Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Cable Statement

June 2018, Revision 1

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Approved By:	Helen Jameson
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Revision	A

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1 Summary

1.1 Vattenfall Wind Power Ltd (the **Applicant**) is planning to develop the Thanet Extension Offshore Wind Farm (the **Project**) with up to 34 turbines and an installed capacity of up to 340 MW. The Project would be located approximately 8km from the coast of Thanet, Kent at its closest point to land, covering an area of approximately 70km^2.

1.2 As the total installed electricity generating capacity will exceed 100 MW, the Project is deemed to be a Nationally Significant Infrastructure Project (**NSIP**), and therefore the Applicant is submitting an application to the Secretary of State under Section 37 of the Planning Act 2008 for a Development Consent Order (**DCO**) for the construction and operation of the Project.

1.3 This Cable Statement has been prepared in accordance with Regulation 6(1)(b)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009 (the **APFP Regulations**) which requires the applicant for a DCO for the construction of an offshore generating station to provide a statement regarding the route and method of installation of any cable connecting the generating station to the onshore electricity transmission network.

1.4 The Applicant's application contains all of the electrical grid connection works required for the Project, summarised as follows:

- The offshore electrical components for the Project will consist of inter-array and export cables that convey the electricity from the wind turbine generators (**WTG**) to shore. The offshore electrical assets will also consist of up to one offshore substation platform and up to one meteorological mast.
- The onshore electrical works consist of up to four circuits consisting of a maximum of 12 cables running from up to four TJB at the landfall at Pegwell Bay to a new onshore substation at Richborough Port. Once transformed up to to 400kV, up to two onshore 400kV transmission cables will convey the electricity to the grid connection point at the National Grid Electricity Transmission plc (NGET) 400kV Richborough substation, Kent.

1.5 The Bilateral Connection Agreement with National Grid that has been secured by the Applicant is for a 400kV connection at the NGET 400kV Richborough substation in Kent.

2 Introduction

2.1 This Cable Statement has been prepared by Vattenfall Wind Power Ltd (the **Applicant**) pursuant to Regulation 6(1)(b)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (the **APFP Regulations**).

2.2 This Statement forms part of the application to the Secretary of State for a Development Consent Order (**DCO**) to construct and operate an offshore generating station with up to 34 turbines and an installed capacity of up to 340 MW (the **Project**). As the total installed capacity of the Project will exceed 100 MW the Project is a Nationally Significant Infrastructure Project (**NSIP**) as defined under sections 14(1)(a) and 15(3) of the Planning Act 2008.

2.3 The Project comprises an electrically separate extension to the existing Thanet Offshore Wind Farm off the coast of Thanet, Kent, to be located approximately 8km offshore (at the closest point). The offshore array site occupies an area of approximately 70 km^2.

2.4 Further information on the location and design of the Project is set out in the accompanying Environmental Statement (Document 6).

2.5 This Statement provides details of the proposed offshore and onshore cable routes and cable installation methods and is intended to provide a summary of the detailed information set out in the Project Description Chapters of the Environmental Statement (Documents 6.2.1 and 6.3.1).

3 Description of Grid Connection Works

3.1 The Applicant's application for a DCO (the **Application**) contains all of the electrical cable works, onshore and offshore, required for the Project.

Offshore works

3.2 Inter-array cables will collect and convey electricity generated by the WTGs within the array. Inter-array cables connect WTGs together as separate 'strings', with the number of WTGs connected together depending on factors such as the voltage of the inter-array cables, generation capacity of each WTG, distance between wind turbines and the cable sizes available. In the event of an offshore substation platform being required, the inter-array cables would connect the WTG strings to the offshore substation platform.

3.3 The export cables would connect the offshore wind farm (either directly or via the offshore substation) to a landfall at Pegwell Bay on the Kent coast. The offshore cable corridor is approximately 30 km in length from the wind farm array to the landfall location.

