOL's Offshore Wind Farm to the National Electricity Transmission System (NETS). As detailed in *Chapter 1: Introduction* ICOL is currently acting as 'interim Offshore Transmission Owner (OfTO)'. As an OfTO, ICOL is required by the Office of Gas and Electricity Markets (OfGEM) to deliver best value for money to the customer and justify their key decisions as part of the obligations under the Energy Act 2004.

4.1.2 Grid Connection Agreement

- 4 In 2011, a range of possible locations where ICOL's Offshore Wind Farm could connect to the NETS were identified through an iterative process involving ICOL, National Grid and the relevant onshore Transmission Owners, hereafter described as the Connection Infrastructure Options Note (CION) process. This process included consideration of locations at Arbroath and Tealing in Angus, several locations in East Lothian such as New Branxton, Cockenzie and Torness, Crystal Rig and locations in the North East of England at Blyth and Hawthorn Pit.
- 5 The principle criteria set out by the CION process to be used to assess these options were:
 - Environmental considerations;
 - Economics of overall NETS design (including the OfTO system);
 - Programme of works and contract dates;
 - NETS capability, constraints and requirements for wider improvement works;
 - Economically efficiency for the UK electricity consumer; and
 - Optimal nationwide electrical solutions.

- 6 Following the conclusion of this process, in January 2012 NGET was able to offer ICOL a grid connection with a connection point at the existing grid substation in Cockenzie. Subsequently ICOL accepted the grid connection offer. This connection point was reviewed again in 2013 based upon updated assumptions and design information, with the connection point remaining at the existing Cockenzie substation. The grid connection dates within the NGET agreement were varied in 2017 to reflect revised project timescales; during this process NGET were required to assess if Cockenzie remains as the most appropriate point of connection, or if another point of connection should be offered. The outcome of the offer variation process was that the point of connection remains at Cockenzie substation.

4.2 OnTW Site Selection

4.2.1 Summary of Original OnTW Selection Process

- 7 The following provides a summary of the process by which ICOL identified the Original OnTW as the preferred Application Site in 2014. Full details of this process can be found in *Chapter 4: Site Selection and Alternatives* of ICOL's 2014 Onshore ES, which has been included as *Appendix 4A* to this chapter.
- 8 An initial site selection assessment was undertaken by ICOL between 2012 and 2014, which investigated potential landfall options, cable routes and substation locations. The study focused upon land along the East Lothian coast from Prestonpans to Throntonloch as this is where National Grid made a connection offer to ICOL.
- 9 The selection process was based on considerations such as bathymetric approaches, offshore geotechnical conditions, offshore/coastal environmental designation, onshore cable route distances and key environmental, technical and economic factors. Based on the potential landfall locations identified, in mid-2012, ICOL identified a 'Substation Location Study Area' within which it focused its principal efforts to identify a site capable of accommodating the various works associated with the OnTW.
- 10 In July 2012, a workshop was held to consider sites within the Substation Location Study Area against a range of planning, environmental and technical criteria. The outcome of the workshop identified a shortlist of four sites (Shown in figure 4.1) which were considered suitable for further analysis:
- PL3 – at or around the former Coal Store (Cockenzie)¹
 - PL6 – east of Seton Mains (Seton Sands)
 - PL10 – west side of Blindwells (Blindwells)
 - PL15 – near Drummohr (Prestonpans)

¹ ICOL obtained PPP for PL3 in September 2014.

