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# Norfolk Boreas Offshore Wind Farm

# Consultation Report

## Appendix 22.13 Consultation Summary Document

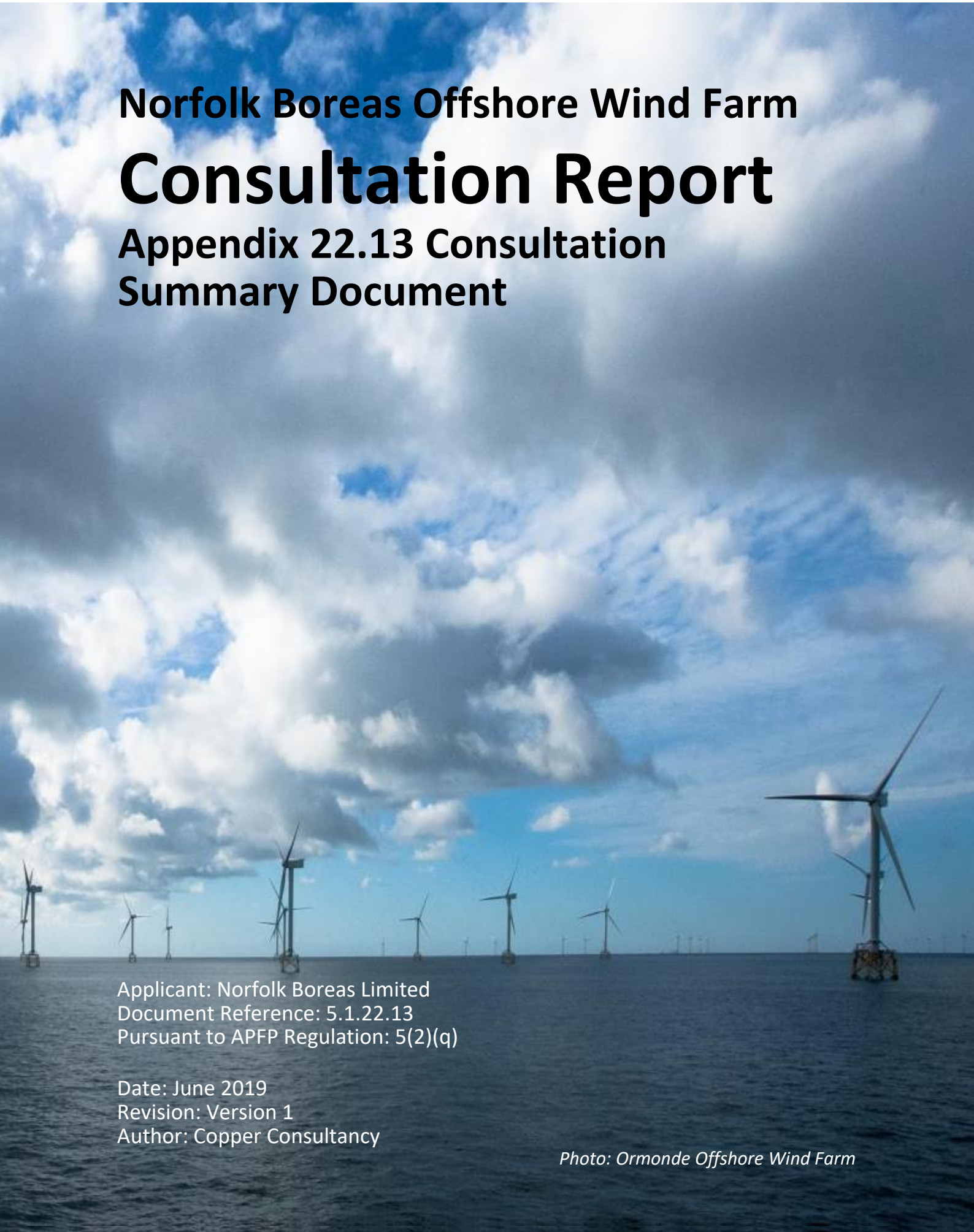

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*Photo: Ormonde Offshore Wind Farm*

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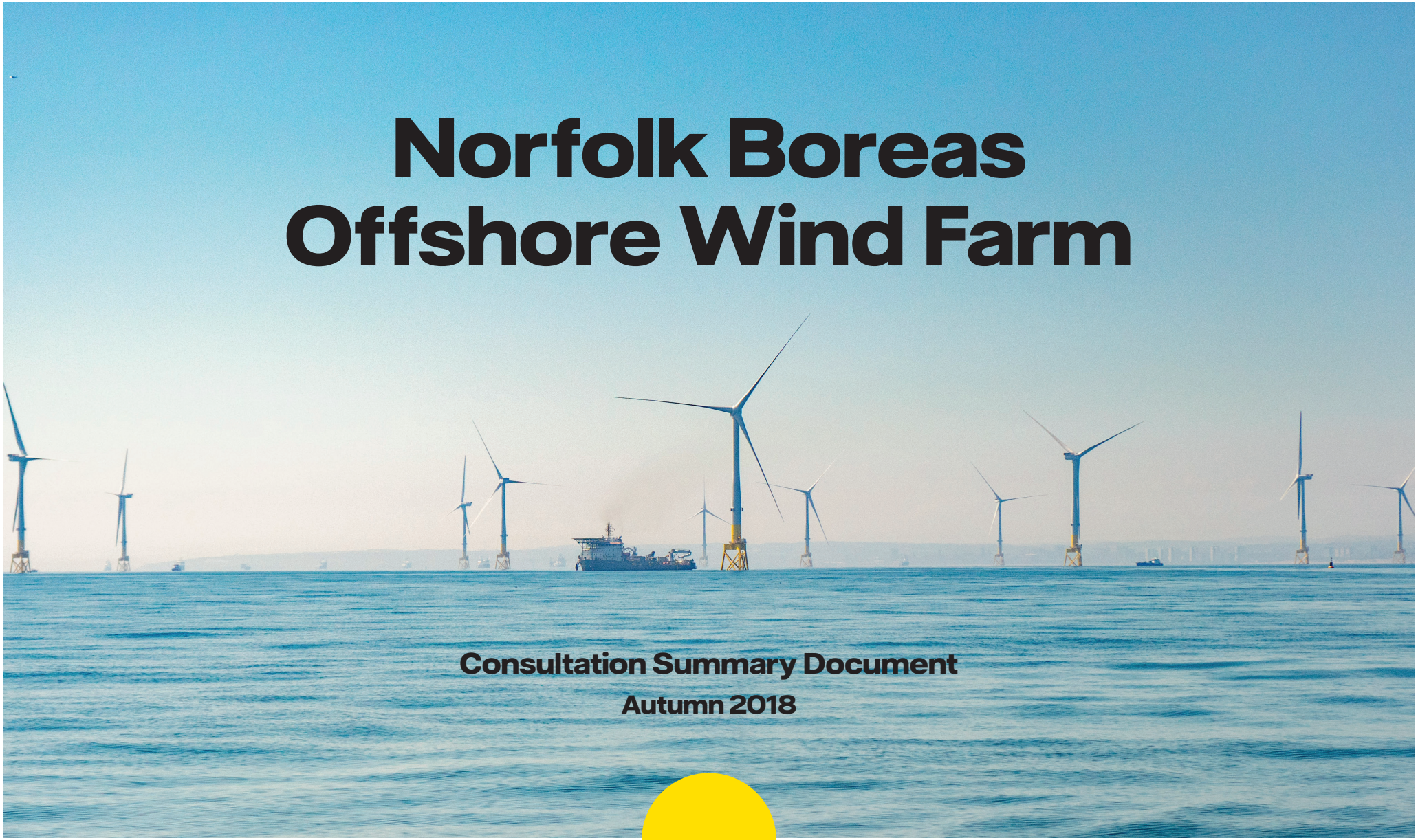
# Norfolk Boreas Offshore Wind Farm



## Consultation Summary Document

Autumn 2018

VATTENFALL

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**Front cover: European Offshore Wind Deployment Centre. Left: Thanet Offshore Wind Farm**



# Introduction

**Norfolk Boreas Limited (NBL) a company wholly owned by Vattenfall Wind Power Limited (Vattenfall) is seeking to develop the Norfolk Boreas Offshore Wind Farm in the Southern North Sea.**

The Norfolk Boreas Offshore Wind Farm could accommodate an export capacity of up to 1,800 megawatts (MW), which could generate enough electricity for the domestic needs of around 1.3 million homes.[1]

Because of its scale and power generation capacity, the project is classed as a Nationally Significant Infrastructure Project (NSIP). Under the Planning Act 2008, NSIPs – major developments such as large transport or energy generation projects – need to seek a Development Consent Order (DCO) in order to be built and operate.

The DCO would authorise the construction, operation and maintenance of the proposed offshore wind farm, which would be approximately 73km from the coast of Norfolk at its closest point to land, along with all associated infrastructure including a grid connection. Norfolk Boreas is an Environmental Impact Assessment (EIA) development and so NBL will prepare an Environmental Statement to accompany the application to the Planning Inspectorate.

NBL has undertaken extensive surveys, reviews and informal consultation with the local community, landowners, key stakeholders and statutory consultees up to this point. The proposals currently being consulted upon are the result of a significant amount of work shaping the project, including a similar process followed earlier in the year by NBL's sister project, Norfolk Vanguard. Prior to submission of an application to the Planning Inspectorate, we are consulting the local community and stakeholders to help us refine our final proposals.

This document provides a summary description of our project proposals, and aims to help you contribute to the Statutory Consultation. It contains:

- Information about Vattenfall
- An overview of the consultation processes and the DCO process
- A description of the Norfolk Boreas project, including the two scenarios in which the project could be built depending on whether the Norfolk Vanguard project is consented and proceeds to construction or not
- An overview of how our plans have evolved
- Details about the Preliminary Environmental Information which identifies the potential impacts of the project, offshore and onshore; and
- How to respond to this consultation and make your views known

**Between October 2016 and December 2017, we have held 31 exhibitions and workshops and talked directly to more than 2,500 people which has led to a number of substantial project alterations. We are keen to maintain this ongoing dialogue with the local community and look forward to hearing further views on our plans before we finalise and submit our DCO application in 2019.**

**Graham Davey, Norfolk Boreas Project Manager**

[1] Number of homes equivalent: This is calculated using statistics from the Department for Business, Energy and Industrial Strategy showing that annual UK average domestic household consumption is 4,115kWh: renewableuk.com/page/UKWEDExplained

# How to use this document

This document builds on our engagement with local communities to date, and aims to respond as far as possible to local interests. We have noted an interest in:

- ✔ low-carbon energy generation
- ✔ onshore infrastructure, and in particular the potential environmental effects that may result during construction and operation (e.g. landfall, the cable route, the project substation and associated works) and the options for mitigation that can be considered in order to avoid and mitigate any potential impacts, as well as enable possible enhancements
- ✔ maximising the opportunities and benefits the project can bring

The document is structured to help you access more information on these themes easily. It also provides an introduction to the Environmental Impact Assessment (EIA) that helped shape the project proposals along with consultation. For more information on the EIA, you should refer to the Non-Technical Summary of the Preliminary Environmental Information Report (PEIR) or to the PEIR itself. Details of how you can access these documents are provided in this consultation booklet.

In particular, where permanent infrastructure is proposed, we have consistently been asked to show visual aids to help understand the project. We provide some of these here, and there is more to be seen at our drop-in events, and on our website **www.vattenfall.co.uk/norfolkboreas**.

# About Vattenfall

Vattenfall is the Swedish state-owned energy company, employing more than 20,000 people, with operations in Sweden, Germany, the Netherlands, Denmark, Finland and the UK. Vattenfall is the second largest operator in the global offshore wind sector.

In the UK Vattenfall has ten offices and some 400 members of staff. Since 2008, Vattenfall has invested more than £3bn in the UK, primarily in onshore and offshore wind projects, as well as in solar farms and innovative technologies, including heat, e-mobility and providing 100% renewable power to domestic and business customers. Our aim is to help drive the transition to fossil fuel free energy systems while delivering a secure, reliable and cost-effective energy supply.

Vattenfall exists to power climate smarter living. We aim to enable our customers to live free from fossil fuels within a generation. Many innovative solutions to societal challenges are required, some we are developing are shown on the next page. For more see https://corporate.vattenfall.co.uk/

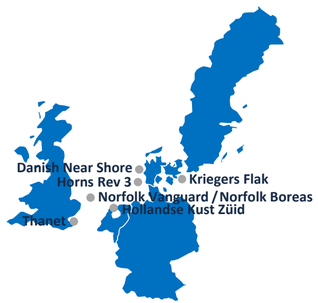
Norfolk Vanguard and Norfolk Boreas are key to realising this purpose, alongside our recent move into British electricity supply, electric vehicle charge point provision, smart electricity networks, and heat networks.

The maps and tables to the right demonstrate the investment Vattenfall is putting into offshore wind. Of those offshore projects currently in the pipeline, even the smallest wind farm will be larger than any sites that are currently in operation.

