Norfolk Vanguard Offshore Wind Farm

Consultation Report

Appendix 20.9 Consultation Summary Document

Applicant: Norfolk Vanguard Limited
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Pursuant to APFP Regulation: 5(2)(q)

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Author: BECG

Photo: Kentish Flats Offshore Wind Farm

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VATTENFALL

You can get in touch in a number of ways:

- Give us your feedback on the questionnaire.
- You can write to us at **Norfolk Vanguard and Norfolk Boreas, The Union Building, 51-59 Rose Lane, Norwich, Norfolk, NR1 1BY**
- All of the information here today is available on our website. You can register your interest in the project via **www.vattenfall.co.uk/norfolkvanguard** to receive project news.
- Email us **info@norfolkvanguard.co.uk**
- Phone us: **01603 567995**

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INTRODUCTION

Under the Planning Act 2008, Nationally Significant Infrastructure Projects (NSIP) – major developments in England and Wales such as large transport or energy generation projects – need to seek a Development Consent Order (DCO) in order to be built and operate.

Norfolk Vanguard Limited (NVL) a company wholly owned by Vattenfall Wind Power Limited (Vattenfall) is seeking a DCO which would permit the development of Norfolk Vanguard Offshore Wind Farm in the Southern North Sea. The Norfolk Vanguard Offshore wind farm could accommodate an installed capacity of up to 1800 megawatts (MW), which could generate enough electricity for the domestic needs of around 1.3 Million homes.[1]

The DCO would authorise the construction, operation and maintenance of the proposed offshore wind farm, which would be 47km from the coast of Norfolk at its closest point to land and would cover a total area of up to 592km^2, along with all associated infrastructure including a grid connection. Norfolk Vanguard is an Environmental Impact Assessment (EIA) development and so NVL will prepare an Environmental Statement to accompany the application to the Planning Inspectorate.

NVL 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, however prior to submission of an application to the Planning Inspectorate (PINS), we are consulting the local community and stakeholders to help us refine our final proposals.

This document contains:

- Information about Vattenfall
- An overview of the consultation processes and the DCO process
- A description of the Norfolk Vanguard project
- 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 the consultation and make your views known

Between October 2016 and August 2017, we have held twenty exhibitions and workshops and talked directly to more than 1,850 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 2018.

Ruari Lean, Norfolk Vanguard 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; cable relay stations if required; the cable corridor, 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 Assessments (EIA) that along with consultation have helped shape the project proposals. 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 understanding 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/norfolkvanguard**.

We have also posed a number of questions throughout this document, which relate to the questions on our feedback questionnaire. This will help to provide information for you to consider as you complete your questionnaire.

ABOUT VATTENFALL

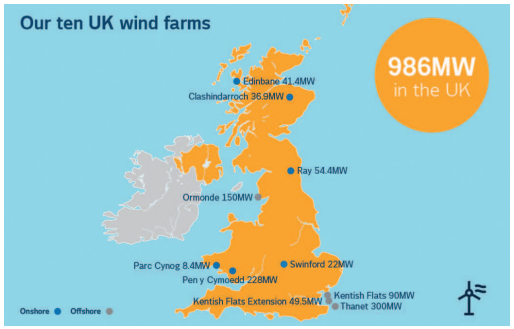
Vattenfall's key drivers in the UK are providing cost effective energy security for the UK, reducing greenhouse gas emissions, and maximising economic opportunities through investment in the UK.

Vattenfall is 100% owned by the Swedish state and is one of Europe's largest energy providers, operating in Sweden, Denmark, Finland, Germany, the Netherlands, Poland, and the United Kingdom, with more than 28,000 employees.

The world is in urgent need of finding alternative, cleaner ways of powering and heating homes, industries and cities, and our purpose is to power 'Climate Smarter Living'. To achieve this Vattenfall plans to invest €5bn in renewables, mainly offshore wind, in Northern Europe by 2020 with an overall ambition to have 4GW of operational capacity by 2020 and 7GW by 2025. Our goal is climate neutrality by 2050, and by 2030 in the Nordic countries.

Vattenfall operates electricity distribution networks in Sweden and Germany and is developing smart grid solutions to ensure security of supply. We are one of Europe's largest producers and distributors of district heating. Vattenfall offers energy services, such as charging solutions for electric vehicles, solar panels, heat pumps and smart control of energy consumption.

To achieve our goals, we are innovating, particularly in key areas such as offshore wind, district heating, decentralised generation and distribution and electrification.



DELIVERING MORE THAN JUST RENEWABLE ENERGY

Every development and operating wind farm is unique, and at each, we strive to ensure our operations are sustainable developments, delivering local, regional, as well as global benefits. Here are some examples of what we mean:

Pen y Cymoedd Onshore Wind Farm – 228MW installed capacity

- ✓ £3 million Habitat Management Plan –upland restoration – from peat bogs, to heathland, grassland, and native woodland (the largest peatland restoration project in South Wales)
- ✓ Construction partnership Jones Bros & Balfour Beatty winners of 2016 Considerate Constructors Awards:
  - "Significant engagement with the local community throughout the project has been continually surpassed"
  - "Site inductions, supplemented by toolbox talks, reinforce an awareness of specific environmental issues among the workforce"

Major boost to Wales' economy

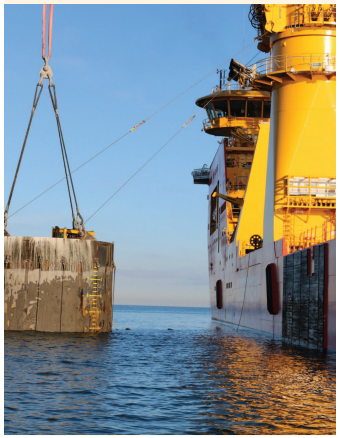
- ✓ Power to 188,000 homes – equivalent to 15% of households in Wales
- ✓ Carbon footprint pay-back by 2020 (less than two years after completion of construction)
- ✓ Innovation – Renewable energy park with an Enhanced Frequency Response battery helping to regulate fluctuations in our National Power network.

Vattenfall's wind farms in numbers

United Kingdom 396MW
Denmark 246MW
The Netherlands 281MW
Sweden 257MW
Germany 19MW

United Kingdom 590MW
Denmark 158MW
The Netherlands 108MW
Sweden 121MW
Germany 636MW

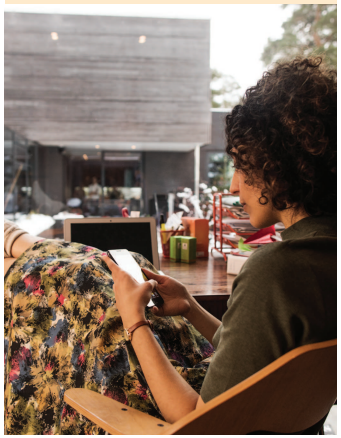
The European Offshore Wind Deployment Centre (EOWDC) located in Aberdeen Bay, is Scotland's largest offshore wind test and demonstration project, to be commissioned in 2018. Innovations tested and demonstrated here lead to increased annual energy production, reduced capital and operating expenditure, and contribute to lowering the offshore wind industry's Levelised Cost of Energy (LCOE). Also attached to EOWDC is a €3 million fund to support research into the socio-environmental impacts of offshore wind, and how negative impacts can be avoided. Studies currently underway include research into marine ornithology, bottlenose dolphins, salmon & sea trout, and socio-economic uplift associated with offshore wind farm projects.



Powerpeers: a digital, interactive marketplace where supply and demand for self-generated energy come together.

Our social media energy platform and the world's first digital peer-to-peer marketplace was launched in the Netherlands in 2016 as a start-up by Vattenfall. This platform is designed to give everyone access to local renewable energy generation. Households can exchange energy in a fun way directly with their friends, neighbours and even their local school.

Consumers can create their own personal energy community by managing their lists of producers, monitoring how much energy they source from whom and when.



Wireless charging Our first wireless bus stop charging station in Sweden is now in operation. The bus parks over a hidden charging segment in the road. 7 minutes of wireless charging is enough to run the bus for its entire route. It uses wireless inductive charging technology to charge the hybrid bus while it is stationary at its terminus.

The project is a joint venture between Vattenfall, Scania, the Royal Institute of Technology (KTH), the local authorities and the public transport company SL.

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

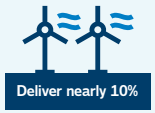
To avoid these effects, UK government has set legally binding emissions reductions targets.

Rt Hon Greg Clark MP, Secretary of State for Business, Energy and Industrial Strategy

"The low carbon economy could grow 11 per cent per year between 2015 and 2030, four times faster than the projected growth of the economy as a whole."