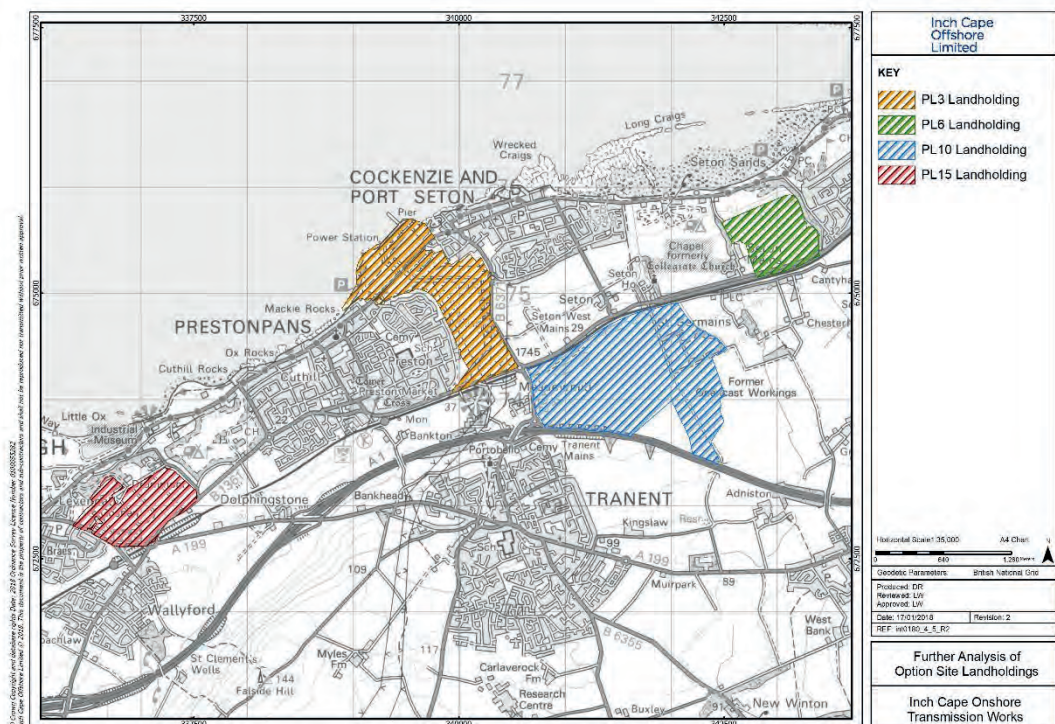


Figure 4.1: 2014 Shortlisted Substation Locations

- 11 Detailed site assessment concluded that location PL3 was the preferred site for the Original Onshore Substation as it offered the following key advantages over the other identified sites:
- Proximity to landfall option;
 - Proximity to grid connection at Cockenzie;
 - Landowner agreeable, in principle, to accommodating Original Onshore Substation on land (restricted to land to south of coal store);
 - Favourable in relation to national and local planning considerations;
 - Potential to minimise disturbance from cable laying on local communities, and other receptors, by limiting distance export cables need to travel between landfall and Original Onshore Substation and back to grid connection to a relatively short distance (c 2.3 km);
 - Ability to maintain existing access infrastructure from B6371 (subject to potential improvements);
 - Land already partly disturbed/developed as part of railway link to coal store and historic use related to the coal store and former Cockenzie Power Station;
 - Presence of existing tree planting to east along B6371 offers well established screening;
 - Potential for design refinement (including footprint definition) during detailed design and further ELC planning processes; and

- Significant electrical infrastructure already present in locality e.g. towers and overhead lines.

12 Based on this ICOL proceeded to prepare an application for Planning Permission in Principle (PPP) for the Original OnTW based on a landfall at Cockenzie which represented the preferred combination in terms of planning, environmental, economic and technical and land considerations. ICOL was successful in achieving PPP in September 2014.

4.2.2 OnTW Application Site

13 Whilst the conclusions of the 2012-2014 assessment remain valid, since the Original OnTW application was submitted to ELC, there has been a number of changes within the Cockenzie landholding area.

14 Scottish Power is no longer progressing plans to replace the former Cockenzie Power Station with Combined Cycle Gas Turbine (CCGT) generating units and the former Cockenzie Power Station has since been decommissioned and demolished, leading ICOL to consider this site as a possible Onshore Substation location.

15 ELC has recently published a Masterplan for Cockenzie, which includes the site of the former Cockenzie Power Station, to identify options that will allow for the redevelopment of the site in an economic and sustainable way.

16 In 2017, in response to these changes ICOL undertook further feasibility work to re-assess the various merits of several locations within the Cockenzie landholding, only. The landholdings which were discounted in 2013 were not re-assessed, as the conclusions from the 2013 assessments are still considered to be valid. At the time of the 2017 assessment no other potential landholdings had become available.