**Offshore wind farms in operation**


| Country | Name | Turbines | MW |
|---|---|---|---|
| UK | Thanet | 100 | 300 |
| DE | DanTysk | 80 | 288 |
| DK | Horns Rev I | 79 | 158 |
| UK | Ormonde | 30 | 150 |
| SE | Lillgrund | 48 | 110 |
| NL | Egmond aan Zee | 36 | 108 |
| UK | Kentish Flats | 30 | 90 |
| GE | Sandbank | 72 | 288 |
| UK | Kentish Flats Extension | 15 | 50 |
| SE | Utgrunden | 7 | 10 |
| UK | EOWDC | 11 | 93.2 |

**Major offshore projects in the pipeline**




| Country | Name | MW | Commissioning |
|---|---|---|---|
| DK | Horns Rev 3 | 407 | 2018 |
| DK | Danish Near Shore | 344 | 2020 |
| DK | Danish Kriegers Flak | 605 | 2021 |
| NL | Hollandse Kust Zuid | 700 | 2022 |
| UK | Thanet Extension | 340 | 2024 |
| UK | Norfolk Vanguard | 1800 | 2025-27 |
| UK | Norfolk Boreas | 1800 | 2026-28 |

### Energy Solutions

In the UK, electricity needs are expected to double by 2050, as we electrify industries and transport. From our renewable energy parks to plans for more than 4GW of wind energy developments, heat, grid and electric charging networks – we're investing now in delivering solutions designed to offer climate smarter possibilities.


### HYBRIT

Achieving ambitious goals means investment in developing solutions like HYBRIT (Hydrogen Breakthrough Ironmaking Technology) – the world's first pilot fossil fuel free steel production facility, currently under construction.


### Charge point

Joined up thinking that makes it easier to live a climate smarter life will need to be at the core of any sustainable city. Cooling will be as important as heating in the future. People will need to charge electric vehicles. Using energy efficiently will be a must.

# Why does the UK need offshore wind farms?

Offshore wind, as a source of renewable energy, offers the UK a wide range of benefits including:

- ✔ energy security
- ✔ decarbonisation of our energy supply
- ✔ economic growth

**Providing a secure supply of energy to UK domestic, industrial and commercial consumers**

Many of the UK's older fossil fuelled and nuclear plants have either reached the end of their operational life span, are no longer economical to run, and/or do not meet legal air quality limits. The UK Energy Security Strategy estimated that around a fifth of the energy capacity available in 2011 will close by 2020 (DECC, 2012). This means that over the next decade, the UK may face a significant shortfall in supply or will have to rely on global markets for imported energy. The second option leaves the UK vulnerable to spikes in world energy market prices, political pressure and potentially, to physical supply disruptions.

At the same time, as heating, transport and industry in the UK become increasingly "electrified", the demand for electricity is set to rise.

To avoid an energy gap, the UK needs to act quickly to replace older power stations with cleaner, more effective solutions that have a track record of being built on time and on budget, such as offshore wind.

**Decarbonising electricity supply**

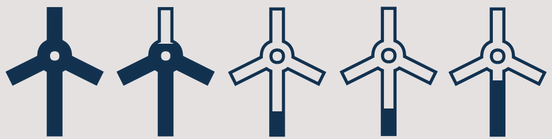
In the Overarching National Policy Statement for Energy (Department of Energy and Climate Change (DECC), 2011), predictions are made that a continuation of global emission trends, including emissions of greenhouse gases such as carbon dioxide, could lead average global temperatures to rise by up to 6°C by the end of this century. The effects of such global temperature rises include:

- Increased frequency of extreme weather events such as floods and drought;
- Reduced food supplies;
- Impacts on human health;
- Increased poverty; and
- Ecosystem impacts, including species extinction

To avoid these effects, UK government has set legally binding emissions reductions targets.

In October 2018 the Intergovernmental Panel on Climate Change (IPCC) issued a special report on the impacts of global warming of 1.5°C above pre-industrial levels. The report states (with a high level of confidence) global warming is likely to reach 1.5°C between 2030 and 2052 if temperatures continue to increase at the current rate. The IPCC urges for a strengthened global response to the threat of climate change through large scale actions - such as the decarbonisation of energy production, and also for citizens to make individual efforts to reduce CO2 emissions.

## The UK is NO.1 in the world for installed offshore wind generation capacity (2018)[2]



| UK | Germany | Netherlands | Denmark | China |
|---|---|---|---|---|
| **7GW** | **5.1GW** | **1.1GW** | **1.3GW** | **3GW** |

**As one of the biggest offshore wind projects in the world, Norfolk Boreas will:**

**Provide up to 1,800MW of renewable energy, securing supply for up to 1.3 million UK households**

(Based on wind energy statistics from RenewableUK)


**Deliver 25% of the East of England's electricity demand (domestic, commercial and industrial), or 2% of the UK's annual energy demand**

(Department for Business, Energy and Industrial Strategy, 2016)

**Sustain at least 175 jobs over the 30 year lifetime of the project**

**Maximising the economic potential of offshore wind**

The UK has the greatest potential for offshore wind out of all assessed EU member states in the Atlantic, North Sea and Baltic Sea areas (Wind Europe, 2017). A key commitment within the UK's Industrial Strategy (developed by the Department for Business, Energy & Industrial Strategy) is to "lead the world in delivering clean energy technology" and to support innovation in this area.

**Delivering prosperity and productivity in coastal areas through clean growth**

**2030 Vision**

| £48bn | £2.6bn | £2.4bn | 27,000 |
|---|---|---|---|
| £48bn investment in UK infrastructure | Exports increase fivefold to £2.6bn per annum | £2.4bn reduction in electricity costs to comsumers | 27,000 skilled jobs |

("A sea of opportunity" a vision for the offshore wind industry, produced by the Offshore Wind Industry Council)

**The UK supply chain for offshore wind is strong, and can get stronger.**

In 2015 48% of the total expenditure associated with UK offshore wind farms was spent in the UK, and new projects are required to achieve over 50% UK content in 2018.

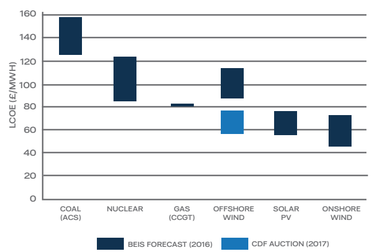
Early engagement with suppliers and representative bodies should enable greater involvement in all phases of a wind farm's lifecycle. In collaboration with local stakeholders we are planning a supply chain event in early December to focus on onshore pre-construction and construction works. If you are interested, please visit the project website for details.

The offshore wind industry presents an opportunity to utilise and further develop the UK's maritime engineering skills as other industries decline (such as shipbuilding and North Sea oil and gas) in order to secure supply chain and other employment opportunities in the UK, including during the manufacturing and construction of offshore wind farms.

Costs for offshore wind have been falling rapidly. The industry reached a landmark target of bringing the Levelised Cost of Energy (LCOE) below £100/MWh in 2015/16 – 4 years ahead of target. On the 11th September 2017 the results of the latest Contract for Difference (CFD) auctions showed a dramatic fall in the cost of offshore wind of almost 50% (from £105 to £57.50/MWh) in 2 years. Now, offshore wind is one of the most attractive and cost effective methods of generating large quantities of low carbon energy. The drive is for further improvements in efficiency and therefore further reductions to cost. Offshore wind is consistent and is regarded as having the potential to provide baseload energy for the UK.

**Offshore wind continues to be one of the most cost efficient form of energy generation in the UK[3]**

The chart to the right shows how the cost of offshore wind generation compares with other forms of energy generation in the UK.




[2, 3] Offshore Wind Industry Prospectus 2018. Prepared by ORE Catapult and the Whitmarsh Supply Chain Review Team on behalf of the Offshore Wind Industry Council (OWIC). https://cdn.ymaws.com/www.renewableuk.com/resource/resmgr/publications/catapult_prospectus_final.pdf)

# A Nationally Significant Infrastructure Project (NSIP)

Due to the size of the proposed offshore wind farm, the Project is classed as a Nationally Significant Infrastructure Project (NSIP), and we are required to seek a Development Consent Order (DCO) from the Secretary of State for Business, Energy and Industrial Strategy (BEIS).

Consequently, an Environmental Impact Assessment (EIA) is required as part of a DCO application.

This process requires us to make an application for development consent to the Planning Inspectorate, which will review and consider our proposals before making a recommendation to the Secretary of State, who will make the final decision. The process is summarised below:

**Pre-application Consultation**

The Planning Inspectorate will need to be satisfied that we have carried out effective pre-application consultation with statutory consultees and local communities in accordance with the Planning Act 2008 (The Act). The Act requires that we formally consult with a prescribed list of people, which includes, for example, local planning authorities and bodies such as the Marine Management Organisation and Natural England. We are also required to prepare a statement setting out how we propose to consult people living in the vicinity about the application for the Project. Consultation must then be carried out in accordance with that document, which is known as the Statement of Community Consultation (SoCC). The SoCC was published on 17th October 2018 and can be viewed on the project website **www.vattenfall.co.uk/norfolkboreas**.

**All consultation that we have undertaken so far is classed as 'informal' or 'non-statutory' consultation. As we have noted elsewhere in this document, feedback from consultation that we have undertaken so far, including consultation on the Norfolk Vanguard project, has resulted in quite significant alterations to the proposals, and will be reported in our Consultation Report, which will be submitted as part of the DCO application.**

**Acceptance of our Application and Examination**

Provided that the Planning Inspectorate is content such pre-application consultation has been carried out effectively, and other specific criteria have been met, the DCO application will be accepted. There will then be an Examination of the DCO application with the Planning Inspectorate acting as 'Examining Authority'. The Examining Authority review the application that has been made, ask written questions and can hold hearings during the Examination process.

The DCO application for Norfolk Vanguard was accepted by the Planning Inspectorate on 24th July 2018.

**Examination**

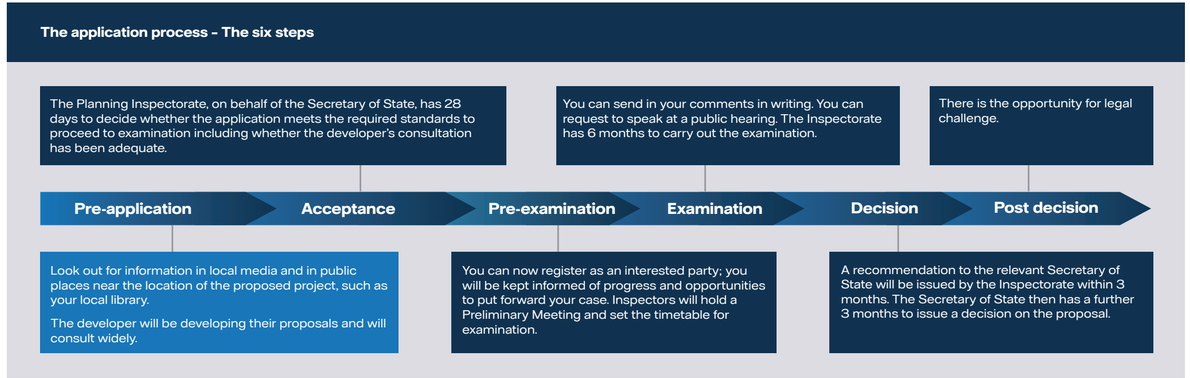
Following acceptance, you can register as an Interested Party. This means that the Planning Inspectorate will keep you informed of the process and when there are opportunities to put your case forward to the Secretary of State.

The Planning Inspectorate will then make a recommendation, in the form of a Report, to the Secretary of State for BEIS who will make the decision on whether or not to grant a DCO for the Project.

**Throughout this process, both prior to submission to the Planning Inspectorate and during the Examination period, interested parties (including members of the local community) will be entitled to participate both in the formulation of the DCO application and its consideration by the Examining Authority.**

**We are committed to ongoing engagement with the local communities within which we seek to operate, so we are keen to receive continued feedback and queries throughout the process.**

Further information about the NSIP process and the requirements for a DCO application can be found on the Planning Inspectorate website: **infrastructure.planninginspectorate. gov.uk/application-process/**.




**Kentish Flats & Extension. Image courtesy of MHI Vestas**

# Early project definition, site selection & refinement

**When designing a new offshore wind farm, some early decisions form the basis of what then continues as an adaptive refinement process, with assessments being reviewed and repeated as the project design emerges.**

We summarise here; more information on how the project proposals have evolved can be found in Chapter 4 of the PEIR.