Source: https://www.gov.uk/government/news/government-reaffirms-commitment-to-lead-the-world-in-cost-effective-clean-growth

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



of the UK offshore wind cumulative deployment target for 2030

(as recommended by the Committee on Climate Change in the 5th Carbon Budget)

Prevent more than 2,000,000 tCO_2 from entering the atmosphere

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)

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.

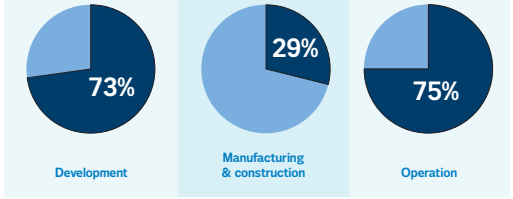
supported and a 0.6% increase in Gross Domestic Product (GDP) delivered by 2030

(Centre for Economics and Business Research, 2012)

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 (OWF) was spent in the UK, and new projects are required to achieve over 50% UK content in 2015.

UK content in different parts of OWF lifetimes (RenewableUK, 2017).



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) in order to secure supply chain and other employment opportunities in the UK, including during the manufacturing and construction of OWF.

Isn't offshore wind expensive?

Costs 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.

Please tell us your views on offshore wind and its role in the UK's energy mix?

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 Industry Strategy (BEIS). Consequently, an Environmental Impact Assessment (EIA) is required as part of a Development Consent Order (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 16th October 2017 and can be viewed on the project website **www.vattenfall.co.uk/norfolkvanguard**.

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 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 (PINS) 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 PINS 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.

Examination

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

Recommendation to the Secretary of State

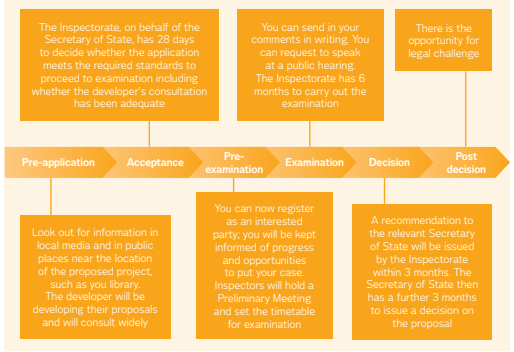
The Planning Inspectorate will then make a recommendation, in the form of a Report, to the Secretary of State for BEIS who will make the decision on whether or not to grant a DCO for the Project.

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/**

The application process – The six steps



Oyster fishermen in the vicinity of Vattenfall's Kent cluster of offshore wind farms

EARLY PROJECT DEFINITION, SITE SELECTION & REFINEMENT

When designing a new offshore wind farm some early decisions form the basis of what then continues as a more iterative refinement process.

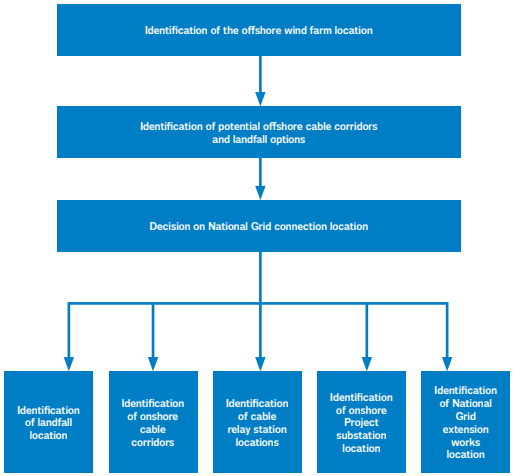
Fundamental and early decisions are made at a nationally strategic level – the selection of large areas of UK seabed which are suitable for developing offshore wind farms, for example. Norfolk Vanguard is located in one of these areas, identified by The Crown Estate as part of a programme called 'Round 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. Norfolk Vanguard Limited (NVL) was awarded an Agreement for Lease (AfL) for the areas within which it will develop Norfolk Vanguard in 2016. Site selection with the Round 3 zones was based on strong wind resource, suitability of seabed and a range of environmental considerations.

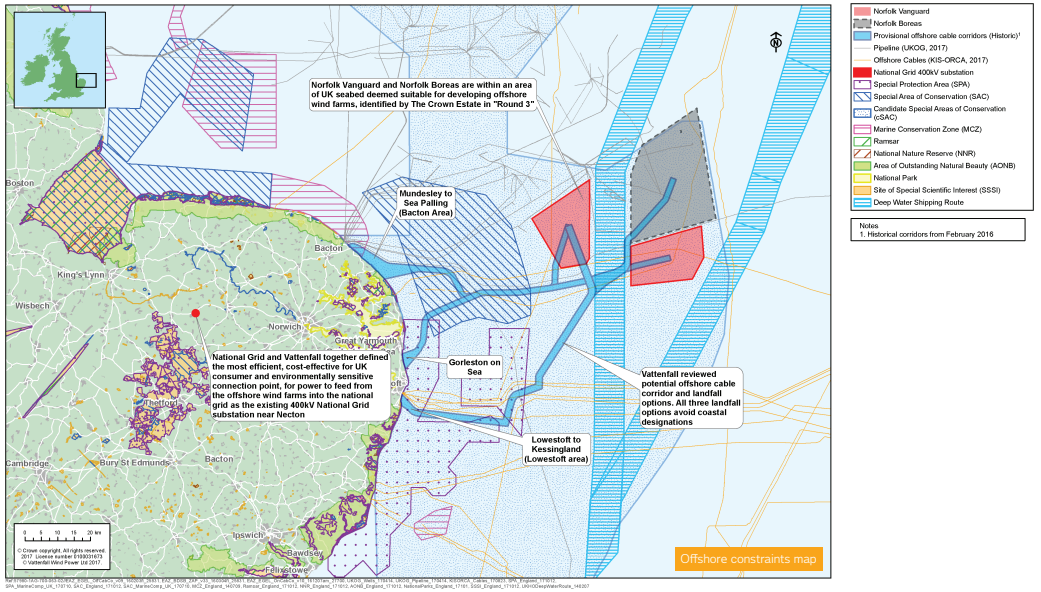
Next followed a review of potential offshore cable corridor and landfall options – defined by existing constraints and opportunities. Understanding possible landfalls helped to define the scope of investigations involving National Grid and NVL as to the appropriate strategic, economical and efficient location for power generated by Norfolk Vanguard to connect into the National Grid's transmission network.

With these endpoints 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 (see page 15) e.g. NVL 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 to minimise impacts, cost and transmission losses by minimising footprint for the offshore and onshore cable routes;
- 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, including retaining options for both HVAC technology and HVDC technology to be deployed).





ENVIRONMENTAL IMPACT ASSESSMENT ~ WHAT IS IT, WHAT IS ITS ROLE 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 Regulations explain that the EIA should describe those: "...aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors." and that those environmental resources that are "likely to be significantly affected by the development" should be identified and assessed in detail.

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 environmental impacts. At this stage, we are consulting on the Preliminary Environmental Information (PEI). This document helps you get 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 which will accompany the application for a Development Consent Order.

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 Environmental Statement (ES), to PINS in 2018 as part of the Development Consent Order (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 severe by encompassing solutions to issues within the project design. There are two main ways in which this is done:

- Site selection (to avoid key designated or sensitive areas); 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 mitigation measures that are identified during the EIA process specifically to reduce or eliminate any predicted impacts, may subsequently be adopted as project commitments.

Technical and Community Consultation

A key aspect of the EIA process is early engagement and consultation in the development of the Project. In determining the scope of the assessments for this Project, a scoping exercise was completed early in the process, the results of which guided the approach to Environmental Impact Assessment. Consultation has continued with consultees throughout the process. Two stages of engagement with the local community have been undertaken during the preparation of the Preliminary Environmental Information, the results of which have informed the scope of the assessment work and consideration of design principles and possible mitigation measures.

In addition to consultation with local communities and key stakeholders (including Parish and Town Councils, District and County Councils, elected representatives and others) the project team have held meetings with experts from statutory organisations throughout the planning process of the project, to discuss and agree all areas where environmental issues may occur. As part of this process, planned research and surveys have been agreed to ensure the correct and relevant information is being collected. This type of consultation is known as the Evidence Plan Process (EPP) as it focusses on the evidence and information required to enable a robust assessment of the impacts of the project.

ABOUT THE PEIR

The PEI reports the preliminary findings of the EIA completed to date.