17 The sites included in the updated feasibility are highlighted in Figure 4.2.

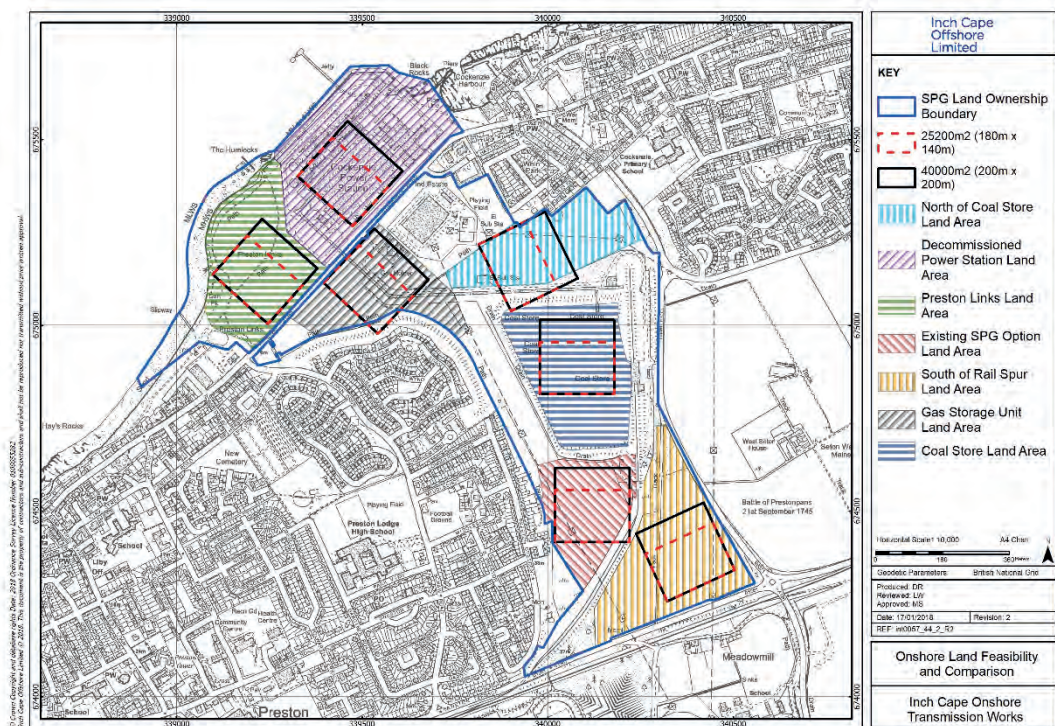


Figure 4.2: 2017 Sites Considered as Potential Substation Locations

4.2.3 Feasibility Study Results

- **Greenhills**-The Greenhills site has well established community use, protected open space designation and landscape sensitivities, so whilst the area could accommodate the Onshore Substation footprint, the impacts on public access were considered too great;
- **Former Cockenzie Power Station**-The site of the former Cockenzie Power Station was carried forward to detailed feasibility as it was considered that in locating the Onshore Substation on the site of the former Cockenzie Power Station, ICOL would be utilising the 'existing energy footprint', on a brownfield site;
- **Gas Holder**- After the removal of the gas holder, this location was added into the feasibility assessment. Constraints on this site include proximity to housing and the footprint of the Onshore Substation potentially being larger than the land available, this site was therefore discounted;
- **Coal Store North**-The Coal Store North site was discounted from detailed feasibility due to the presence of 275 kilovolts (kV) and 400 (kV) overhead power lines. This introduces the possibility for the transfer of raised earth potential during an electrical fault. This would mean that the Onshore Substation would need to be located further from the pylons, thus exceeding the boundaries of the available site;
- **Coal Store**- The feasibility study identified that the Coal Store could be considered a suitable site due to the presence of an existing bund which may help to serve as both a landscape and noise mitigation measure to the local residents. There is however a risk

that the land may be contaminated and have a combustion potential, and it is also likely that the onshore export cables would require a greater burial depth than what is considered standard in order to avoid existing 33 kV underground lines which pass through the site. The combination of the possibility of land contamination and the additional engineering and construction difficulties associated with routing the onshore cables has resulted in the Coal Store being discounted; and

- **Original OnTW**-Whilst there was PPP on this site for OnTW, ICOL decided not to progress with detailed design for this site following discussions with ELC and considering also the emerging, albeit draft, development scenarios considered as part of the Cockenzie masterplan exercise. In addition, following consideration of onshore substation space requirements, obtained from similar projects elsewhere, ICOL felt this site may be spatially constrained.