Onshore works

3.4 The landfall TJBs, where the offshore export cables will be jointed to the onshore export cables, would be located at Pegwell Bay. To enable the offshore export cables to be brought to the TJBs, the onshore electrical works will also include up to 12 directionally drilled ducts, installed underground between the TJB and the intertidal exit point. As well as the up to four transition joint bays, up to 16 joint pits will be required (maximum of four per cable circuit, at intervals between the landfall and the onshore substation). Joint pits are required to joint sections of the onshore export cable together.

3.5 The onshore cable route would run between the onshore TJBs and the new onshore substation at Richborough Port, Kent. The route is approximately 2.5 km long.

Onshore substation

3.6 The proposed site for the onshore substation is Richborough Port, in proximity to the existing NGET 400kV Richborough substation. The main components within the new substation would include, but not be limited to, Super Grid Transformers, switchgear, Reactive Compensation Equipment, STATCOM unit, HV/MV equipment, GIS switchrooms, Applicant and OFTO control buildings as well as additional auxiliary and support systems and equipment. The onshore substation would be connected to the grid connection point at the existing NGET 400kV substation by means of up to two underground 400kV cable circuits.

4 Consenting of Grid Connection

4.1 Part 1 of Schedule 1 of the draft DCO describes the works for which development consent is being sought.

Offshore works

4.2 The inter-array cables, up to one meteorological mast, up to one wave buoy and up to one floating lidar device form part of the Generating Station NSIP set out within Work No 1.

4.3 Work No. 2 comprises up to one offshore substation.

4.4 Up to 4 offshore subsea export cables to export electricity and transmit electronic communications from the offshore substation or wind farm array to the shore along routes within the Order Limits seaward of MHWS including one or more cable crossings comprise Work No. 3.

Intertidal

4.5 Work No. 3A comprises up to 4 subsea export cables to export electricity and transmit electronic communications from the offshore substation or wind farm array to the shore between work number 3 and work number 3B between MLWS and MHWS at Pegwell Bay and where required works to facilitate horizontal directional drilling.

4.6 Work No. 3B comprises onshore connection works at Pegwell Bay consisting of up to 4 export cables and, where required, a temporary cofferdam to facilitate the installation of cables through the sea wall and subsequent reinstatement of the sea wall and, if surface laid, an extension of the sea wall up to 18.5 m seaward from the existing alignment and up to 155 m long with a temporary cofferdam to facilitate the extension of the sea wall.

Onshore

4.7 The Applicant has included its onshore works from mean low water springs to the new onshore substation as "associated development" within its DCO application to the Secretary of State.

4.8 Work No. 4A comprises 4 subsea export cables connecting to up to 4 TJBs (above or below ground) to facilitate onshore connection works within Pegwell Bay Country Park.

4.9 Work No. 4B comprises 4 subsea export cables to facilitate onshore connection works within Pegwell Bay Country Park, and where required works to facilitate horizontal directional drilling.

4.10 Work No. 5 comprises a new temporary construction compound within Pegwell Bay Country Park including a new temporary vehicular access and temporary widening and upgrades to an existing vehicular access from Sandwich Road and modifications to the junctions of access and Sandwich Road. Works No. 6 comprises the upgrading and widening of existing access from Sandwich Road.

4.11 Work No. 7 comprises connection works consisting of up to 4 cable circuits and communication cables laid underground from Work No. 4 to Work No. 13 running in a south westerly direction and crossing the Minster Stream.

4.12 Work No. 8 comprises a new temporary vehicular access track running in a north easterly direction from Sandwich Road to Work No. 7 including permanent modifications to the junction of the new vehicular access track and Sandwich and the permanent installation of an access gate. The construction of an adjoining temporary works area comprises Work No. 9.

4.13 Work No. 10 comprises temporary widening and upgrade of an existing private road running in an easterly direction from Sandwich Road. The construction of an adjoining temporary works area comprises Work No. 11.

4.14 Work No.12 comprises temporary widening and upgrade of an existing private road running in an easterly direction off the roundabout on the A256.

4.15 Work No. 13 comprises a new onshore substation including a new vehicular access track from the private road off the eastern exit of the roundabout on the A256 and including onshore connection works to the extent that they connect to the onshore substation and onward connection works.