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

Key steps in the EIA Process

In line with this process, the assessment of the Project identifies:

- Collection and collation of existing baseline information, plus original surveys to fill any gaps in knowledge or to update any historic information
- Consultation with experts and relevant consultees to define the scope of the assessment and study area and to consider emerging study findings
- Consideration of the potential effects of the project on the baseline conditions, and design work to look to avoid or reduce any predicted significant effects
- Engagement with other topic specialists and engineers/designers to look to optimise the design and identify any appropriate mitigation measures
- Assessment of the scheme design and evaluation of remaining significant effects after mitigation measures have been implemented: and
- Compilation of the assessment chapter

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 Vanguard 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, 2012) 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.

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

- Build-out scenarios/ phasing options to enable NVL 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 2024;
- High Voltage Alternating Current (HVAC) and High Voltage Direct Current (HVDC) power transmission options to enable competitive procurement and the most cost effective system to meet government objectives on the lowest cost of energy for UK consumers; and
- Construction, operation and maintenance methodologies to enable competitive procurement and the most cost effective option to be adopted.

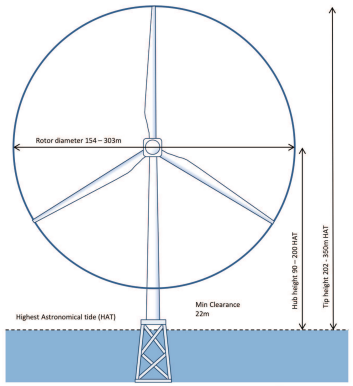
Factors where flexibility is required include:

Phasing the construction

Norfolk Vanguard Ltd is currently considering constructing the project in a single phase of up to 1800MW, or two phases of up to 900MW, or a three phased approach of up to 600MW.

Turbine size

Between 90 and 257 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 7MW of power.



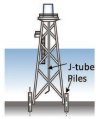
Schematic illustrating the maximum turbine dimensions

Foundations

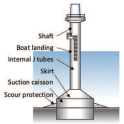
There are many possible foundation types currently available or under design to support offshore wind turbines and/or offshore platforms. The foundation type used will be determined by a number of constraints including: ground conditions, water depths, turbine model used, wind conditions and market options. 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;
- Quadropod and tripod – jacket foundations with either three or four feet attached to the seabed with either 3 or 4 suction caissons or piles;
- Suction caissons – cylindrical tubes which are installed by reducing the pressure inside the tube to draw the caisson into the seabed;
- Monopiles – large cylinders which are hammered into the seabed; 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.

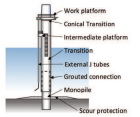
Typical gravity based structure



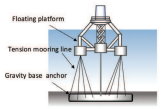
Typical jacket structure



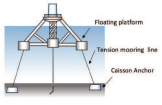
Typical suction caissons



Typical monopile structure



Typical tension leg floating foundation with gravity anchor



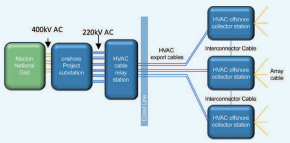
Typical tension leg floating foundation with piled or suction caisson

HVAC vs HVDC

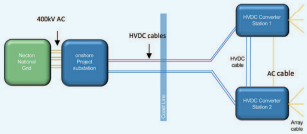
We are looking at deploying either Alternating Current (AC) or Direct Current (DC) transmission systems. Both provide viable, innovative solutions in terms of technological readiness, cost-effectiveness and supply chain capability. The AC solution uses well established technology that can be sourced from a broad range of suppliers; the DC option uses technology that has been developed relatively recently and is only offered by a small number of suppliers worldwide. In terms of impacts, the two options are quite different from each other: DC cables can transmit more power over long distances than AC cables, so the HVDC solution only requires two cable-pairs (4 cables in total (2 per trench, 2 trenches)) to transmit 1800MW of power, whereas the HVAC solution requires up to six three-cable circuits (18 cables in total (3 per trench, 6 trenches)). In addition, the HVAC solution involves the construction of a 'cable relay station' close to the cable landfall, in order to boost efficiency; this is not needed for the HVDC solution. Both solutions involve the construction of a large electrical substation close to the Necton National Grid Substation; although the land 'footprints' are similar for both options, the converter buildings that are needed for the HVDC option will be significantly larger and taller than any of the equipment that is required for the HVAC solution.

The DC option presents challenges in terms of the resilience of the energy export system and the potential impact of cable failures. For the AC solution, the impact of a failure of one cable is relatively small; in contrast for DC a failure of one cable will restrict the power output of the wind farm to around 50% of its installed capacity. As we want to support the UK drive toward low cost, secure, fossil fuel free electricity the loss of 50% production could have a noticeable impact on those nationally important aims.

Maximum Requirements HVAC



Maximum Requirements HVDC



THE NORFOLK VANGUARD OFFSHORE WIND FARM PROPOSAL

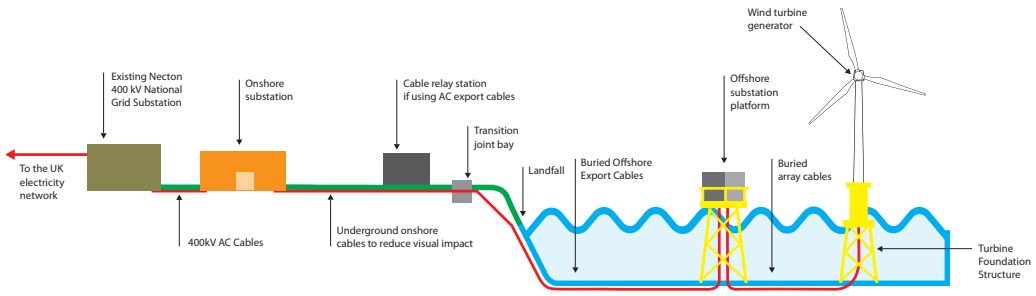
The wind farm itself comprises two distinct areas, Norfolk Vanguard East (NV East) and Norfolk Vanguard West (NV West), within which wind turbines would be located. The offshore wind farm comprises the following:

- 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)

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;
- A cable relay station, (only required if an HVAC solution is chosen);
- 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 2020 and 2021 for the onshore works, and around 2023 for the offshore works. Onshore constructions would likely be completed by 2026 under the longest, three phase build scenario. 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.



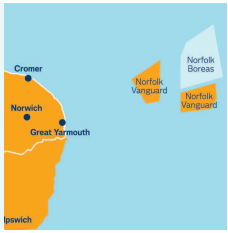
The proposed DCO would, amongst other things, authorise **offshore components** including:

1. Between 90-257 wind turbine generators ("WTGs")	Each WTG would have a capacity of between 7-20MW, a maximum turbine hub height of 198.5m, a maximum rotor diameter of 303m and a maximum tip height of 350m
2. Offshore Substation Platforms ("OSPs")	Up to three OSPs, which may employ either high voltage alternating current ("HVAC") or high voltage direct current ("HVDC") technology
3. Offshore Accommodation Platforms ("OAPs") or Offshore Accommodation Vessels ("OAV")	These will provide areas for accommodating construction and operational workers at the wind farm
4. Foundations for the WTGs and OSPs	There are a number of potential foundation types that could be used and the Project may require more than one type (explained further on page 16)
5. Up to 514km array 66kV cables	To link WTGs to the OSPs within the array
6. Up to 640 km offshore export cables from the OSPs to the shore	To transmit electricity from the array to the shore
7. Scour protection, as required for foundations and cables; and	To protect the offshore infrastructure from seabed erosion
8. Up to two meteorological masts, a number of guard buoys and monitoring equipment.	As required to monitor and demarcate the offshore site

Norfolk Boreas

Norfolk Boreas is Norfolk Vanguard's sister project and is being developed approximately 1 year later. Proposals continue to be refined through Norfolk Boreas' Environmental Impact Assessment (EIA) process. We are applying to install some shared infrastructure (such as cable ducts) for Norfolk Boreas within the Norfolk Vanguard DCO application in order to minimise environmental impacts.

Norfolk Boreas will be submitting its DCO application in Q2 2019. Find out more at **www.vattenfall.co.uk/norfolkboreas**.