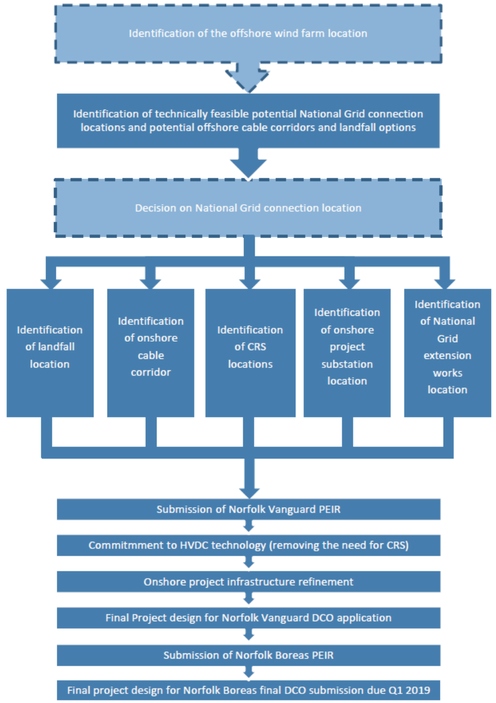
Fundamental and early decisions are made at a nationally strategic level – the selection of large areas of UK seabed which are suitable for developing offshore wind farms, for example. Norfolk Boreas is located in one of these areas, identified by The Crown Estate as part of a programme called 'Round 3'. In 2009, The Crown Estate ran a competitive tender process, and awarded the Round 3 zones to different offshore wind developers. Development within these zones has been ongoing since the awards. NBL was awarded an Agreement for Lease (AfL) for the areas within which it will develop Norfolk Boreas in 2016. Site selection for the Round 3 zones was based on strong wind resource, suitability of seabed and a range of environmental considerations.

Next followed a review of potential offshore cable corridor and landfall options – defined by existing constraints and opportunities. Understanding possible landfall locations helped to define the scope of investigations for defining an appropriate strategic, economical and efficient location for power generated by Norfolk Boreas to connect into National Grid's transmission network. Work to define the grid connection location was done jointly by both National Grid and NBL and a connection offer was subsequently made by National Grid.

With these endpoints (the Norfolk Boreas offshore site and the grid connection point) in place, the project design has progressed, led both by consultation and the EIA process, with cycles of appraisal to review options and critically reflect on their implications.

During site selection and project refinement, the following commitments guide our decision making:

- Exclude those options outside the project design envelope e.g. NBL made the commitment to rule out use of overhead lines to connect into the national grid, in order to minimise visual impacts;
- Shortest route preference for cable routing and best technology to minimise impacts, cost and transmission losses by minimising footprint for the offshore and onshore cable routes e.g. NBL have made a commitment to use HVDC transmission to reduce impacts;
- Avoidance of key sensitive features where possible (where this has not been possible, further mitigation will be undertaken as required);
- The need to accommodate the range of technology options sought within the design envelope (e.g. different sized turbines, different turbine foundations, different transmission technology).




**European Offshore Wind Deployment Centre**

# Environmental impact assessment - what its role is in the development of a DCO

**What is an Environmental Impact Assessment (EIA)?**

The EIA is a systematic process that must be followed for certain categories of project before they can be granted planning permission. EIA helps decision-makers consider the environmental consequences of proposed developments and ensure that potentially significant effects of a project and the scope for reducing them are properly understood.

The 2017 EIA Regulations say that a developers' EIA should describe the factors likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape'.

The process expects the Applicant to:

- assess a project's likely significant environmental effects:
- consider mitigation measures to reduce the level of effects; and
- assess any remaining effects with these measures applied.

**Key characteristics of the Environmental Impact Assessment Process**

- It is systematic, comprising a sequence of tasks that is defined both by regulation and by practice
- It is analytical, requiring the application of specialist skills from the environmental sciences
- It is impartial, its objective being to inform decision-making rather than to promote the project
- It is consultative, with provision being made for obtaining information and feedback from interested parties including local authorities, members of the public and statutory and non-statutory agencies: and
- It is iterative, allowing opportunities for environmental concerns to be addressed during the planning and design of a project

**This consultation and the purpose of the Preliminary Environmental Information**

Before submitting a DCO, appropriate pre-application consultation helps developers ensure they have a good understanding of stakeholders' concerns and have designed and refined their proposals appropriately. For EIA projects this includes consulting on preliminary assessments of potential impacts. At this stage, we are consulting on the Preliminary Environmental Information (PEI). This document provides you with an overview of what is in the Preliminary Environmental Information Report (PEIR), for more details, the full PEIR or a Non-Technical Summary of the PEIR can be reviewed. The PEIR contains information to enable interested parties to:

- Develop an understanding of the Project and relevant context
- Gain an understanding of potential environmental effects, their likely significance and any mitigation measures proposed to reduce them to inform any consultation responses; and
- Describe any remaining information that the Applicant expects to provide in the final Environmental Statement (ES) which will accompany the application for a DCO.

Feedback from this consultation will be used to inform the final design and impact assessment of the project. A Consultation Report detailing the consultation undertaken and the project refinement process will be submitted, along with the final ES, to the Planning Inspectorate in 2019 as part of the DCO application.

The purpose of the ES is to inform the decision-maker, stakeholders and all interested parties of any significant environmental issues that would result from the project during its construction, operation and (where relevant) decommissioning.

**Mitigation**

Where the impact assessment identifies that an aspect of the development is likely to give rise to significant environmental impacts, mitigation measures have been proposed and discussed with the relevant authorities to avoid impacts or reduce them to acceptable levels and if possible, to enhance the environment.

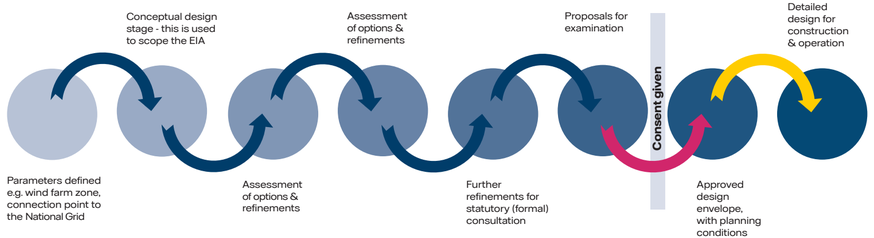
Embedded mitigation describes ways in which potential impacts identified during the EIA process can be eliminated, reduced, or made less significant by encompassing solutions to issues within the project design. There are three main ways in which this is done:

- Site selection (to avoid key designated or sensitive areas);
- Consideration of technological alternatives i.e. selecting HVDC transmission systems in order to reduce the width of the cable route, and eliminate the need for additional permanent onshore infrastructure; and
- Construction methodology selection (i.e. consideration of trenchless crossing techniques for watercourses, woodlands and roads which intersect with the onshore infrastructure.)

Additional mitigation, consisting of further measures that are identified during the EIA process specifically to reduce or eliminate any predicted impacts. These are usually subsequently adopted as project commitments.

**Environmental Impact Assessment (EIA) process consultation**

The diagram below illustrates the importance of consultation and engagement in the EIA process, which enables developers to progress their proposal, taking into account all appropriate constraints and opportunities to ensure an environmentally sensitive proposal emerges. Physical, social and environmental issues are addressed holistically through this consultation and engagement, with time and space programmed in for feedback loops – so ideas can be presented, discussed, tested, worked on further, re-presented and so on. For this methodology to be effective, developers engage at an early stage of development, when many decisions remain open, and the proposals are conceptual.




## About the PEIR

The PEIR presents the initial findings of the EIA. For each topic the following is provided:

- Overall Non-Technical Summary
- Introduction
- Legislation, Guidance and Policy
- Consultation
- Assessment Methodology
- Scope of assessment
- Existing Environment
- Embedded and Additional Mitigation
- Potential impacts (during construction operation and decommissioning)
- Mitigation
- Inter-relationships and interactions
- Summary
- References

# The project design envelope

**Offshore wind projects, as is frequently the case for NSIPs deploy new, rapidly evolving technology. In addition, offshore wind farms are proposed in increasingly challenging environments - further from shore where marine and seabed conditions are increasingly challenging. For these reasons, the DCO process accommodates a degree of uncertainty.**

The Norfolk Boreas EIA will therefore be based on a project envelope approach, also known as the 'Rochdale Envelope' approach. The Planning Inspectorate Advice Note Nine (the Planning Inspectorate, 2018) recognises that, at the time of submitting an application, offshore wind developers may not know the precise nature and arrangement of infrastructure that make up the proposed development. This is due to a number of factors such as the evolution of technology and the need for flexibility in key commercial project decisions. The need for further detailed surveys (especially geotechnical surveys) before a final design and layout can be determined is also a factor. It is therefore important that a project is consented with a design envelope to provide adequate flexibility. Where necessary, a range of parameters for each aspect of the project has been defined and the "worst case scenario" used in each impact assessment. The project design envelope outlines the maximum extent of the consent sought. This approach balances the needs of developers, regulators and the environment in the development of new technologies and innovations as they are commercialised and mature. It provides confidence that the EIA process is robustly considering the likely impact of the project whilst allowing the project to be optimised and refined at the time of construction, which may be several years after the DCO application is made. The detailed design of the project can then be developed, refined and procured within this consented 'envelope' prior to construction.

NBL is seeking flexibility in the following areas of project design:

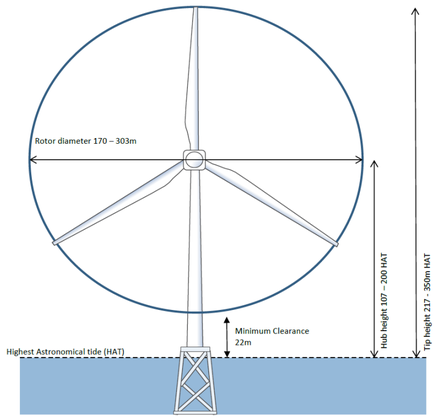
- Build-out scenarios/phasing options to enable NBL to develop the offshore wind farm in a way which produces power to the national grid as early as possible whilst maximising efficiencies during construction;
- Turbine capacity and parameters to allow the adoption of best in class technology prior to offshore construction, from around 2026;
- Flexible turbine and offshore platform layouts to enable the HVDC solution to be viable; and
- Construction, operation and maintenance methodologies to enable competitive procurement and the most cost effective option to be adopted.

### Phasing the construction

NBL is currently considering constructing the project in a single phase of up to 1,800MW, or two phases of up to 900MW.

### Turbine size

Between 90 and 200 wind turbines would be installed within the wind farm site. Turbines could be as tall as 350m (above sea level) and produce up to 20MW of power each, whilst the smallest turbines under consideration would produce 9MW of power.

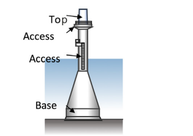



**Schematic illustrating the range of turbine dimensions**

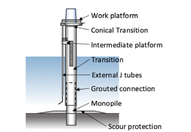
### Foundations

There are many possible foundation types currently available or under design to support offshore wind turbines and/or offshore platforms. The foundation type used will be determined by a number of constraints including: ground conditions, water depths, turbine model used, wind conditions and market options. For the project design envelope, one or more of the following foundation types could be considered:

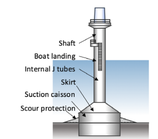
- Gravity base structures - which rely on the weight of the structure to anchor it to the seabed;
- Monopiles - large cylinders which are hammered, drilled or vibrated into the seabed;
- Suction caissons - cylindrical tubes which are installed by reducing the pressure inside the tube to draw the caisson into the seabed;
- Quadropod and tripod - jacket foundations with either three or four feet attached to the seabed with either 3 or 4 suction caissons or piles; and
- Tension leg floating foundations - a floating platform which is attached to the seabed by taught mooring lines to a gravity anchor or up to four suction caissons or piled anchors.



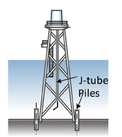

Typical gravity based structure



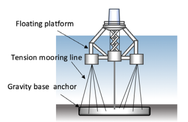

Typical monpile structure



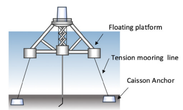

Typical suction caissons




Typical jacket structure




Typical tension leg floating foundation with gravity anchor



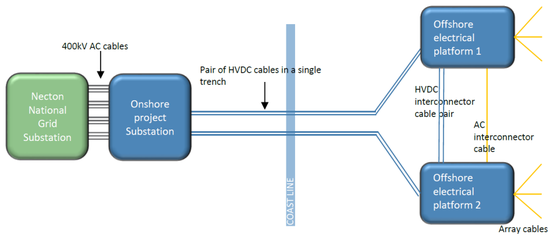

Typical tension leg floating foundation with piled or suction caisson

### The NBL transmission system will deploy HVDC technology

NBL is committed to deploying HVDC technology for the transmission of power from the wind farm to the onshore project substation. The schematic (right) shows how each element of the project will be connected.

The use of HVDC is an example of where the consultation process has influenced the design of the scheme following an initial potential option to use HVAC technology.

Currently only one offshore wind farm uses HVDC technology to transmit power to shore. Vattenfall believes important technological breakthrough in offshore wind transmission systems is possible in the coming years.