4.16 Work No. 14 comprises works to facilitate the construction of the onshore substation (Work No. 13) including a new temporary construction compound, relocation of Ministry of Justice vehicle holding area, removal and relocation of associated structures, vehicle parking, access ways, CCTV, security fencing, portable buildings and utilities connections.

4.17 Works No. 15 comprises a substation landscaping and biodiversity enhancement area, including planting and hardstanding.

4.18 Work No. 16 comprises onshore connection works, consisting of up to 2 cable circuits and communications cables laid underground from Work No. 13 to the NGET 400kV substation at Richborough Energy Park running in a westerly direction crossing under the A256 and then in a northerly direction including temporary works areas and modifications and upgrades to the existing Richborough Energy Park access off the A256.

5 Description of Generating Equipment

5.1 Each WTG consists of three primary components, i.e. the tower, the nacelle and the rotor. The rotor is the device which, through circular motion, converts kinetic energy from wind to electricity. The nacelle houses the equipment that can convert rotational motion into electrical energy. The tower supports the nacelle and gives the rotor the necessary height to optimise wind resource.

5.2 The Project would consist of up to a maximum of 34 WTGs, with combined output not exceeding 340 MW. The final capacity of the Project will depend on the number of WTGs that are installed and their individual rating.

5.3 In the UK, offshore wind farm developers can either construct the offshore transmission assets themselves or opt for an Offshore Transmission Owner (**OFTO**) to do so, subject to the rules of the OFTO regime. Offshore transmission assets are defined generally consist of any offshore substation platforms, the offshore export cables, and all onshore infrastructure required to facilitate connection of the project to the onshore electricity network.

5.4 If the Applicant constructs the assets itself, then it must transfer the assets to an OFTO post-construction. OFTOs are selected on a competitive basis through a tender process. It is anticipated that the Applicant will opt for the generator build option which means that, if the project export voltage is 132kV or above, the offshore transmission assets will be transferred to an OFTO post construction.

6 Offshore Cable Installation

Cable installation methods

Inter-array cables

6.1 The inter-array cables will be buried below the seabed wherever possible. Optimum burial depth may not be achieved in areas of rock outcrop or where there is a high frequency of boulders. Where optimum burial depth is not achieved the cable may be protected to prevent movement of the cables, to prevent any risk to other marine users and to protect the cables from impacts arising from other marine activities such as fishing.

6.2 The inter-array cables are expected to be installed from a cable laying vessel, which will be equipped with specialist cable handling equipment and will have support vessels in attendance as necessary, for example anchor handling. The cables are loaded on to cable carousels or cable drums, mounted on the deck of the vessel.

6.3 There are several different methods available for the installation of offshore cables, including the following:

- Ploughing

  The cable is simultaneously laid and buried. The cable plough lifts a section of the seabed deposit and places the cable below. The seabed deposit is then returned to its original position. In areas of very hard substrate modifications to this technique may be used, including use of a rock cutter plough or vibrating share plough.

- Trenching

  This method consists of three operations. First, a trench is excavated or cut while placing the sediment and fill next to the trench. The cable is subsequently laid in the trench and lastly the sediment or fill is returned to the trench. Pre-lay cutting of trenches (or "pre-trenching") could also be used whereby a large trench is cut in one or multiple passes to the correct depth before the cable is laid back in trench at a later date. The trench can be backfilled naturally or if required with a backfill plough or other method of material replacement. The use of backfill ploughs is normally not favoured due to the danger of damaging the cable.

- Jetting/Mass Flow Excavation

  The cable is first laid on the seafloor. A ROV (Remotely Operated Vehicle) equipped with high pressure water jets then proceeds along the cable route, fluidising the seabed around the cable, allowing the cable to be lowered into the trench. The fluidised sediment subsequently settles back onto the seabed.

- Cutting / Vertical injector

  In shallow waters a vertical injector could be used. This is a large jetting and cutting shear which is strapped to the side of a barge and the cable is laid in the foot of the trench. The burial depth is controlled by means of raising or lowering the tool and horizontal positioning, by means of adjusting the barge anchor.