The key **onshore components** would, amongst other things, comprise the following:

1. Landfall site	To bring ashore the offshore cables and connect to the onshore cables requiring up to six transition pits
2. If HVAC	Up to 18 no. onshore underground cables within separate ducts in six separate trenches (i.e. three cables per trench) and up to six fibre optic cables (i.e. 1 per trench)
3. If HVDC	Up to four onshore cables each in separate ducts in two trenches (i.e. two cables per trench) and up to two fibre optic cables (i.e. 1 per trench)
4. Onshore cable corridor	Within which onshore export cables, including for the Norfolk Boreas Offshore Wind Farm Project, will be laid within cable ducts
5. Link boxes and jointing pits	At intervals along the cable route
6. Trenchless crossings	(for example horizontal directional drilling, cable bridges or other trenchless methods) at some roads, railways and sensitive habitats
7. Cable relay station (CRS)	Only required under the HVAC electrical solution
8. Onshore Project substation	In proximity to the grid connection location at the existing Necton 400kV National Grid Substation
9. Modification of the existing overhead line network	In the vicinity of the Necton 400kV National Grid substation
10. Extension to Necton 400kV National Grid Substation	To accommodate the new project
11. Up to 12 no. 400kV underground interface cables	Between the new onshore substation and the existing 400kV National Grid Substation near Necton
12. Temporary construction areas and access roads	Throughout construction period
13. Planting to provide screening for permanent infrastructure	As part of the mitigation works

In addition we are seeking the permanent and/or temporary compulsory acquisition (if required) of land and/or rights for the proposed Project; overriding of easements and other rights over or affecting land for the proposed Project alongside the application and/or disapplication of legislation relevant to the proposed Project including inter alia legislation relating to compulsory purchase; and such ancillary, incidental and consequential provisions, permits or consents as are necessary and/or convenient.

OFFSHORE ELEMENTS OF THE PROPOSAL

We have run 7,700 km of geophysical surveys over Norfolk Vanguard, taking 163 days.

The data from Norfolk Vanguard surveys is available in the Preliminary Environmental Impact Report.

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

Marine Geology, Oceanography and Physical Processes

Marine Water and Sediment Quality

Benthic and Intertidal Ecology

Fish and Shellfish Ecology

Marine Mammal Ecology

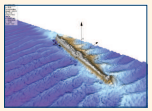
Offshore Ornithology

Commercial Fisheries

Shipping and Navigation

Aviation and Radar

Offshore and Intertidal Archaeology and Cultural Heritage



At landfall, we will place the cables in ducts 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.

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 Site of Community Importance 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.

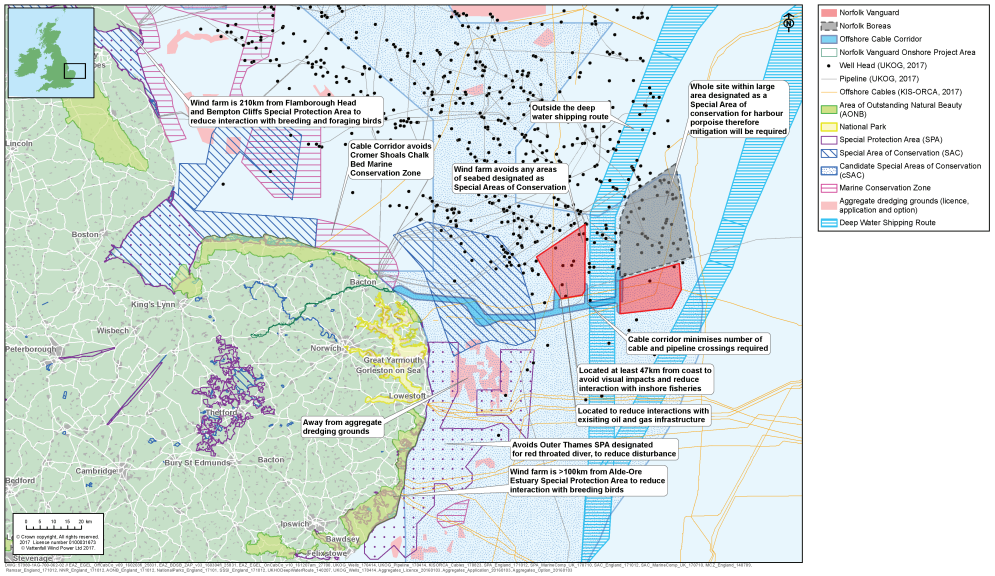
Since September 2015, aerial surveys have assessed bird and marine mammal numbers using or passing through the Project site. We will work with regulators to agree suitable mitigation for potential impacts; and with other offshore wind developers to understand and manage the cumulative impacts where possible.

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. A working group involving research teams from the Ancient Human Occupation of Britain and Pathways to Ancient Britain aims to ensure that EIA data is published and contributes to wider understanding and knowledge.

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



To what extent do you agree we have considered all topics relevant to the offshore elements of the proposal?

Are there any specific factors you would suggest we consider in order to minimise impacts on other marine users, including commercial fishing, shipping, recreational sailing, any other?

Are there any specific factors you would suggest we consider in order to minimise impacts on the natural or historic environment, including for example ornithology, marine mammals, marine archaeology?

ONSHORE ELEMENTS OF THE PROPOSAL

We have refined our onshore search areas for the landfall location, cable relay station location, onshore cable corridor and onshore Project substation location, based on ecological surveying that has progressed over the course of 2017, 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

Health impact review

Landscape and visual impact assessment

Tourism and recreation

Ground conditions and containment

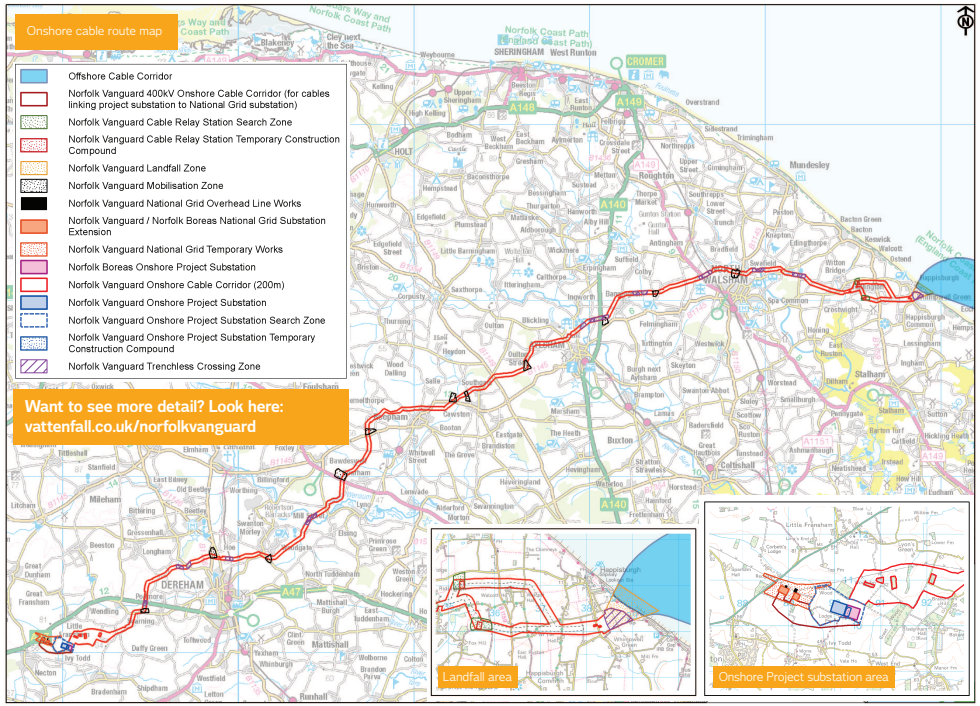
Air quality

Water resources and flood risk

Socio-economics

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

To what extent do you agree we have considered relevant topics relating to the onshore elements of the proposal?



LANDFALL

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)
- It supports appropriate options for siting of CRS (if required) in relatively secluded sites, with good access and natural screening and topographic characteristics that we can work with to help minimise visual and noise impacts

The Landfall search zone has been refined to a subarea of the previously identified Happisburgh South landfall option which excludes 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 compound will be micro-sited over the coming months, 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 have undertaken 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.

Over the coming months we will be conducting geophysical surveys 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 two to nine months depending on the transmission technology (HVAC or HVDC) and the required length of the drill. 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 haul road with direct access from Whimpwell Street or via side accesses from Rollesby Way or School Common Road.

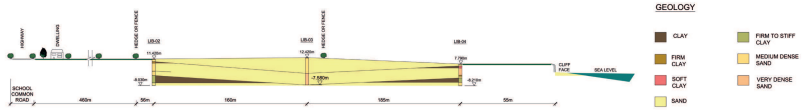
Norfolk Boreas landfall installation would not be conducted at the same time as Norfolk Vanguard works.