# The Norfolk Boreas Offshore Wind Farm proposal

The wind farm itself comprises the Norfolk Boreas site, within which wind turbines would be located. This would contain the following:

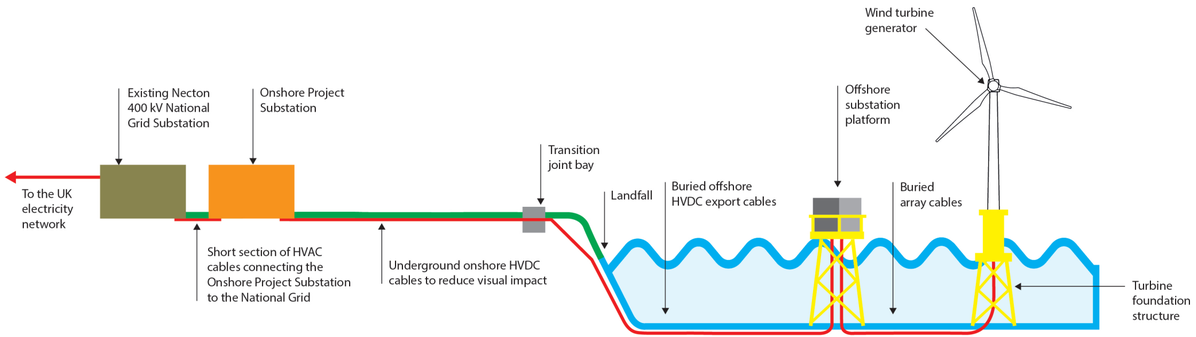
- Wind turbines;
- Offshore platforms (including electrical and accommodation platforms)
- Subsea cables (including array cables connecting the wind turbines and platforms and export cables taking energy to shore)
- Meteorological monitoring equipment;
- Navigational aids

The project will also require onshore infrastructure in order to transmit and connect the offshore wind farm to the national grid (see below diagram), which in summary comprises:

- Landfall at Happisburgh South, where the offshore cables are brought ashore and jointed to the onshore cables;
- Underground cables;
- An onshore project substation near the existing Necton National Grid substation; and
- Works at the Necton National Grid Substation (including extension of the existing substation and modification of the overhead powerlines).

Construction of the project is anticipated to commence between 2021 and 2022 for the onshore works. Onshore constructions would likely be completed by 2027 under the longest, two phase build programme. Offshore construction is expected to start in the mid twenty twenties and be complete by 2029 at the latest.

Construction at any one place within the onshore project area would be completed in a much shorter timescale. Offshore, a 3 to 7 year construction window is anticipated.






The Norfolk Boreas DCO application will consider two scenarios. Scenario 1 is where both Norfolk Vanguard and Norfolk Boreas are delivered (with associated synergies which are set out below), and Scenario 2 is where only Norfolk Boreas is delivered.

It has been Vattenfall's intent from the outset that the inter-relationship of both Norfolk Boreas and Norfolk Vanguard proceeding to construction and development optimises their positive potential. It also reduces impacts overall during construction, operation and eventual decommissioning.

Some of the proposed synergies include:

- Norfolk Boreas offshore cable corridor is 226km$^2$ and 97% of its area is shared with Norfolk Vanguard.
- From landfall to the onshore project substation 100% of the onshore cable route is shared (including all associated access points and mobilisation zones).
- Norfolk Vanguard plan to install onshore ducting[4] for the transmission cables for both projects over a period of four years, in total, with pre-construction preparation conducted over two years and two years for construction (securing 400-500 jobs during the most intense period of working).

This approach eliminates:

- The need for a second phase of duct installation for Norfolk Boreas.
- Co-location of landfall, south of Happisburgh, and onshore project substations near to Necton.

This approach means a shared operations and maintenance base at Great Yarmouth port[5] – employing 150 engineers, marine specialists and other highly skilled roles over 20+ years.

If both projects secure consent and progress to construction, these synergies will be realised. It is Vattenfall's intention that both projects will be built, however, Norfolk Boreas needs to consider the possibility that the Norfolk Vanguard project may not be built. In order for Norfolk Boreas to be considered as an independent project by the Planning Inspectorate, this scenario must be provided for within the Norfolk Boreas DCO application.

Therefore within the application two scenarios will be considered:

- **Scenario 1 - Norfolk Vanguard and Norfolk Boreas** – Norfolk Vanguard proceeds to construction, and installs ducts and carries out other shared enabling works to benefit Norfolk Boreas. This scenario is optimal and the most probable outcome.
- **Scenario 2 - Norfolk Boreas only** – Norfolk Vanguard does not proceed to construction and Norfolk Boreas proceeds alone. The Norfolk Boreas EIA will also consider associated constraints and opportunities, under Scenario 2 and undertakes all works required as an independent project.

[4] A duct is a length of underground piping, which is used to house electrical and communication cables.

[5] The operations base will serve Vattenfall's Norfolk Vanguard and Norfolk Boreas projects. More details here: bit.ly/VattenfallPeelPorts. Operations at Great Yarmouth are not included within the Norfolk Boreas DCO application, and so will be subject to a separate application.

| Onshore elements | Scenario 1 - Norfolk Vanguard and Norfolk Boreas<br>Norfolk Vanguard proceeds to construction and installs ducts and carries out other shared enabling works to benefit Norfolk Boreas. | Scenario 2 - Norfolk Boreas only<br>Norfolk Vanguard does not proceed to construction and Norfolk Boreas proceeds alone. Norfolk Boreas undertakes all works required as an independent project. |
|---|---|---|
| **Landfall** | | |
| Landfall compounds | ✔ | ✔ |
| Cable duct installation via HDD | ✔ | ✔ |
| Transition pits and link boxes | ✔ | ✔ |
| Cable pulling | ✔ | ✔ |
| **Onshore Cable Route** | | |
| Pre-construction works | ✔ | ✔ |
| Cable duct installation via open cut trenching | ✕ (installed by Norfolk Vanguard) | ✔ |
| Cable duct crossings (e.g. hedgerows, under-ground services, roads or tracks, watercourses) | ✕ (installed by Norfolk Vanguard) | ✔ |
| Trenchless crossings (e.g. HDD) and associated trenchless compounds | ✕ (installed by Norfolk Vanguard) | ✔ |
| Mobilisation areas | ✕ (not required) | ✔ |
| Running track | ✔ (approx. 12km) | ✔ (approx. 60km) |
| Accesses | ✔ | ✔ |
| Cable pulling | ✔ | ✔ |
| Cable logistics area | ✔ | ✔ |
| Jointing pits and link boxes | ✔ | ✔ |
| **Onshore Project Substation** | | |
| Pre-construction works | ✔ | ✔ |
| A47 junction improvement | ✕ (installed by Norfolk Vanguard) | ✔ |
| Access road to onshore project substation | ✔ (extension of road installed by Norfolk Vanguard by approx. 125m) | ✔ (approx. 1.8km) |
| Construction of onshore project substation | ✔ | ✔ |
| Screening | ✔ | ✔ |
| **National Grid Substation Extension and Overhead Modifications** | | |
| Pre-construction works | ✔ | ✔ |
| Extension to existing Necton National Grid Substation | ✔ (easterly direction) | ✔ (westerly direction) |
| National Grid Overhead line modifications | ✕ (installed by Norfolk Vanguard) | ✔ |
| Screening | ✔ | ✔ |

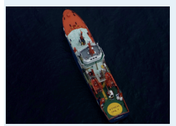
# Offshore elements of the proposal

**We have run 7,700 km of geophysical surveys over Norfolk Boreas, taking 109 days.**

The data from Norfolk Boreas surveys is available in the Preliminary Environmental Information Report (PEIR).

The PEIR and Non Technical Summary (NTS) of the PEIR provide more detailed information on the following topics:

### Marine Water and Sediment Quality

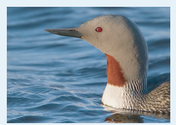


### Benthic and Intertidal Ecology

### Fish and Shellfish Ecology

### Marine Mammal Ecology

### Offshore Ornithology



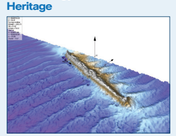
### Commercial Fisheries

### Shipping and Navigation

### Aviation and Radar

### Marine Geology, Oceanography and Physical Processes

### Offshore and Intertidal Archaeology and Cultural Heritage



At landfall, we will place the cables in a long duct at a depth below the cliff where consolidated, stable material is present to ensure the Project would not impact on coastal erosion, nor interfere with the Shoreline Management Plan. Due to NBL commitment to use a long HDD, there will also be no impact to the beach or the intertidal area.

Best practice techniques and due diligence minimise the potential for pollution throughout construction, operation, and decommissioning, e.g. adherence to international legislation, and using only biodegradable wind turbine oils and lubricants.

Samples and surveys have provided a detailed picture of seabed sediments and species. Direct impacts on the Cromer Shoals Chalk Bed Marine Conservation Zone (MCZ) have been avoided through site selection. Discussions with Natural England aim to agree suitable mitigation to reduce potential impacts on the Haisborough Hammond and Winterton Special Area of Conservation during cable installation.

Assessments on species of conservation importance like salmon and sea lamprey, and on species of commercial value to fishermen have concluded that the project could result in only minor impacts to fish and shellfish populations. Impacts on commercial fishing have been assessed taking account of UK fishing and foreign fleets. Consultation with fishermen is a key part of the process and will continue throughout development.

From August 2016 to July 2018, aerial surveys have assessed bird and marine mammal numbers using or passing through the Project site. We will work with regulators to agree suitable mitigation for potential impacts; and with other offshore wind developers to understand and manage the cumulative impacts where possible.

Data on offshore shipping movements have been collected during two dedicated (summer and winter) shipping surveys. Marine navigational risk has been assessed following Maritime and Coastguard Agency (MCA) and International Maritime Organisation guidelines. Project plans are being discussed with the MCA and Trinity House to agree mitigation, including lighting and marking.

Potential impacts on aviation and radar are being discussed with the Ministry of Defence and the Civil Aviation Authority and plans are being agreed to minimise any disruption to their operations.

Formal protocols for archaeological discoveries, and geophysical and geotechnical surveys, reduce the level of potential impact to archaeological and other historic remains. New data discovered during EIA assessments are feeding into exciting archaeological and paleaoenvironmental research being undertaken by UK academics.

The map below illustrates the offshore wind farm area and the offshore cable corridor. It also illustrates some of the many constraints which influence aspects of project design.

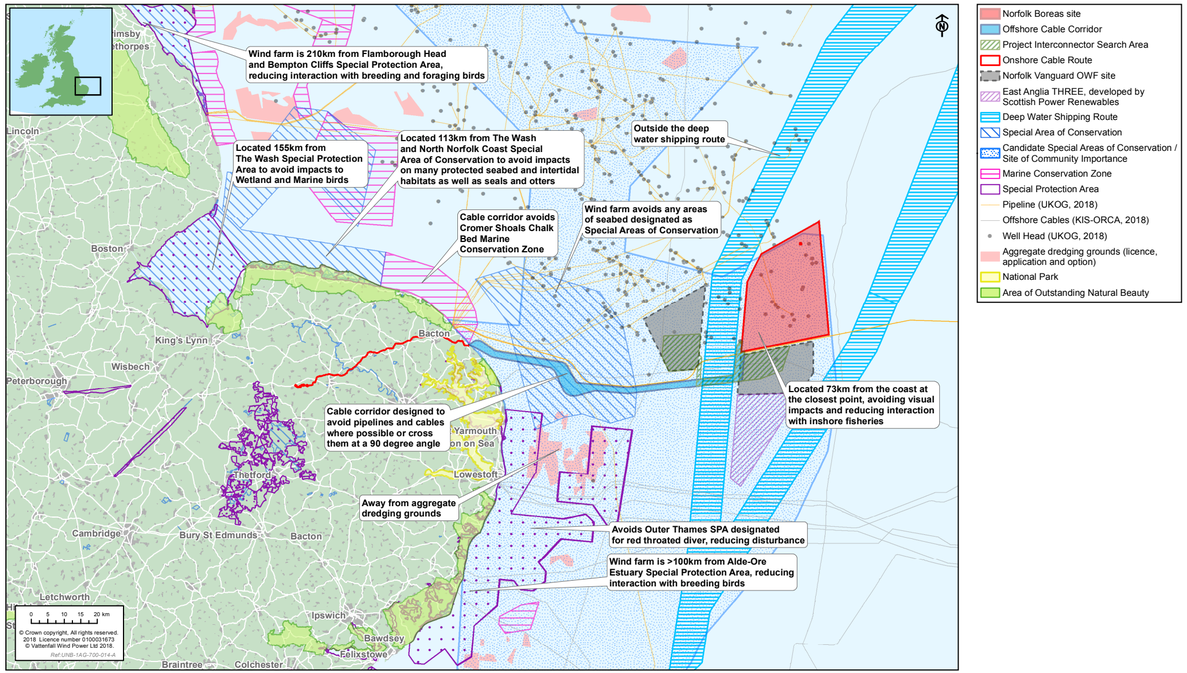



**Fig. UNB-1AG-700-014-A**

# Onshore elements of the proposal

As a result of previous consultation that was primarily carried out for both Norfolk Vanguard and Norfolk Boreas we have refined our onshore search areas for the landfall location, onshore cable route and onshore project substation location, based on ecological surveying that progressed over the course of 2017 and 2018, feedback from statutory consultees, landowners and communities, desk-based research, technical, commercial and environmental considerations.