6.4 The extent to which these cable burial techniques will be used will be dependent upon the results of detailed pre-construction seabed surveys of the final cable route and the associated cable burial assessment process.

Export cables

6.5 The same techniques described above at paragraph 6.3 for array cable installation will be used to install the export cables between the offshore substation (if required) and landfall.

6.6 Export cables between the offshore substation (if required) and landfall may require a number of connections or joints along their length. Jointing of the offshore export cables will be undertaken at sea. Additional time will also be required to recover both ends of the cable to the vessel for jointing and to re-bury the cable following jointing. Due to the complexity of offshore jointing, the number of joints will be kept to a minimum.

Cable protection

6.7 In some cases it may not be possible to apply the above installation techniques and may necessary to use alternative burial methods where desired burial depths cannot be achieved. Details of some of the techniques frequently employed are given below:

- Concrete mattresses

  These are prefabricated flexible concrete coverings that are laid on top of the cable. Grout or sand filled bags could be used as an alternative to concrete mattresses for smaller scale activities.

- Rock Placement

  Rock placement involves the laying of a rock layer on top of the unburied cable to offer protection from and to fishing gear and vessel anchors.

- Frond mattresses

  Frond mattresses could be used to provide protection by stimulating the settlement of sediment over the cable. This method develops a sandbank over time protecting the cable but is only suitable in certain water conditions. This method may be used in close proximity to offshore structures although experience has shown that storms can strip deposited materials from the frond.

- Uraduct (or similar)

  Uraduct is effectively a protective shell which comes in two halves and is fixed around the cable to provide mechanical protection. Uraduct is generally used for short spans at crossings or near offshore structures where there is a high risk from falling objects or abrasion. Uraduct does not provide protection from damage due to fishing trawls or anchor drags.

6.8 Where cable crossings occur they will be protected using suitable cable protection methods, such as rock placement, concreate mattresses, steel bridging or concrete bridging.

Intertidal cable installation

6.9 The cable trench in the intertidal area will be excavated alongside the cable ducts using either conventional mechanical excavators adapted for working on soft soils (low ground pressure excavators) or other suitable means. Further down the shore suitable alternatives (such as a spider plough) will be agreed in advance of construction. Excavated material will be placed to one side for re-use.

6.10 The cables will be laid from a vessel to the shore as a bundle, this is may involve small support vessels such as RIBs, divers and floats in the intertidal area along with pull-in lines from winches and cable rollers in leading up to the upper intertidal saltmarsh area.

6.11 A hauling rope will be installed between the cable pulling device, located with the Country Park, and a cable end on the vessel running through ducting within the saltmarsh and sea wall to the TJB.

6.12 The cable will be pulled in from the vessel moored at the edge of the intertidal area through the ducting within the saltmarsh to the TJB.

6.13 Depending on the state of the tide, the intervening distance between the vessel and the TJB may be predominantly water (noting that MHW is 'below' the sea wall), entirely dry (with the installation vessel resting on the seabed) or more probably a combination of both scenarios. The cable bundle will be supported at the sea surface by floats attached as the cables leave the vessel, and supported on rollers placed on the seabed where it is above the water line.

6.14 The cable bundle will be hauled towards the ducting within the saltmarsh area before passing through to the TJB with floats being removed as necessary. When sufficient length of each cable has been passed to the shore to allow for its correct alignment for jointing to the land cable, it will be secured in the TJB.