In the case of a long HDD, the installation process for the ducts and cables would not involve any works taking place on the beach. However, in the case of a short HDD there would be beach works at several stages in the process. During these operations, public access to the beach will be restricted as follows:

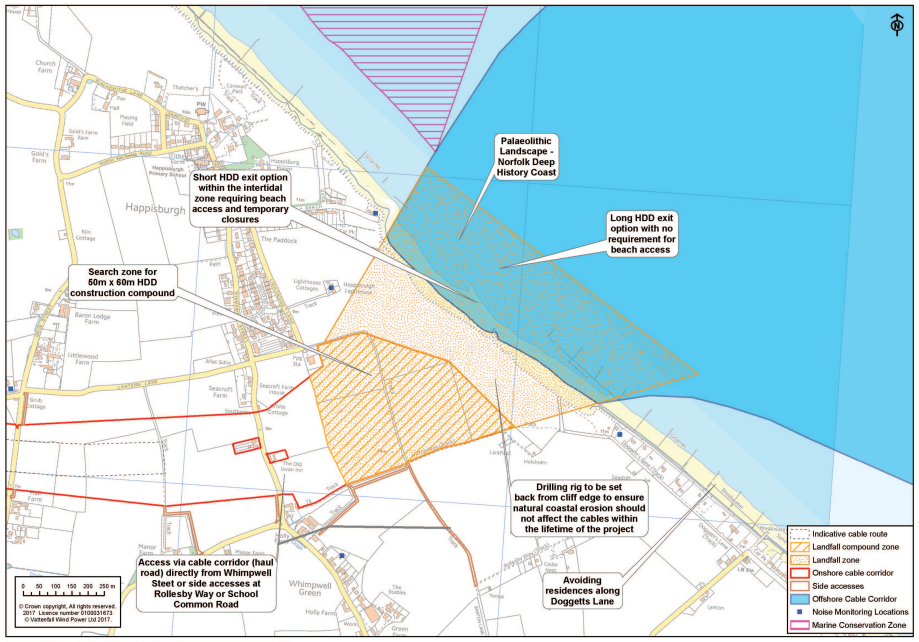
- During the drilling operation, a fenced-off working area would be established at the drill exit point. A fenced vehicle access route to this location would also be required. Most of the beach would remain accessible to the public.
- During the duct installation stage, the fenced-off area would be extended to seaward, to provide a working corridor for the duct pulling operation.
- After duct installation, the seaward end of the duct would be capped and buried, and the beach reinstated. No access restrictions would be required in the intervening period up to cable installation.
- During the cable installation stage, the fenced-off working area would be re-established on the beach, extending from the seaward end of the duct out to the low water mark.

Avoiding exacerbating coastal processes

The preferred landfall site lies to the south of Happisburgh in an area fronted by unprotected cliffs which are eroding. The proposed HDD drilling compound and transition pit 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.

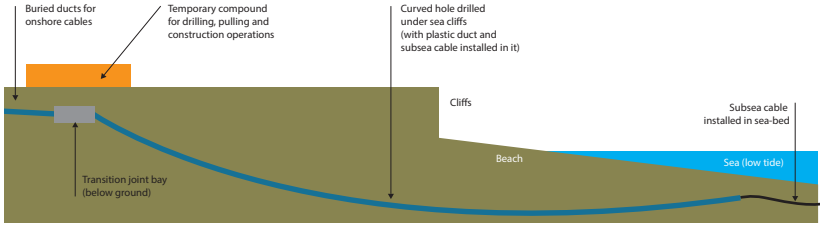


Geological Cross section based on site investigation drilling at Happisburgh in Summer 2017. The Cromer Forest Bed was not encountered in these bore holes.



BRINGING POWER ASHORE AT LANDFALL ~ HOW IS THIS ACHIEVED?

At the landfall, we will use a trenchless method – known as Horizontal Directional Drilling (HDD) – to install a series of 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 two to nine months, depending on the technology we deploy (HVAC or HVDC) to transmit power and the length of the drill required.



Sequence of operations:

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

Horizontal directional drilling unit (HDD), showing the drill rig and drilling pipes.

Horizontal directional drilling outfall. The image shows preparations on the beach to excavate the HDD exit.

These images show HDD significantly closer to the shoreline than we consider appropriate for Norfolk Vanguard and Norfolk Boreas.

Transition joint bay. This is the onshore cable running up to the transition joint bay (concrete floor). The next step will be pulling the offshore cable into this location for the joint to be made. This arrangement is a concrete floor only design, with temporary shuttering to the sides. The alternative is a fully concreted box with concrete sides.

Are there any specific factors you would suggest we consider when micro-siting the drilling compound?

Are there any factors you would like us to consider as we seek to reduce any temporary impacts of landfall (HHD) works?

Do you have any general comments regarding Landfall in terms of siting, environmental considerations, timing and management plans for the works?

CABLE RELAY STATION (CRS)

The purpose of a CRS is to maximise the efficiency of power transfer from the offshore wind farm to the National Grid at Necton. A CRS would only be required if it is necessary to deploy a HVAC transmission system (see page 16).

The CRS will comprise six electrical reactors, one for each of the cable circuits, associated electrical switches and connections and a control building.

The electrical equipment within the CRS will make noise, however our final design will meet the rigorous standards of low noise emissions expected by the UK regulatory bodies and stakeholders. Noise reduction technology and embedded mitigation is considered within the PEIR. Mitigation options to meet the required low noise emissions could include a combination of noise barriers, bunds, enclosures, site layout and plant selection at procurement stage. An example of an acoustic noise enclosure (for example to enclose reactors) is shown here.

The Cable Relay Station will comprise a fenced compound containing electrical plant (reactors and switchgear). There will also be a control building next to the compound.

- The main compound dimensions are expected to be 135m x 75m.
- The maximum height of the equipment is expected to be 8m.

The Cable Relay Station needs to be located on the onshore underground cable route, within a few kilometres of landfall. We are planning to select a preferred site following this statutory consultation.

Construction of the Cable Relay Station 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 two or three 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.

Construction traffic is proposed via the B1159. HGVs will be diverted around residential areas of North Walsham. For local roads construction traffic will avoid school arrival/departure times and employ enhanced construction traffic management plan procedures agreed with Norfolk County Council.

During operation, the site will normally be unstaffed and not-lit. Occasional visits will be made to carry out inspection and maintenance activities.

CABLE RELAY STATION

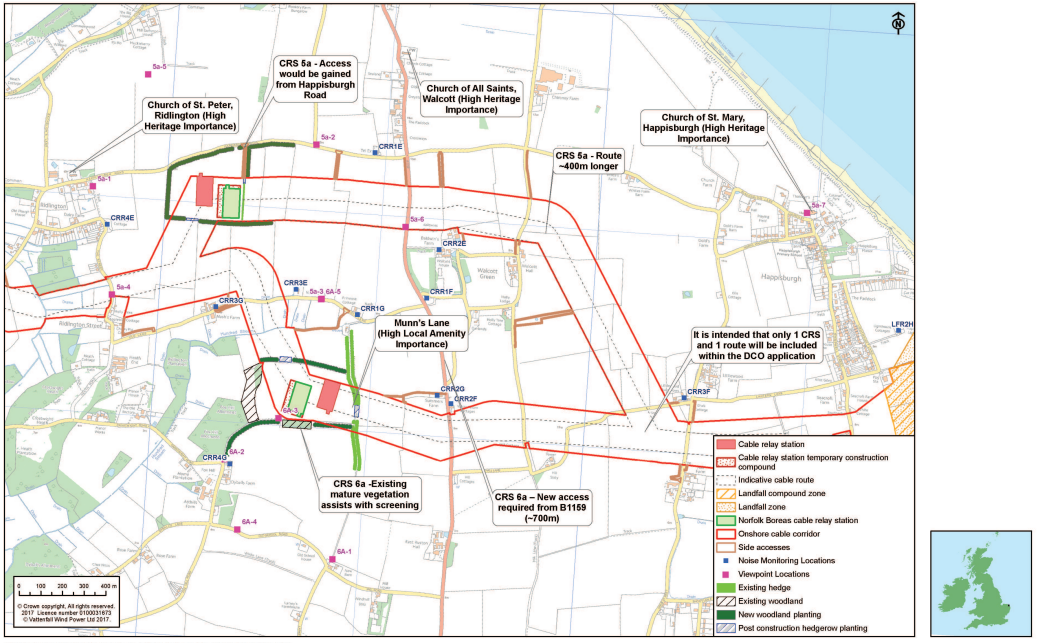
CRS 5a and 6a

The CRS search zone has been refined to two locations west of Walcott Green. Only one location will be included within the final planning application (DCO submission).

There are separate cable corridors associated with the two CRS sites which also require consideration.