**Our site selection process for all onshore infrastructure seeks to:**

- Avoid residential properties and sensitive areas (e.g. schools)
- Avoid designated sites and unacceptable impacts on protected species
- Avoid important habitat, trees, ponds, agricultural ditches and hedgerows
- Be sensitive to landscape settings and viewpoints
- Use open agricultural land in flat terrain, and along field boundaries
- Be sensitive to existing land use
- Avoid areas of flood risk
- Avoid archaeology and heritage assets
- Ensure engineering requirements and feasibility are balanced with environmental considerations
- Identify appropriate highway access and minimise traffic and transport disruption
- Avoid disruption to local services, roads and footpaths
- Minimise the number of crossings, e.g. road, river and rail required
- Take into account / avoid underground services e.g. gas pipelines / utilities
- Encourage and enable two-way communication and consultation in order to improve the quality and robustness of project-defining decision-making

**The PEIR and NTS provide more detailed information on the following topics:**

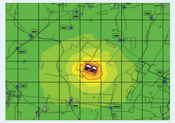
**Land use and agriculture**

**Onshore ecology**

**Onshore ornithology**

**Onshore archaeology and cultural heritage**

**Noise and vibration**



**Traffic and transport**

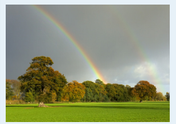
**Human health**

**Landscape and visual impact assessment**

**Tourism and recreation**

**Ground conditions and containment**

**Air quality**



**Water resources and flood risk**

**Socio-economics**

**In the following sections, we focus on some of the onshore elements of the project.**

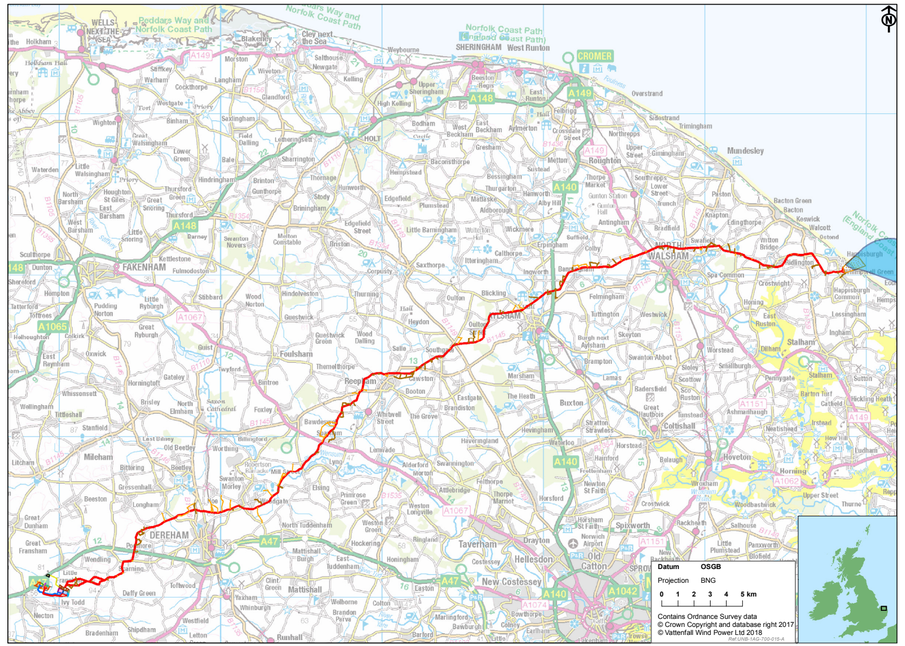
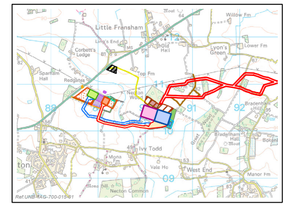



Fig. UNB-1AG-700-016-A


- Offshore cable corridor
- Onshore cable route
- Landfall zone
- Mobilisation zone
- Construction access
- Operational access
- Permanent access
- Onshore project substation temporary construction compound zone
- Indicative onshore project substation temporary construction compound
- National Grid temporary works
- Norfolk Boreas indicative attenuation pond
- Norfolk Boreas attenuation pond zone
- Indicative National Grid attenuation pond
- National Grid attenuation pond location search area
- Indicative mobilisation area compound
- Indicative mitigation planting areas for Norfolk Boreas
- Norfolk Boreas National Grid substation extension
- Norfolk Boreas onshore project substation
- Norfolk Boreas 400kV cable route
- Norfolk Vanguard National Grid substation extension
- Norfolk Vanguard onshore project substation
- Norfolk Vanguard 400kV cable route

Existing substation locations

- Dudgeon substation
- Necton National Grid substation

# Landfall

**What is landfall**

Landfall is the location along the project cable route where the offshore transmission cables carrying power from the wind turbines are brought ashore and link to the onshore cables. Following an extensive site selection process, the landfall for Norfolk Vanguard and Norfolk Boreas will be south of Happisburgh.

Landfall at Happisburgh South has the following principle advantages, it:

- Avoids offshore cables traversing the Marine Conservation Zone
- Accommodates the co-location of Norfolk Vanguard & Norfolk Boreas transmission cables (thereby limiting environmental impacts)

The Landfall search zone identified at Happisburgh South has been defined to exclude any direct impacts on properties along Doggetts Lane. The search zone remains a relatively large area of approximately 450m x 300m within which the drilling compounds will be micro-sited to a size of 50m x 60m.

We will utilise Horizontal Directional Drilling (HDD) at landfall, drilling from ground level at the drilling compound within the onshore landfall search zone out to an offshore location. This method allows the landfall to be made without impacting on the cliff face.

Over spring/summer 2017, we completed borehole logs at key crossing locations along the cable route, including within the landfall search zone, to gain a better understanding of the ground conditions. We are developing further details of our HDD works based on this information.

We utilised Norfolk based SI Drilling to conduct the boreholes.

Geophysical surveys have been undertaken to better understand the archaeology in the area and use this information, alongside the borehole information and other considerations, to microsite the drilling compound within the current search area.

Drilling operations will be completed within approximately five months for the long HDD. The majority of the works will be restricted to the onshore drilling compound with minor offshore works to pull the duct within the drilled hole. Offshore cables will be pulled through the preinstalled ducts at a later date, in line with phased development of the offshore wind turbines.

Access to the drilling compound for the drilling operations can be made via the cable route running track with direct access from Whimpwell Street.

**Summary Information:**

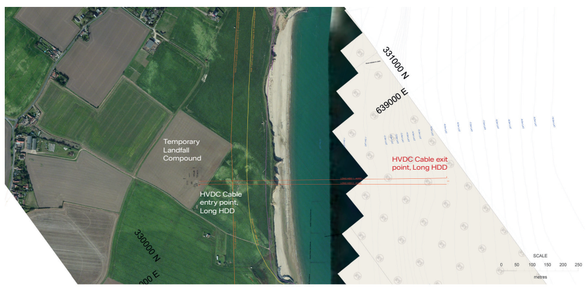
**Location** – South of Happisburgh

**Timescale** – 20 weeks duct installation, currently predicted to occur in 2024/25. Up to 16 weeks cable installation (up to two phases 2026/27)

**Access to landfall compound** – using temporary running track from the junction of the onshore cable route with Whimpwell Street

**Traffic** – Approximately 3 HGVs per hour in the first and last week to allow for site setup and demobilisation, reducing to 0.3 HGV's per hour for the remaining 18 weeks. Approximately 10-20 personnel.

**Avoiding exacerbating coastal processes**
The landfall site lies to the south of Happisburgh in an area fronted by unprotected cliffs which are eroding. The proposed HDD drilling compounds and transition pits are located in an agricultural field and suitably set back from the cliff edge to ensure natural coastal erosion scenarios should not affect the drilled cable or transition pits within the conceivable lifetime of the project.



PLAN VIEW

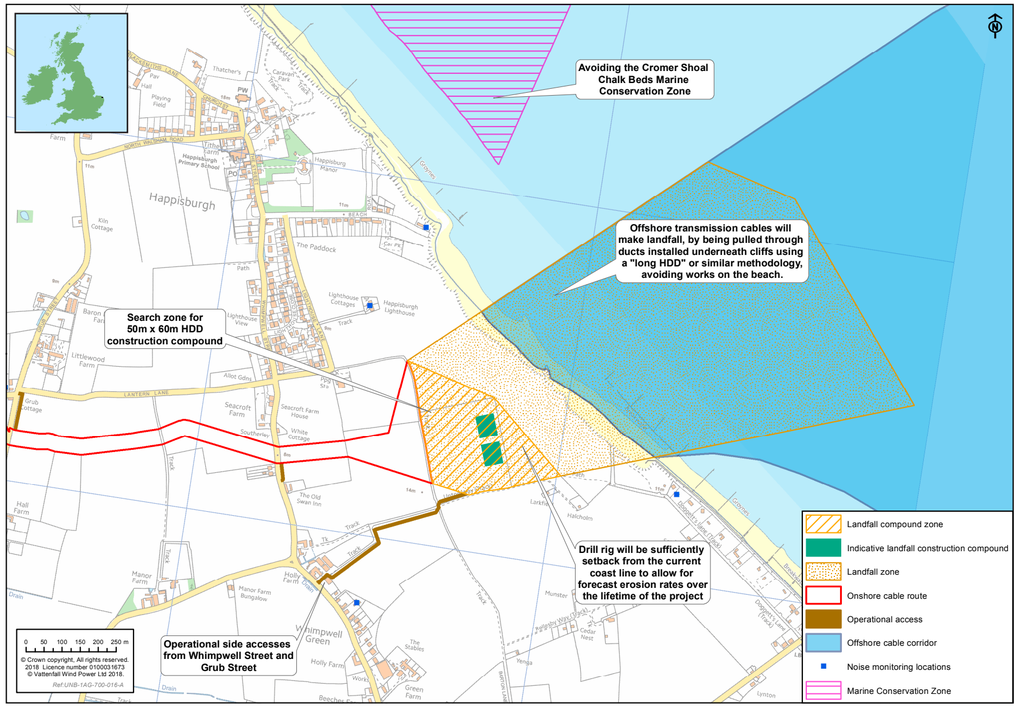
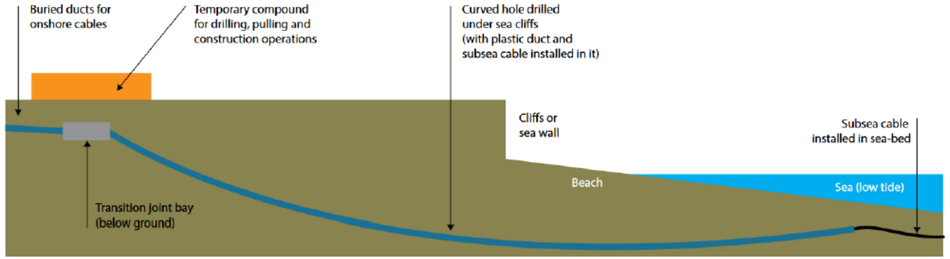


**Fig. UNB-1AG-700-016-A**

# Bringing power ashore at landfall - how this is achieved

At the landfall, we will use a trenchless method – known as Horizontal Directional Drilling (HDD) – to install two cable ducts in the ground below the beach and cliffs. This will involve setting up a temporary compound where the drilling operations will take place. Drilling operations will be completed within approximately 5 months




| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Establish temporary compound onshore | Drill pilot holes under cliffs, then enlarge to required diameter | Pull plastic duct into hole (from seaward end) | Instal or construct transition joint bay (TJB) | Clear temporary compound and reinstate land | Pull end of sub-sea cable through duct to TJB | Join sub-sea cable to land cables within TJB |

HDD unit, showing the drill rig and drilling pipes.

Example of offshore equipment required for HDD at landfall

Community Event at Balmedie Beach near the European Offshore Wind Deployment Centre

# Underground cable route

The cable route is currently identified as a 45m corridor within which a 35m working width will be sited. Route amendments have been made following consultation with stakeholders and landowners.