- 18 In line with the EIA Regulations, Table 4.1 below provides an overview of the main reasons for selecting the site of the former Cockenzie Power Station for the Application Site for the OnTW, and an overview of the environmental effects compared with the Original OnTW and the sites considered within the 2017 feasibility exercise. As Table 4.1 highlights, the former Cockenzie Power Station represents a more favourable location, in environmental terms, for the Application Site compared to the alternatives studies by the applicant.

Table 4.1 Summary of Potential Onshore Substation Sites constraints

ICOL Site Reference	Factors in favour of the site	Factors against the site
Former Cockenzie Power Station	<p>Proximity to connection point. Access from road system. Site is within single ownership. A brownfield site historically used for energy generation. In the 2008 Local Plan the entire Application Site is located with an area safeguarded for use as or in association with a power generating station.</p> <p>No constraints associated with existing overhead or underground lines, is situated a suitable distance away from local residences and provides ample space to allow for the Onshore Substation, and lay down areas during the construction period.</p> <p>Potential to utilise existing ducts under the B1348 for onshore export cables from the grid onshore substation to the grid connection point. Less road disruption</p>	Potentially in an area at risk of coastal flooding.
Original OnTW	Proximity to connection point. Access from road system. Incorporates areas of brownfield land. Site is within single ownership and is partly located with an area safeguarded for use as or in association with a power generating station within the East Lothian Local Plan 2008. Potential to mitigate landscape or micro-site development to avoid cultural heritage features.	Proximity to archaeology and cultural heritage features including Waggonway and Prestonpans Battlefield. Proximity to some utilities and redundant mine shaft. Proximity to consented gas pipeline corridor to be considered. Significantly longer onshore cable than the former Cockenzie Power Station Site. The Original OnTW site was not considered as part of the ELC Masterplanning.
Greenhills	Proximity to connection point. Access from road system. Incorporates areas of brownfield land. Site is within single ownership and is partly located with an area safeguarded for use as or in association with a power generating station within the East Lothian Local Plan 2008. Potential to mitigate landscape or micro-site development to avoid cultural heritage features.	Well established community use and protected open space designation. Potential visual impacts.

Gas Holder	Proximity to connection point. Access from road system. Incorporates areas of brownfield land. Site is within single ownership and is partly located with an area safeguarded for use as or in association with a power generating station within the East Lothian Local Plan 2008. Potential to mitigate landscape or micro-site development to avoid cultural heritage features.	Significantly constrained in terms of land availability, design and mitigation of the Onshore Substation would be limited by this. The area is also currently designated as a protected open space and is well used as an area of recreation within the community.
Coal Store	Proximity to connection point. Access from road system. Site is within single ownership. A brownfield site historically used for energy generation. In the 2008 Local Plan the entire Application Site is located with an area safeguarded for use as or in association with a power generating station. Presence of existing bund may help to serve as both a landscape and noise mitigation measure to residents.	Significant remediation costs associated with this site.
Coal Store North	Proximity to connection point. Access from road system. Site is within single ownership. A brownfield site historically used for energy generation. In the 2008 Local Plan the entire Application Site is located with an area safeguarded for use as or in association with a power generating station.	Site is crossed by 275 kV and 400 kV overhead power lines. This introduces the possibility for the transfer of raised earth potential during an electrical fault. This may mean that the substation would need to be located further from the pylons, thus exceeding the boundaries of the available site.

4.3 Technical Alternatives

As part of the OnTW design and engineering processes a number of technical solutions were considered. The evaluation of technical solutions was advanced in parallel with the site selection process.

4.3.1 Technical Design Decisions

Alternating Current vs Direct Current

- 19 Two technical solutions are possible for the export cables, either Alternating Current (AC) or Direct Current (DC). Analysis during engineering concept selection identified the following risks with DC equipment:
- Relatively unproven technically;
 - Delivery timescales were longer than required;
 - Larger footprint required offshore and onshore; and
 - Higher cost than AC.
- 20 These constraints, principally the increased Onshore Substation land take, resulted in a DC solution being ruled out.