Each site has relative pros and cons when considering different criteria.

	CRS 5a	CRS 6a
Cable Route	Additional 400m length of cable route compared to CRS 6a. However desktop analysis suggests potentially less archaeological risk and reduced (-2) number of track crossings (namely Munn's Lane and Nash's Lane).	Cable route length minimised by 400m. However, desktop analysis suggests potentially more archaeological risks and additional track crossings of Munn's Lane and Nash's Lane.
Access	Directly accessible from North Walsham Road in close proximity to B1159	Would require 0.7 km new access to be constructed from B1159, crossing Munn's Lane
Topology	Land is within 2m elevation change, minimising extensive earthworks requirements	
Noise	The closest residential property to CRS option 5a is approximately 425m away. Initial studies of unmitigated designs have indicated that noise mitigation measures will be required. We will continue to explore these mitigation options in order to establish a design that will comfortably meet the rigorous standards of low noise emissions by both the UK regulatory bodies and stakeholders.	The closest residential property to CRS option 6a is approximately 325m away. Initial studies of unmitigated designs have indicated that noise mitigation measures will be required. We will continue to explore these mitigation options in order to establish a design that will comfortably meet the rigorous standards of low noise emissions by both the UK regulatory bodies and stakeholders.
Visual	CRS 5a would be visible from Happisburgh Road to the north, Nash's Lane to the south, the north-east corner of Ridlington to the east and surrounding Public Rights of Way. CRS 5a would be seen in an open field with some screening from hedgerows. Proposed planting around CRS 5a would help to gradually screen it, such that after 15 years visibility would be notably reduced.	CRS 6a would be visible from Munn's Lane to the east, parts of Nash's Lane to the north, parts of Old School Road to the south and Public Right of Way East Ruston FP16 from Fox Hill to Munn's Lane. CRS 6a would be located in a field but with mature trees to the south and mature hedgerow to the east providing screening to start with. Proposed planting around CRS 6a would help to gradually screen it further, such that after 15 years visibility would be notably reduced.
Heritage Setting	Heritage settings assessment is ongoing. However, at this stage heritage setting effects and considerations are anticipated to be more complex at CRS 5a compared to CRS 6a. Given the nature of the Cable Relay Station structure, opportunities for effective mitigation, associated with this location, should still be feasible. Further assessment beyond PEI will further establish the situation and recommend appropriate approaches and options moving into the DCO application.	Heritage settings assessment is ongoing. However, at this stage heritage setting effects and considerations are anticipated to be fewer and more straight forward at CRS 6a compared to CRS 5a. This is in part due to the presence of existing natural screening. Given the nature of the Cable Relay Station structure, opportunities for effective mitigation, if required, associated with this location, should be feasible. Further assessment beyond PEI should help establish this.
Archaeology	Desk Based review and Aerial Photographic assessment suggests potentially less archaeological risk with the location of CRS 5a (and associated temporary construction compound) itself when compared to CRS 6a. However, the associated cable corridor options both appear to provide likely interactions with (i.e. the strong likelihood of encountering) archaeological remains. As a next step, this will be further corroborated by the programme of priority archaeological geophysical survey currently underway across targeted locations of the onshore project area.	Desk Based review and Aerial Photographic assessment suggests potentially greater archaeological risk with the location of CRS 6a (and associated temporary construction compound) itself when compared to CRS 5a. However, the associated cable corridor options both appear to provide likely interactions with (i.e. the strong likelihood of encountering) archaeological remains. As a next step, this will be further corroborated by the programme of priority archaeological geophysical survey currently underway across targeted locations of the onshore project area.



Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas cable relay stations (Option 6a) from Nash's Lane without mitigation planting

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas cable relay stations (Option 6a) from Nash's Lane after 15 years of mitigation planting

The photomontages shown cover a 90 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.

Are there any specific factors you would suggest we consider when deciding which CRS option would be most appropriate (if required)?

Are there any additional specific measures you would suggest we put in place to reduce any potential traffic issues during construction of the CRS?

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas cable relay stations (Option 5a) from Ridlington Barn without mitigation planting

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas cable relay stations (Option 5a) from Ridlington Barn after 15 years of mitigation planting

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

Do you have any comments regarding the CRS, in terms of siting, environmental considerations, timing and management plans for the works?

Please tell us which you think are the most important views towards either potential CRS site, that we should consider in any mitigation planting scheme to be developed (if required).

UNDERGROUND CABLE CORRIDOR

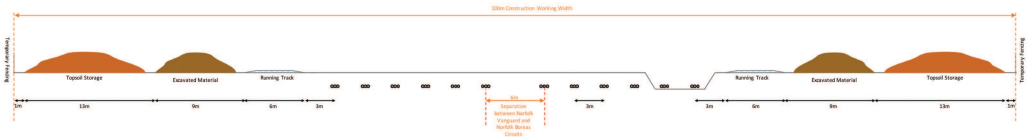
The cable corridor is currently identified as a search area of 200m width within which the maximum 100m working corridor will be sited. Route amendments have been made since March 2017 following consultation with stakeholders and landowners.

- 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 future Norfolk Boreas projects concurrently to minimise impacts and disruption.
- 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 separated) at a later stage, in line with the development of the wind turbines offshore.
- The worst case corridor width is 100m and allows for HVAC connection of both Norfolk Vanguard and Norfolk Boreas.
- 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 corridor.
- 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 100m of trench excavation, duct laying and subsoil reinstatement can be achieved each week, at which point, the construction crews will move onto the next 100m section.
- To achieve the 2 year programme, multiple sections of the route will be worked in parallel from mobilisation areas approximately every 10km 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 haul road required to be temporarily reinstated where local roads are unsuitable to allow delivery of the cables to the jointing locations.
- Irrespective of whether DC or AC cables are used, 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

The onshore cable corridor crosses a number of long distance trails (e.g. The Peddars Way and Norfolk Coast Path), Public Rights of Way, 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.

A Code of Construction Practice 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, PRoW and local footpath networks, sign posting and dissemination of information to the public to minimise all possible impacts to an acceptable level.

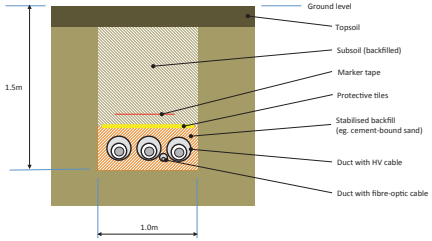


Indicative HVAC Onshore Construction Working Width

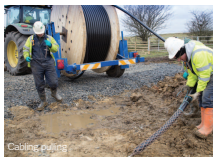
The onshore cable route will extend from the landfall site to the onshore substation, close to Necton. The proposed route is roughly 60km in length, and is largely on agricultural land.

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.

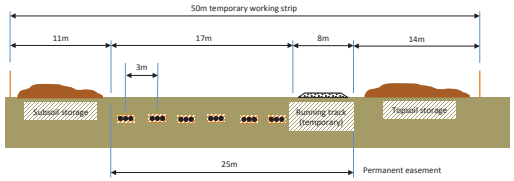
Section of single cable trench (HVAC)