- Vattenfall has committed to burying the electrical cables to mitigate the impacts associated with overhead lines.
- Vattenfall has also committed to a duct installation approach and to install ducts for both the Norfolk Vanguard and Norfolk Boreas projects concurrently to minimise impacts and disruption (Scenario 1).
- This approach allows the ducts for both projects to be buried throughout the 60km route length within a two year period. Cables can then be pulled through these ducts from pulling and jointing pits (approximately 800m apart) at a later stage, to facilitate the development of the wind turbines offshore.
- In the unlikely event Norfolk Vanguard does not proceed (Scenario 2) Norfolk Boreas will undertake its own duct installation over a two year period. To minimise impacts to the transport network during duct installation, construction materials and traffic will be delivered to mobilisation areas sited at the junction of the cable route and primary roads in the region and transported along a temporary running track/haul road adjacent to the trench excavations within the cable route.
- The duct installation approach allows the trenches to be excavated for as short a period as possible to minimise damage to the ground structures. It is anticipated that 150m of trench excavation, duct laying and subsoil reinstatement can be achieved every one to two weeks, at which point, the construction crews will move onto the next 150m section.
- To achieve the 2 year programme, multiple sections of the route will be worked in parallel from mobilisation areas approximately every 5km along the route.
- Following duct installation the land will be fully reinstated. When cables are pulled through the ducts in later years, access will be gained primarily using the highways network with an estimation of 20% of the route running track required to be temporarily reinstated where local roads are unsuitable, to allow delivery of the cables to the jointing locations.
- The project will be compliant with the UK exposure limits set to protect members of the public against electric and magnetic fields.
- We want to minimise the long-term impact of the installation process on the affected land. This will be achieved through careful planning and management of the installation works, together with close attention to issues such as drainage and soil management.

**Code of Construction Practice**

A Code of Construction Practice (in accordance with the Outline Code of Construction Practice, which will be submitted with the DCO application) would be prepared and agreed in consultation with all relevant stakeholders. This would detail methodologies to be used during construction activities, including all requirements for alternative routes including long distance trails, cycle routes, Public Rights of Way (PROWs) and local footpath networks, sign posting and dissemination of information to the public to minimise all possible impacts to an acceptable level.

The onshore cable route crosses a number of long distance trails (e.g. The Peddars Way and Norfolk Coast Path), PROWs, cycle paths and local footpaths. A number of temporary closures, soft management measures or provision of agreed alternative routes could be required along the onshore cable corridor.


The onshore cable route will extend from the landfall site to the onshore project substation, close to Necton. The proposed route is roughly 60km in length, and is largely on agricultural land.

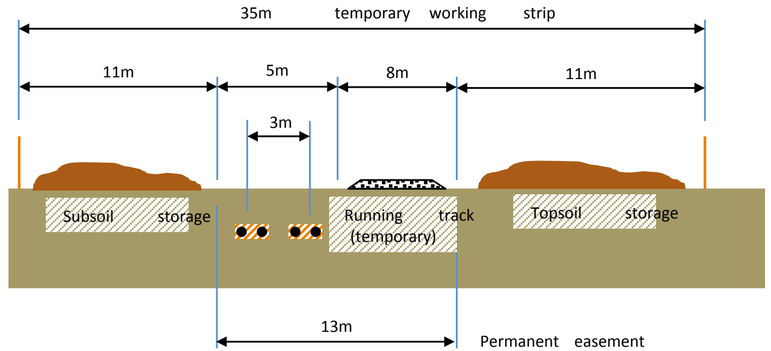
The cables will be installed in plastic ducts, which will be buried to a minimum depth of roughly 1.05m. Installation of the ducts will generally be an open-cut trenching method. As such, this process will involve a temporary disruption to normal agricultural activities. However, the land will be reinstated and returned to normal use once the ducts are installed. We will deploy trenchless crossing methods to minimise impacts on sensitive features such as major roads, rivers and railways.

HVDC cables will run from the landfall to the onshore project substation. A small section of HVAC cables will be installed between the onshore project substation and National Grid's substation.


Open trenching


Cabling pulling

Cable working width (Norfolk Boreas only) – HVDC solution



## Scenario 1 (Norfolk Vanguard and Norfolk Boreas)

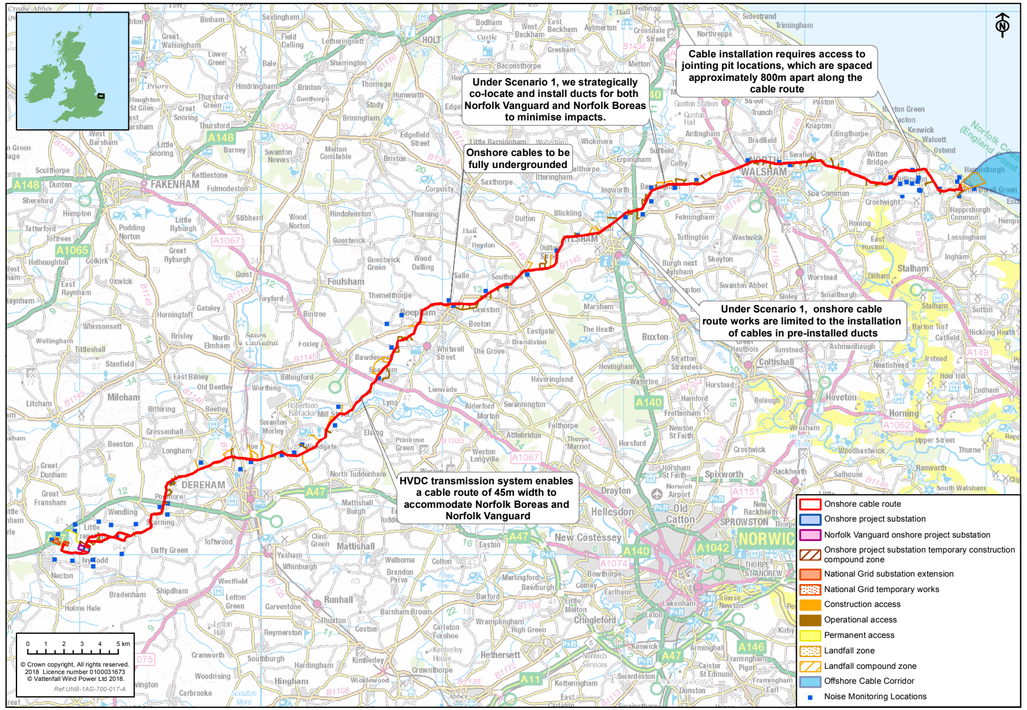



Fig. UNB-1AG-700-017-A

## Scenario 2 (Norfolk Boreas only)

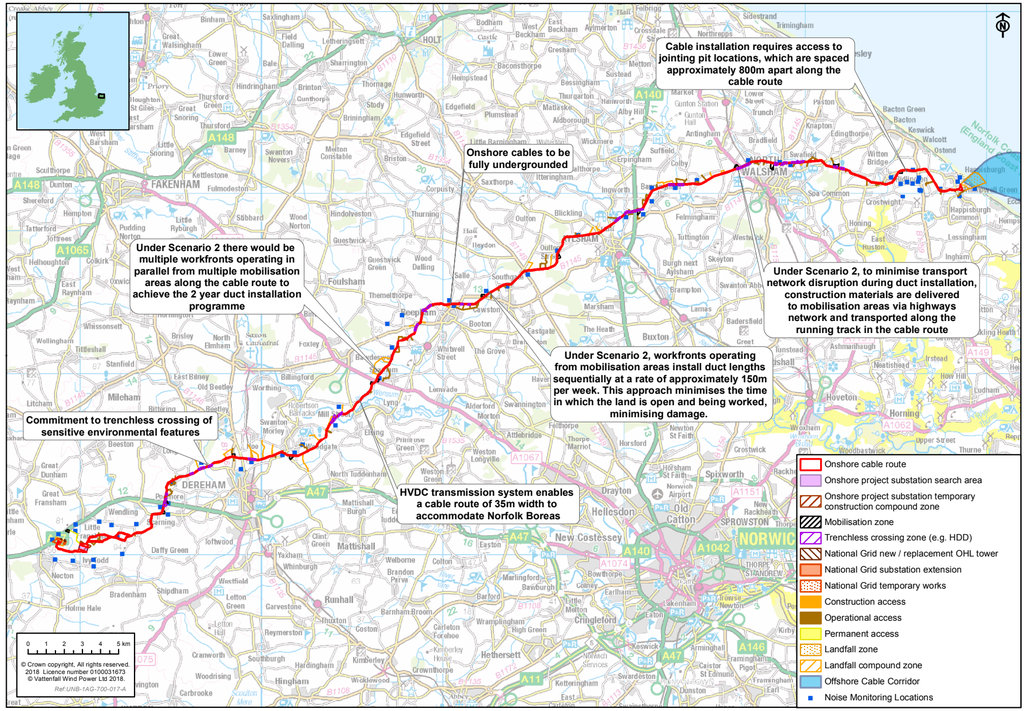



Fig. UNB-1AG-700-017-A

# Onshore project substation

**The onshore project substation is to be located to the south of Necton Wood. The location will allow co-location of the Norfolk Vanguard and Norfolk Boreas substations.**

- The onshore substation's purpose is to convert the HVDC transmitted electrical power to HVAC for connection into the national grid (for a HVDC connection).
- The footprint of the onshore project substation is the same under both scenarios (300m by 250m). Under Scenario 1 the onshore project substation would be located adjacent to the Norfolk Vanguard substation. Under Scenario 2, the exact location of the onshore project substation is not defined and will be within a defined search area.
- The electrical equipment within the onshore project substation will make noise, however we are committed to providing a final project design meeting the rigorous standards of low noise emissions expected by the UK regulatory bodies and stakeholders. Noise reduction technology and design approach is considered within the PEIR and mitigation options include a combination of noise barriers, bunds, enclosures, site layout (e.g. location of static noise sources) and plant selection at procurement stage.
- The onshore project substation will be compliant with the UK exposure limits set to protect members of the public against electric and magnetic fields.
- The onshore project substation will be accessed from a new junction with the A47 at Spicer's Corner which will be installed by Norfolk Vanguard under Scenario 1 or by Norfolk Boreas under Scenario 2.

**National Grid Extension Works**

- Necton National Grid substation is required to be extended to accommodate Norfolk Boreas connection.
- Under Scenario 1 the existing substation will be extended to the east, as Norfolk Vanguard would have already extended it to the west. The extension footprint would be approximately 130m by 142m. The tallest structure within the substation will be 19m and similar to the infrastructure installed at the existing substation.
- Under Scenario 2 the extension will be in a westerly direction, with a footprint of approximately 200m by 142m.
- Existing National Grid 400 kV overhead lines require modification to accommodate the connection to the existing substation. Under Scenario 1 Norfolk Vanguard would have completed these modifications to accommodate both projects. Under Scenario 2 these works would be undertaken by Norfolk Boreas and would consist of temporarily erecting three new towers to allow the existing 400 kV circuits to be transferred and the existing connection to remain operational through the construction works. Two new permanent towers will be erected, maximum height 55m and one existing tower dismantled (a net addition of one new permanent tower). The circuits will then be transferred from the temporary towers onto the permanent towers and the temporary towers removed.
- Access for construction and operation associated with the existing National Grid substation will be obtained from existing access to the A47.

**Maps showing the onshore project substation layout for both scenarios can be found on page 32 and 33.**

The onshore project substation will comprise of a fenced compound containing high-voltage electrical plant and buildings.

- The Norfolk Boreas compound dimension is expected to be 300m x 250m.
- The maximum height of the building is expected to be 19m.

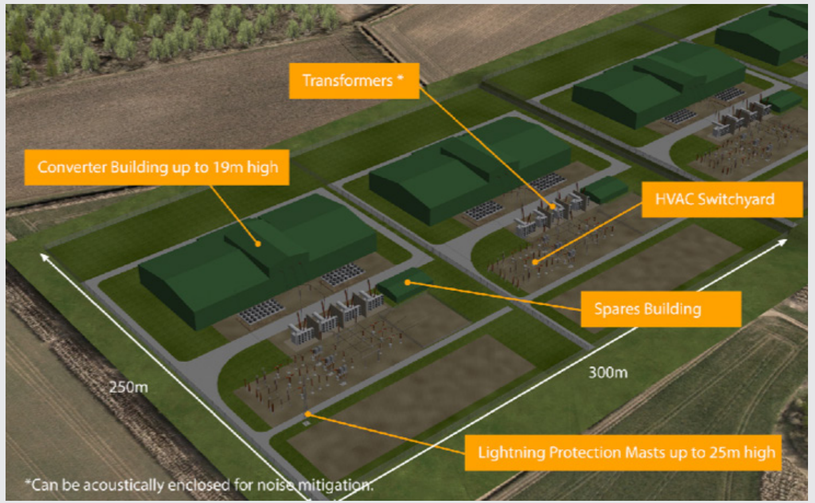
The physical appearance of the substation will depend on the final design, however would typically comprise of two similar HVDC converter stations. Each converter station will have an outdoor AC switchyard and a large converter building.

Construction of the substation will involve groundworks to clear and prepare the site, and to establish suitable foundations for the electrical plant and the control building. These groundworks, together with the construction of the building and the perimeter fence, will take around 18 months.