Cable landfall

6.15 Given the conditions at landfall, the following three Options have been assessed. For all three options, the TJBs are located within the Country Park, up to 350 m from the existing sea wall. Options 1 and 3 assume that the outcomes of SI works and further detailed design indicate that trenching and/or HDD are possible within the historic landfill. A description of the three landfall options is given below:

6.16 Option 1 would locate the TJBs below ground within the Country Park and cross the sea wall by Horizontal Directional Drilling (HDD). This Option requires a larger onshore temporary works area to house the HDD rig and associated equipment but does not require excavation and reinstatement of the sea wall. Under this Option HDD would be undertaken from land to sea, with an initial bore undertaken prior to a wider drill profile and installation of ducts to house the cables. The HDD ducts would be installed from the TJB location, out to a punch-out location at least 100 m seaward of the sea wall. As a result of the uncertainty associated with the contents of the landfill there may be a need to control the HDD works in order to prevent the introduction of a pathway for the contaminants present. Whilst the detailed design will be subject to the outcomes of the SI works, and any additional SI works that may be required post-consent, there are a number of methods that could be applied to control the release of contaminants from the landfill. This may include excavating down through the landfill and lining it with plastic or other material (depending on depth), or installation of casing through the first section of the HDD bore (within the initial landfill area) to seal it (disposing of the excavated material appropriately) before continuing the bore out to the punch out/receptor pit in clean ground.

6.17 Option 2 would locate the TJBs above ground within the Country Park. This requires installation of a temporary cofferdam within the upper intertidal/saltmarsh area before extending the existing sea wall. The cables would be trenched through the upper intertidal area to the seawall extension. The seawall extension is required to allow for the vertical transition from buried offshore cables to the above ground TJBs and onward surface laid onshore cables. This would ensure that the works do not expose any of the landfill. For the purposes of assessment it is assumed that the temporary cofferdam will be installed using percussive piling and will take a duration of 16 days, assuming active piling for 70% of the 12 hour working day (noting construction works between 0700 and 1900 6 days per week). After construction of the seawall extension and installation of the cables the cofferdam would be removed, and the seawall extension reinstated.

6.18 Option 3 would locate the TJBs below ground within the Country Park before trenching the remainder of the route. As with Option 2 this requires installation of a temporary cofferdam before excavating through from the upper intertidal, through the existing sea wall. For this Option the cofferdam is required to ensure no release of contaminants from the landfall into the marine environment. The offshore cables would be trenched from the intertidal area through this cofferdam and seawall area onshore into the TJB area. The cofferdam would be removed, and the seawall reinstated.

7 Onshore Cable Installation

Transition Joint Bays

7.1 Each cable circuit (of three cables) will require a separate TJB to connect the offshore and onshore cables, giving a total of up to four pits. TJBs will be grouped together and staggered as necessary to be accommodated within the permanent cable corridor. The TJBs will require a temporary works area of 50 x 60 m (Option 1) or 30 x 40 m (Option 2 and Option 3), with a reinforced concrete floor for the TJBs to allow winching during cable pulling and a stable surface to allow jointing.

Onshore cabling

7.2 For the Option 1 and Option 3 landfall options, cable will be buried below ground along the entire cable route, although these options are subject to SI works confirming this is possible within the historic landfill of the Country Park. These are described further in paragraphs 1.5.39 et seq.

7.3 For the Option 2 onward cable route, cables will be surface laid within the Country Park, covered by a 1.2 m high berm for the primary cable, and a slightly larger berm where jointing bays are required until the cable route reaches the Stonelees Nature Reserve. From here, all cables will be buried and there is no further distinction between the three Options.

7.4 The berm will comprise a base layer of geotextile topped with the concrete trough in which the cables will be installed. The trough will be covered over with a capping layer and made into a berm. As noted previously the slopes of the berm will be a 1:5 gradient potentially comprising a capping layer (potentially constructed out of chalk) across the sloped section and flatter top section. The capping layer may then be seeded or left to self-seed in line with a Landscape and Ecological Mitigation Plan (LEMP) which will be defined in consultation with the relevant authorities

Onshore substation

7.5 An onshore substation will be required to transform the electricity up to 400 kV for connection to the National Grid electricity transmission network. Construction will include a number of key stages, including enabling works, site establishment, earthworks and grading, main civil works, electrical works and commissioning.

7.6 The Applicant has a Bilateral Grid Connection Agreement with National Grid for a connection located at NGET 400kV Richborough substation. The 400 kV up to two interconnecting cables from the onshore substation to the grid connection will be installed in accordance with the main underground cable laying and installation works set out above.