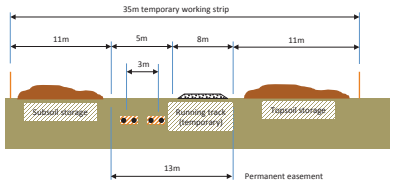

Open trenching

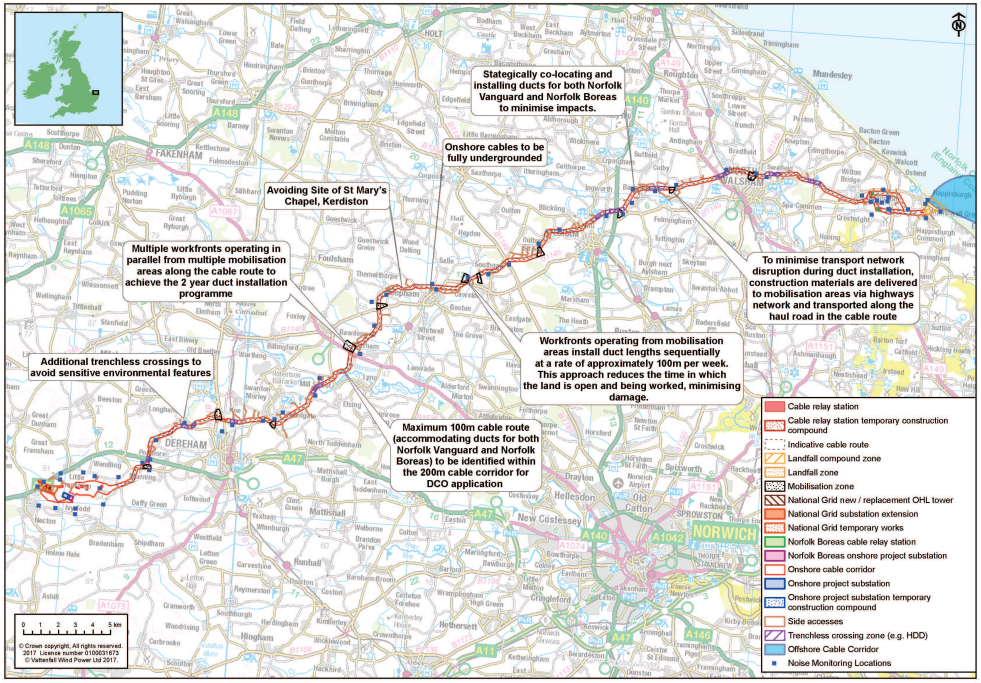

Cabling during

Cable easement (Norfolk Vanguard only) – HVAC solution



Cable easement (Norfolk Vanguard only) – HVDC solution





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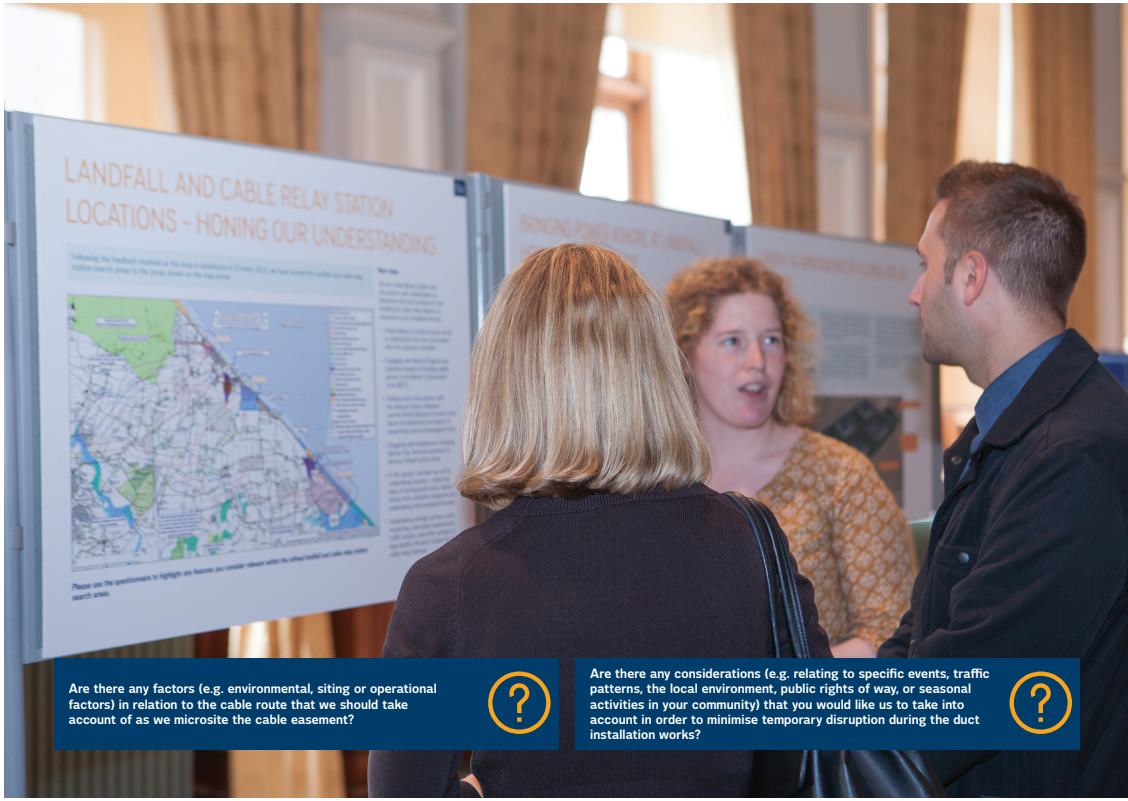


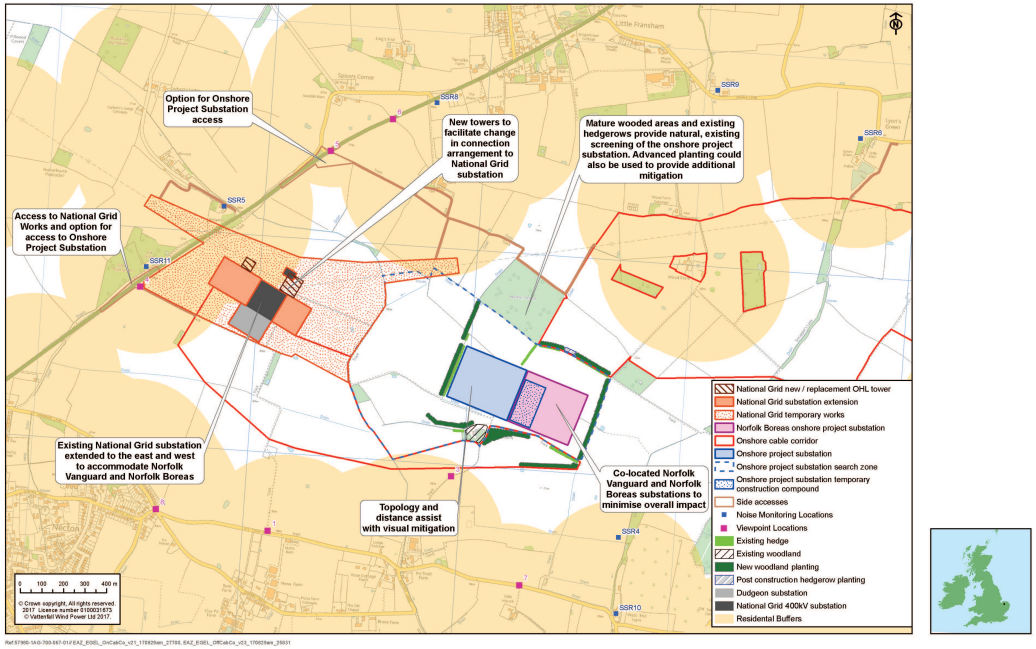
ONSHORE PROJECT SUBSTATION

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) or transform the HVAC transmitted voltage to the appropriate National Grid voltage (for a HVAC connection)
- 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. An example of an acoustic noise enclosure for noise emitting electrical assets is shown on page 28.
- The onshore Project substation will be compliant with the UK exposure limits set to protect members of the public against electric and magnetic fields.

National Grid Extension Works

- Existing National Grid Necton substation is required to be extended to accommodate Norfolk Vanguard connection. Preparatory extension works will also to be conducted for the future Norfolk Boreas connection concurrently.
- The substation extension will be to the east and west of the existing substation for a fenced distance of 130m to the east and 200m to the west at a width of 145m. The tallest structure within the substation will be 15m and similar to the infrastructure installed at the existing substation.
- Existing National Grid 400 kV overhead lines require modification to accommodate the Norfolk Vanguard connection. Temporarily three new towers will be erected 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 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 will be obtained from the existing access to the A47.



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

- The Norfolk Vanguard compound dimension is expected to be 300m x 250m.
- The maximum height of the building is expected to be 15m for the HVAC option, or up to 19m for the HVDC option.

The physical appearance of the substation will depend on the final choice of technology for the offshore transmission system.

In the case of an HVAC solution the compound area will mostly be occupied by outdoor equipment such as transformers and reactors.

In the case of a HVDC solution the substation will comprise two similar HVDC converter stations. Each converter station will have an outdoor AC switchyard and a large converter building.

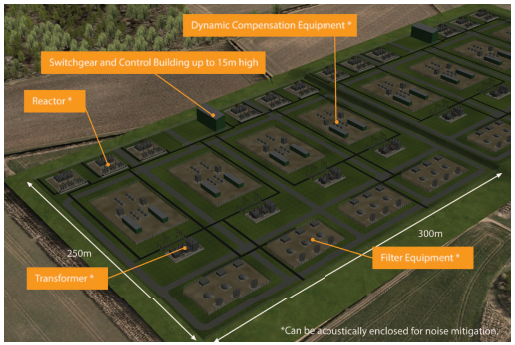
Construction of the substation will involve groundworks to clear and prepare the site, and to establish suitable foundations for the electrical plant and the control building. These groundworks, together with the construction of the building and the perimeter fence, will take around 18 months.