The electrical plant will be delivered and installed at the site in up to two stages, at intervals of 12 months or so.

On each occasion, there will be a short period of activity at the site, to bring the new equipment into commission. This activity is expected to last for 2-3 months on each occasion.

During operation, the site will normally be unstaffed. Occasional visits will be made to carry out inspection and maintenance activities.




**3D visualisation of onshore project substation**

## Scenario 1 (Norfolk Vanguard and Norfolk Boreas)

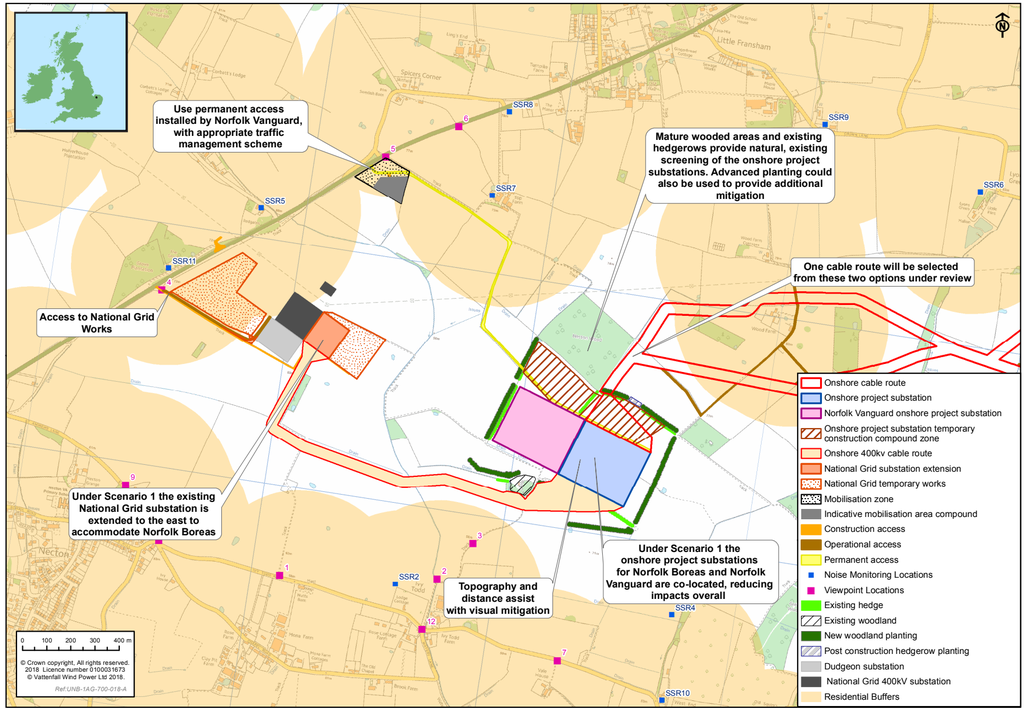



**Fig. UNB-1AG-700-018-A**

## Scenario 2 (Norfolk Boreas only)

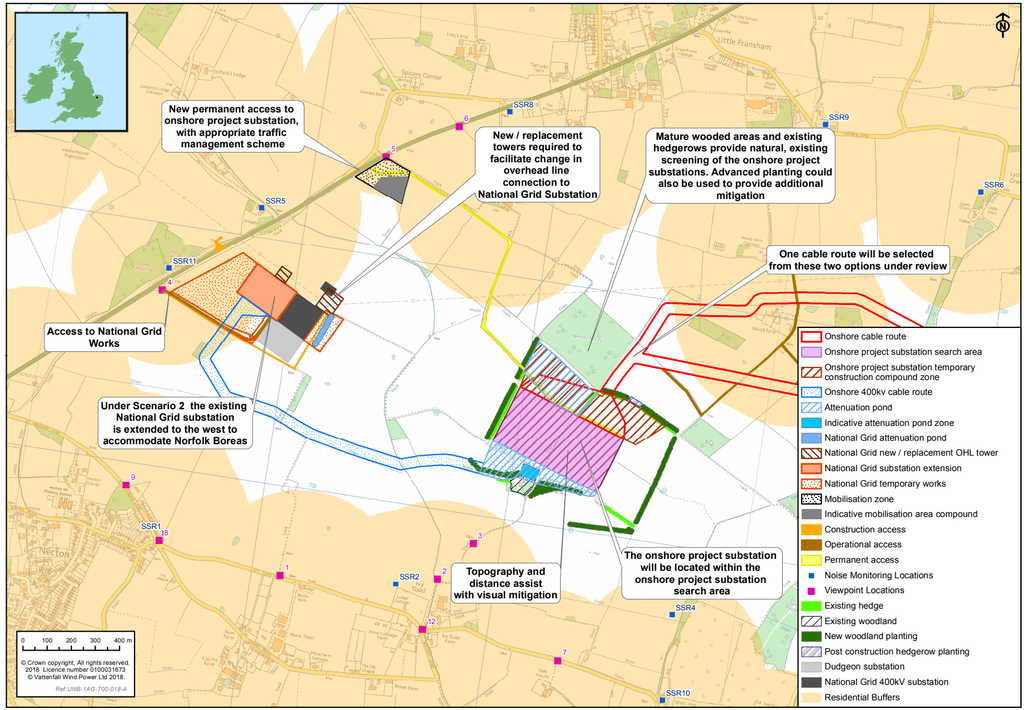



**Fig. UNB-1AG-700-018-A**

**Viewpoint from Lodge Lane South**


**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations**


**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations with mitigation planting**

Currently all mitigation planting is contained within the site boundaries of onshore project substations, although opportunities to extend this further into the surrounding landscape may be explored as the project progresses.



**Viewpoint from Lodge Lane South**


**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations**


**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations with mitigation planting**

The photomontages shown cover a 180 degree field of view.

The photomontages used in this document are for illustrative purposes only and, whilst useful tools in the assessment, are not considered to be completely representative of what will be apparent to the human eye. The assessments are carried out from observations in the field and therefore may include elements that are not visible in the photographs.

Larger versions of photomontages are available in the PEIR and at the drop-in exhibitions.

**Viewpoint from A47 Spicer's Corner**


**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations**

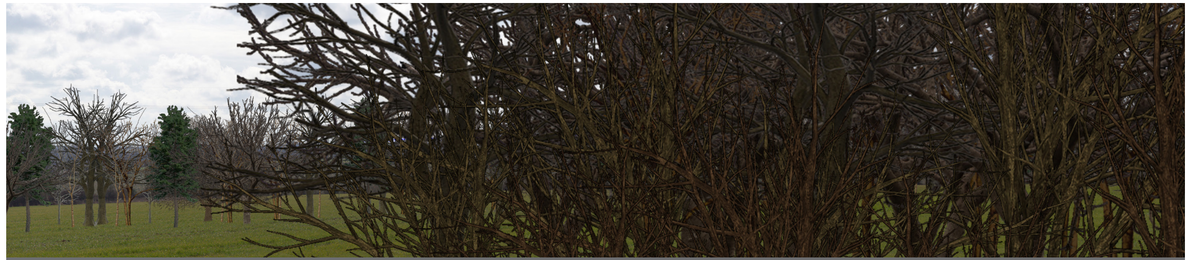

**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations with the National Grid Substation Extension and mitigation planting**

Currently all mitigation planting is contained within the site boundaries of onshore project substations, although opportunities to extend this further into the surrounding landscape may be explored as the project progresses.



**Viewpoint from A47 Spicer's Corner**


**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations**



**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations with mitigation planting**

The photomontages shown cover a 180 degree field of view.

The photomontages used in this document are for illustrative purposes only and, whilst useful tools in the assessment, are not considered to be completely representative of what will be apparent to the human eye. The assessments are carried out from observations in the field and therefore may include elements that are not visible in the photographs.

Larger versions of photomontages are available in the PEIR and at the drop-in exhibitions.

**Viewpoint from Ivy Road West**


**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations**


**Photomontage of the proposed Norfolk Boreas and Norfolk Vanguard HVDC Substations with mitigation planting**

The photomontages shown cover a 180 degree field of view.

The photomontages used in this document are for illustrative purposes only and, whilst useful tools in the assessment, are not considered to be completely representative of what will be apparent to the human eye. The assessments are carried out from observations in the field and therefore may include elements that are not visible in the photographs.

Larger versions of photomontages are available in the PEIR and at the drop-in exhibitions.



**Thanet Offshore Wind Farm**

# Potential impacts during decommissioning

No decision has been made regarding the final decommissioning policy for the onshore cables, as it is recognised that industry best practice, rules and legislation change over time. It is likely the cables would be pulled through the ducts and removed, with the ducts themselves left in situ.

In relation to the onshore project substation, the programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology would be determined later within the project lifetime, but are expected to include:

- Dismantling and removal of outside electrical equipment from site located outside of the substation buildings;
- Removal of cabling from site;
- Dismantling and removal of electrical equipment from within the onshore project substation buildings;
- Removal of main onshore project substation building and minor services equipment;
- Demolition of the support buildings and removal of fencing;
- Landscaping and reinstatement of the site (including land drainage); and
- Removal of areas of hard standing.

Whilst details regarding the decommissioning of the onshore project substation are currently unknown, considering the worst case assumptions which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would be similar or less than to those during construction.

The decommissioning methodology would need to be finalised nearer to the end of the lifetime of the project so as to be in line with current guidance, policy and legislation at that point. Any such methodology would be agreed with the relevant authorities. The decommissioning works could be subject to a separate licencing and consenting approach.

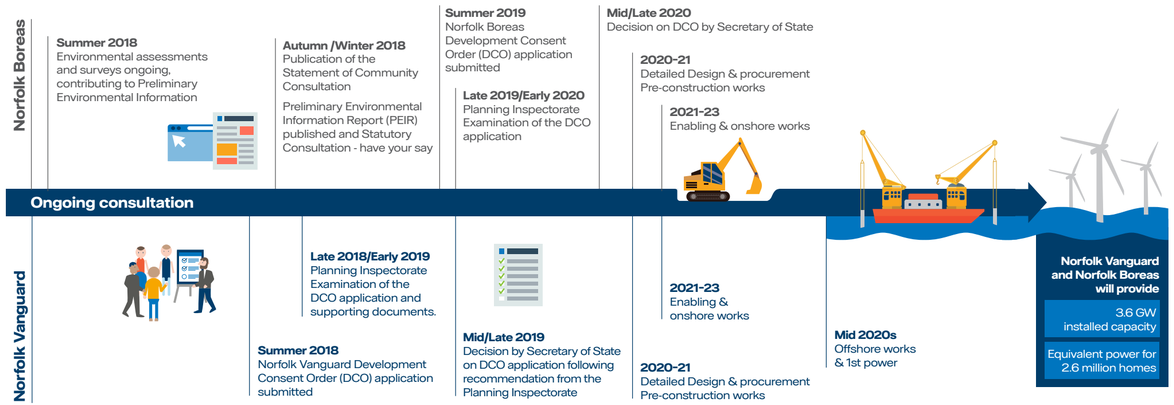


# Project timeframe

The project is currently at the point of statutory consultation on the preliminary environmental information that is available. Following the close of this consultation period at 11.59pm on 9th December 2018 we will be developing our final proposals and taking on board feedback received from the local community and consultees to help shape the plans. We will then be preparing our application ready for submission to the Planning Inspectorate in Summer 2019.

The timeline shows where we are in the process, and when we would expect to receive a decision on our Development Consent Order application. The expected timeframes for Norfolk Vanguard is also mapped out to provide context to both projects' next steps.

## Norfolk Boreas and Norfolk Vanguard timeline



# What kind of local opportunities and benefits are important to Norfolk?

Jobs and skills provision are key elements that people identify as the benefits associated with inward investment from the offshore wind industry.

**Supply chain**

Vattenfall is committed to ensuring that our approach to project procurement and investment supports local businesses to enter and prosper in the renewable energy and green job sectors.

Having reached agreement with Peel Ports to reserve space for our operations and maintenance base for Norfolk Vanguard and Norfolk Boreas at Great Yarmouth – which will be home to up to 175 skilled workers for 30 years, we are also looking at means of encouraging the local supply chain to work with us, bringing valuable local knowledge and expertise to bear on our projects.

Already we are working with stakeholders from local government, business development agencies, businesses and education providers to enable and encourage Norfolk and the East of England to capitalise on the socio-economic opportunities of the UK's growing offshore wind industry. By partnering with these organisations and training providers in the region, together we can ensure Norfolk gains significantly from the major investment that comes from multi-billion pound schemes like Norfolk Boreas and Norfolk Vanguard.

Early engagement with the supply chain will assist us in producing a contracting strategy that works for the Norfolk projects, bringing valuable local knowledge and expertise. We have a number of supply chain events programmed for the coming months, looking at opportunities associated with onshore and offshore works.