4.3.2 Onshore Export Cables Requirements

- 21 As part of the CION process an early decision was made that all Onshore Export Cables would be underground as this removes any permanent visual intrusion.
- 22 During engineering concept selection, the number of cables necessary to transmit electricity from ICOL's Offshore Wind Farm to the NETS reduced from four to two. This was primarily based on the identification of optimal materials, electrical capacity requirements and installation costs. The identified Onshore Export Cable Corridor is 60 m wide with the necessary burial trenches not individually exceeding 1.5 m in width. The actual locations within the identified corridor will be confirmed based on detailed design and site investigation.

4.3.3 Offshore Export Cable Landfall

- 23 The Offshore Export Cable landfall is located in very close proximity to the Onshore Substation, thus minimising the length of the onshore cable routes and the associated construction durations. The cables will pass under the existing reinforced concrete seawall. Twin conduits will be provided between the seawall and the cable transition pits. The conduits will be backfilled over soon after installation, thus allowing the coastal footpath to be reopened.

4.4 Onshore Substation

4.4.1 Onshore Substation Location within the site of the former Cockenzie Power Station

- 24 The Onshore Substation has been located as far to the west of the Application Site as possible. This has the advantage that it allows the east end of the site to be made available for other purposes and it allows the existing power station west access road to be re-used as the onshore substation access.

4.4.2 Onshore Substation Flooding Mechanisms

- 25 Locating the Onshore Substation at the west end of the site means that it will be located on the power station's reinforced concrete base slab. This sits at a level of 1.2 m AOD which is 3.8 m below the typical ground level of five metres AOD which prevails in this area. The base slab is seen to be at risk of flooding from all the following flooding mechanisms:

- Burst of local watercourses
- Abnormally high tide
- Ground water
- Rainfall

- 26 Full details of flood risk can be found in *Chapter 7: Hydrology, Geology and Hydrogeology* and *Appendix 7A*, Volume 2.

4.4.3 Flood Prevention Measures

- 27 Preliminary indications are that raising the construction elevation of the Onshore Substation to approximately 3.5 m AOD will prevent flooding via rising ground water level.
- 28 Providing an earth embankment or similar around the perimeter of the onshore substation will provide protection against flooding from burst watercourses, abnormally high tides and surface water.
- 29 The earth embankment will retain rainfall falling within its perimeter, hence a pumped drainage system will be provided to remove this.
- 30 The proposed flood prevention measures will not have any adverse effects on surrounding areas as no properties lie downstream of the Onshore Substation.

4.4.4 The Vulnerability of the OnTW to Risks of Major Accidents and/or Disasters

- 31 In accordance with Schedule 4 of the EIA Regulations 2017, consideration has been given in this EIA Report to the *“expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned”*.
- 32 In the context of the amended Directive, it is assumed that major accidents and disasters would be defined as *“man-made and natural risks which are considered to be likely, and are*

anticipated to result in substantial harm that the normal functioning of the project is unable to cope with/rectify i.e. a significant effect” (IEMA 2016).

- 33 The only risks of major accidents and/or disasters relevant to the OnTW that can be considered under such a definition are the risk of pollution of habitats which is fully assessed within *Chapter 6: Ecology* and *Chapter 7: Hydrology, Geology and Hydrogeology* and the risk of flooding which is fully assessed within *Chapter 7: Hydrology, Geology and Hydrogeology*.
- 34 In addition, as detailed within *Chapter 5: Description of Development*, a Construction Environmental Management Plan (CEMP) will be produced prior to the commencement of works. It is envisaged that this will include details of all precautionary methods of working and pollution prevention measures to avoid or minimise the risk of any pollution incidents occurring.

References

IEMA (2016). *Assessing Risks of Major Accidents / Disasters in EIA*. Available at: https://www.iema.net/assets/uploads/EIA%20Articles/wsp_assessing_risks_of_major_accidents_disasters_in_eia_revised.pdf