**During the peak of onshore construction, some 400 engineers and construction workers will be required to prepare and build the onshore elements of the project.**

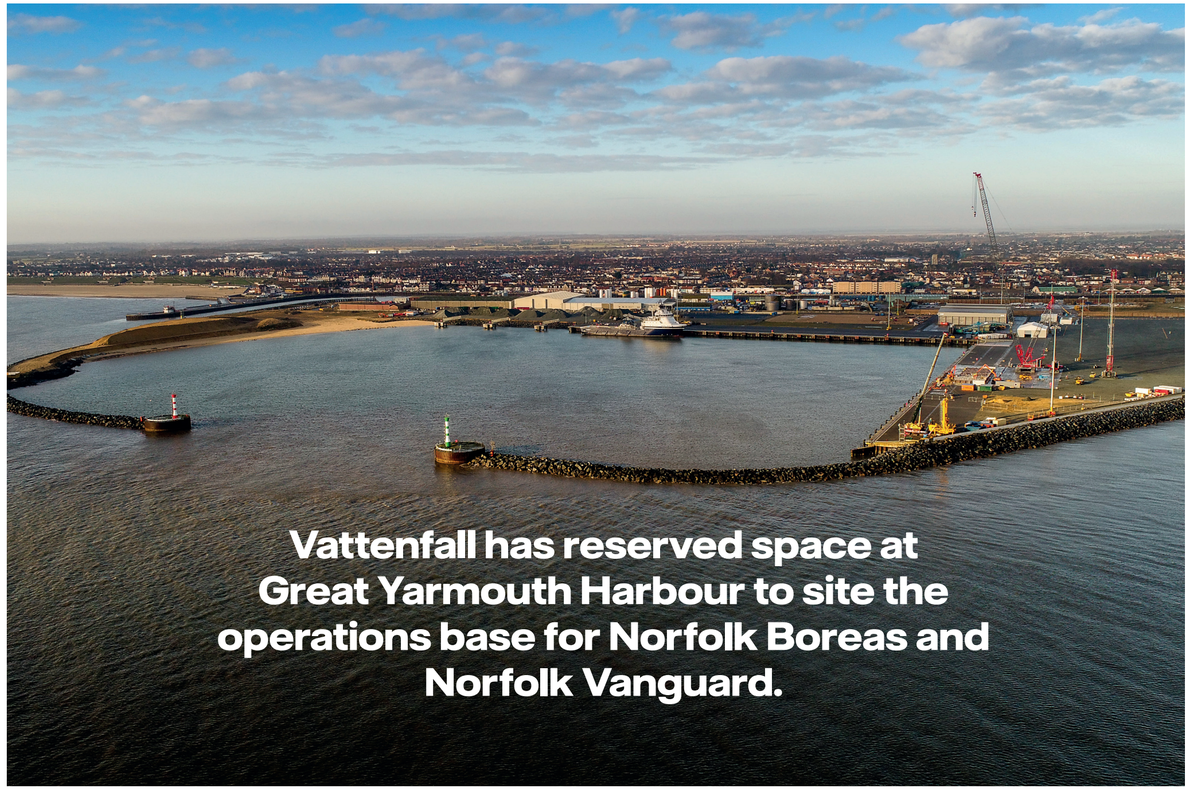
**Skills and Jobs for the Future**

Vattenfall have a strategic opportunity to inspire and develop the local workforce of the future – within Vattenfall itself and within the broader supply chain.

We believe in working collaboratively for and with the next generation. We have shown our commitment to this by enabling early engagement and through offering a variety of opportunities to young people of all ages who live and go to schools and colleges within our project area.

We are also excited to work with The University of East Anglia (UEA) – especially the undergraduate and masters students studying Engineering and Environmental Science. We hope stakeholders will meet some of these students during the consultation – working alongside us.






Great Yarmouth Harbour, courtesy of Peel Ports Group. (https://group.vattenfall.com/uk/newsroom/news-press-releases/pressreleases/stories/offshore-wind-confidence-booster-for-norfolk-as-energy-company-plans-great-yarmouth-home)

### What we have been developing

Over the past year we have built on our early work and developed a primary school outreach programme. Colby Primary School students have developed a hands-on renewable energy programme that they deliver to other primary school pupils. The focus is on developing confidence, leadership and employability skills. Visit: **https://bit.ly/2yJ9V4D**

### Green Energy Outreach Programme

The Green Energy Outreach Programme is an educational project aimed at teaching Primary School children about renewable energy and preserving our natural resources. It is the culmination of eco work carried out at Colby Primary School over a number of years including a recent collaboration with green energy company Vattenfall.

### Focus on East Coast Energy Internships


Our summer internship programme, saw us work in close partnership with the Ogden Trust and NEXUS.

3 Vattenfall Interns and 1 Nexus Intern worked together to develop a new interactive exhibition, to be used at various events.

They created a professional and engaging piece that will help people of all ages appreciate the scale of the Norfolk Vanguard and Boreas Projects. Meanwhile they gained an important insight into working within business and developed their team work, project management and practical engineering skills.

We look forward to working with our Interns at various events in the forthcoming year.


With our partners 3D-webtech we have developed a 3D virtual reality offshore wind farm development programme to help students understand the opportunities and challenges associated with the design of an environmentally sensitive, economically viable offshore wind farm. Over 300 students from 10 colleges have now gained insights into real issues and solutions using the model. We are now also working with staff and students at the UEA. Visit: **https://bit.ly/2ITSLG7**

YOUTH PLEDGE
NEWANGLIA
Local Enterprise Partnership

**Vattenfall have been awarded the New Anglia Youth Pledge Marque - in recognition of our commitment to supporting the development of the future workforce. We look forward to continually building on our early work with the education community and will be encouraging our supply chain to do the same.**

### Skills and jobs for the future

Career opportunities in offshore wind development, construction and operation are highly varied and include;

- Project managers for each phase of the project
- Graduate project civil engineers
- HSE administrators
- Electrical package managers
- Wind turbine service technicians
- Electrical engineers
- Contracts managers
- GIS and mapping experts
- Data Analysts
- Media and communications officers
- Commercial managers, lawyers etc...

Find out more here: **https://corporate.vattenfall.com/careers/**

### Supply chain opportunities

When you add in the supply chain businesses that contribute to the development of a wind farm, the opportunities are even more diverse;

- Ecologists
- Archaeologists
- 3D VR Visualisation developers
- Land owner liaison officers
- Onshore civil engineers & contractors
- Wind turbine designer/manufacturer
- Service vessel crew and skippers
- Cable layers
- Accommodation providers...

Find out more here: **https://corporate.vattenfall.co.uk/supply-chain/**

### Student & graduate opportunities

Different roles require different skills, qualifications and experience. There are numerous routes into these roles and there are academic, technical and practical jobs.

Vattenfall International Trainee Programme offers enthusiastic graduates a broad experience across the countries it operates in.

In addition, there are internships, thesis project & apprenticeship opportunities;

Find out more here: **https://corporate.vattenfall.co.uk/supply-chain/**

# How to have your say

Electronic copies of the PEIR, which comprises a detailed set of documents, including maps, figures, and photomontages describing the Project, as well as a set of plans showing the overall location of the Project and a much shorter non-technical summary (NTS) and this consultation document, may be accessed and are available to view free of charge for inspection from 31st October 2018 to Sunday 9th December 2018 at the listed locations (below):

| Organisation | Address | Opening Times |
|---|---|---|
| **Aylsham Library** | 7 Hungate St, Aylsham, Norwich, NR11 6AA | **Mon and Fri:** 9.30am - 12.30pm; 1.30 - 7:00pm<br>**Tues and Thurs:** 9.30am - 12.30pm; 1.30 - 5:00pm<br>**Wed:** 1.30 - 7:00pm<br>**Sat:** 9.30am - 4:00pm<br>**Sun:** 11:00am - 2:00pm |
| **Dereham Library*** | 59 High St, Dereham, NR19 1DZ | **Mon, Wed and Thurs:** 9.15am - 5:00pm<br>**Tues and Fri:** 9.15am - 7:00pm<br>**Sat:** 9.15am - 4:00pm |
| **Norwich Millennium Library** | The Forum, Millennium Plain, Norwich, NR2 1AW | **Mon-Fri:** 10:00am - 7:00pm<br>**Sat:** 9:00am - 5:00pm |
| **North Walsham Library*** | New Rd, North Walsham, NR28 9DE | **Mon and Thurs:** 9:30am - 7:30pm<br>**Tues and Fri:** 9:30am - 5:00pm<br>**Wed and Sat:** 9:30am - 1:00pm |
| **North Norfolk District Council** | Council Offices, Holt Road, Cromer, NR27 9EN | **Mon, Tues and Thurs:** 8:30am - 5:00pm<br>**Wed:** 10:00am - 5:00pm<br>**Fri:** 8:30am - 4:30pm |
| **Broadland District Council** | Thorpe Lodge, 1 Yarmouth Road, Norwich, NR7 0DU | **Mon-Fri:** 8:30am - 5:00pm |
| **Breckland District Council** | Elizabeth House, Walpole Loke, Dereham, NR19 1EE | **Mon-Fri:** 8:30am - 5:00pm |
| **Norwich City Council** | St Peters Street, Norwich, NR2 1NH | **Mon-Fri:** 8:45am - 5:00pm |
| **Great Yarmouth Borough Council** | Town Hall, Hall Plain, Great Yarmouth, NR30 2QF | **Mon-Fri:** 9:00am - 5:00pm |
| **Swaffham Library** | The Pightle, Swaffham, PE37 7DF | **Tues and Thurs:** 10.00am - 7.00pm<br>**Fri:** 1.00 - 7.00pm<br>**Sat:** 10.00am - 4.00pm |

*Hard copies of the full PEIR are available to view at Dereham and North Walsham Libraries.

The opening times of these organisations are dependent on and governed by these venues and may be subject to change.

Consultation packs comprising the NTS and consultation booklet, consultation questions and freepost envelope, will also be available at all information points.

We will also hold the following public information days, where the documentation described above will be available for inspection:

| Venue details | Date/Time |
|---|---|
| **Happisburgh**<br>The Wenn Evans Centre, Blacksmiths Lane, Happisburgh, Norwich NR12 0QY | Wednesday 14th November<br>1pm – 7pm |
| **Aylsham**<br>Aylsham Town Hall, Town Hall, Market Place, Aylsham, Norwich NR11 6EL | Thursday 15th November<br>1pm – 7pm |
| **Necton**<br>Necton Rural Community Centre, 13 Tun's Road, Necton, Swaffham, PE37 8EH | Friday 16th November<br>1pm – 7pm |
| **Norwich**<br>The Forum, Bethel St, Millennium Plain, Norwich NR2 1BH | Wednesday 21st November<br>11am – 6:30pm |
| **Dereham**<br>Dereham Sixth Form College, Crown Road, East Dereham NR20 4AG | Thursday 22nd November<br>1pm – 7pm |
| **North Walsham**<br>North Walsham Community Centre, New Road, North Walsham, Norfolk, NR28 9DE | Friday 23rd November<br>1pm – 7pm |
| **Reepham**<br>St Michael's Church, Reepham, Norfolk, NR10 4JL | Saturday 24th November<br>10am – 3pm |

Electronic copies of the PEIR and NTS can also be viewed or downloaded from the Project website **www.vattenfall.co.uk/norfolkboreas**. Where a copy of the documents is requested, this can be provided free of charge on a USB device.

Any responses to or other representations in respect of the Project can be made in writing:

1. Addressed to: **FREEPOST NORFOLK BOREAS** (no stamp required)
2. By email to: **info@norfolkboreas.co.uk**
3. Through completion of a consultation feedback form available at public events noted on this page, drop in locations, and on the Project website **www.vattenfall.co.uk/norfolkboreas**

If you have queries about the consultation process, please call our Freephone number **0800 019 3517** for clarification.

Any response or representation in respect of the proposals DCO must (i) **be received before 11.59pm on 9th December 2018** (ii) state in writing the grounds of the response or representation (iii) indicate who is making the response and representation, and (iv) include an address to which correspondence relating to the response or representations may be sent.

Your comments will be analysed by the Applicant and any appointed agent of the Applicant. Responses may be made public, although personal information will be removed. Personal information that is supplied to Norfolk Boreas Limited (NBL) in connection with its Development Consent Order application and proposals will be treated confidentially and processed and handled in accordance with the Data Protection Act 1998 and the GDPR 2018. The information may be disclosed to or shared with NBL connected companies, agents, contractors and advisors who provide services to NBL in connection with the Development Consent Order application.

**The deadline for comments is 11.59pm on the 9th December 2018**

VATTENFALL

**You can get in touch in a number of ways:**

- Give us your views on the feedback form.
- You can write to us at **FREEPOST NORFOLK BOREAS**
- All of the information here today is available on our website. You can register your interest in the project via **www.vattenfall.co.uk/norfolkboreas** to receive project news.
- Email us **info@norfolkboreas.co.uk**
- Phone us **0800 019 3517**