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

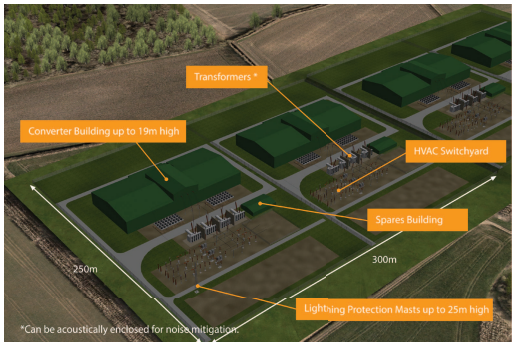
On each occasion, there will be a short period of activity at the site, to bring the new equipment into commission. This activity is expected last for 2-3 months on each occasion.

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

3D visualisation of project substation (HVAC option)



3D visualisation of project substation (HVDC option)



Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas HVAC substations and National Grid substation extension from Lodge Lane south without mitigation planting.

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas HVDC substations and National Grid substation extension from Lodge Lane south without mitigation planting.

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas HVDC substations and National Grid substation extension from Lodge Lane south after 15 years of 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.

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas HVAC substations and National Grid substation extension from Lodge Lane south without mitigation planting (continued).

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas HVDC substations and National Grid substation extension from Lodge Lane south without mitigation planting (continued).

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas HVDC substations and National Grid substation extension from Lodge Lane south after 15 years of mitigation planting (continued).

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.

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas HVAC substations and National Grid substation extension from the A47, Spicer's Corner without mitigation planting.

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas HVDC substations and National Grid substation extension from the A47, Spicer's Corner without mitigation planting.

Photomontage of the proposed Norfolk Vanguard and Norfolk Boreas HVDC substations and National Grid substation extension from the A47 Spicer's Corner after 15 years of mitigation planting.

The photomontages shown cover a 90 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.

Work experience student from Dereham Sixth Form College accompanies onshore ecologists during EIA assessments

Do you have any comments about the onshore Project substation site?

Are there any additional specific measures you would suggest we put in place to reduce any potential traffic issues during construction of the onshore Project substation and the National Grid works?

Please tell us which you think are the most important views towards the onshore Project substation site, and towards the extension to the National Grid substation that we should consider in any mitigation planting scheme to be developed.

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 and CRS, 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.

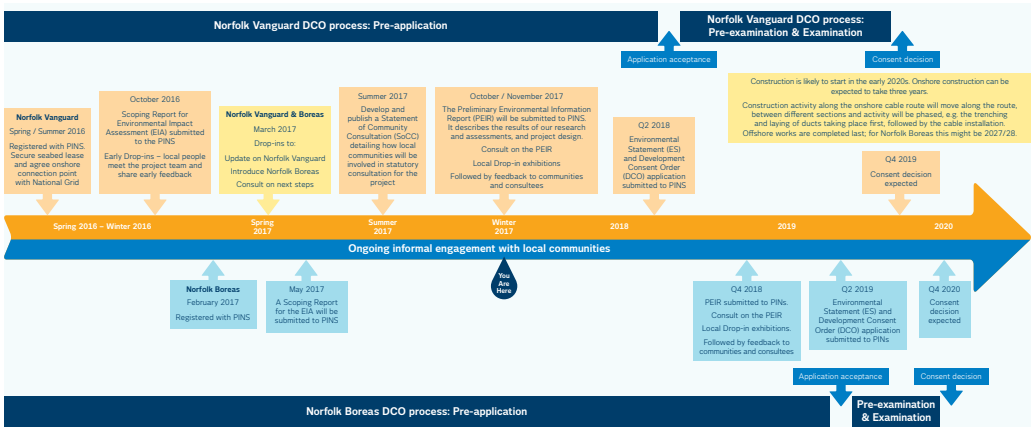
Whilst details regarding the decommissioning of the onshore Project substation and CRS are currently unknown, considering the worst case scenario which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would be similar or less than to those 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 and statutory consultees. The decommissioning works could be subject to a separate licencing and consenting approach.

PROJECT TIMEFRAME

The project is currently at the point of 'formal consultation' on the preliminary environmental information that is available. Following the close of this consultation period at midnight on 11th December 2017 we will be developing our final proposals 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 2018.

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 Boreas is also mapped out to provide context to both projects' next steps.



WHAT KIND OF LOCAL OPPORTUNITIES AND BENEFITS ARE IMPORTANT TO YOU?

During the Spring '17 consultation we asked about the ideas people had around opportunities and benefits.

The answers received were varied, but aligned with the October '16 consultation and included; training and skills development for both adults and young people, apprenticeships, local contractors and contacts for the work, broadband and fibre optic cabling, A47 improvements and local road upgrades; coastal erosion solutions and beach reshaping; archaeological/eco exhibitions, information sharing of new records or data, improvement of very local habitats impacted by the construction, investment in local renewable energy projects. Here are a selection comments we've received:

"Local colleges and 6th forms encouraged to open courses for youngsters to access the industry"

"Education of both adults and young people alike"

"Environmental Education – looking at marine as well as land, primary, secondary and further education"

"Training and skilled job opportunities to people in local area"

"The scheme should employ local contractors"

"Lay fibre optic cables in the trenches to villages along the path"

"Help nurture individual and local investment in renewable energy"

"Local road upgrades. The A47 at Necton has several accident blackspots, promotion of safety and ease of travel which is getting more difficult due to an excess of housing"

"Provide erosion solutions for the village of Happisburgh, offshore reefs"

What we have been developing

Over the past year members of the community have been positive and creative about the opportunities and benefits that they would like to see. We have committed to a number of early projects and sponsorships including Norwich and Norfolk EcoAwards; Norfolk Community Foundation 'Communities that Care – Stay Well This Winter' Campaign; East of England Energy Group sponsorship of 'Skills for Energy' Award.

We would like to engage meaningfully with communities to fully understand their priorities and how we could help. Now is the time for communities to work with us to explore ideas that create win-win benefits.

3D offshore windfarm design training – rolling out to 8 Norfolk Schools & Colleges this Autumn

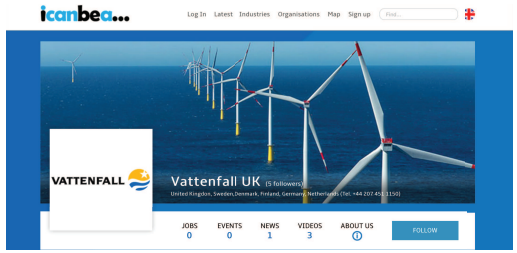
Vattenfall, in partnership with 3DW, have been developing a new 3D virtual reality offshore windfarm design programme aimed at giving students an authentic and innovative experience. Students from University Technical College Norfolk trialled an onshore version in spring and made comprehensive suggestions for its development – which have now been incorporated. The most up to date technology and visualisation packages help students develop an informed and well-rounded appreciation of the complexities of wind farm development, whilst the programme also encourages collaboration and leadership – key skills that Vattenfall will be looking for in its future Norfolk workforce.

Find out more about the programme in Norfolk by contacting Sue, our Local Liaison Officer (susan.falch-lovesey@vattenfall.com). Find out more about Vattenfall Career and Graduate training programmes here: **https://corporate.vattenfall.co.uk/about-vattenfall/careers/students-and-graduates/**

Skills and Jobs for the Future

Education, skills and jobs have been high profile themes throughout our consultation and we have made an early commitment to support schools, colleges and their students

- We are working on a skills strategy that will strategically and comprehensively address both Vattenfall needs, whilst fully appreciating the local educational context
- Building on the work experience pilot, we now have the systems in place to enable further opportunities for more students as our project develops and in line with our capacity to support
- We are actively working with schools and colleges across the project area in order to create innovative and relevant experiences for 14-19 year olds (see our 3DW partnership case study), whilst also exploring opportunities for apprenticeships, internships and thesis projects
- We promote our national and international skills programme through the "I can be a..." website; https://www.icanbea.org.uk/?page_id=56&id=406



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
- Media and communications officers
- Commercial managers, lawyers etc...

Find out more here:

http://bit.ly/vattenfallcareers

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 liason officers
- onshore civil engineers & contractors
- wind turbine designer/manufacturer
- service vessel crew and skippers
- cable layers
- accommodation providers...

Find out more here:

http://bit.ly/vfarchaeology

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;

http://bit.ly/vftrainees

http://bit.ly/vfinttraineeprog

Are there any other environmental, operational or visual impacts from the construction, operation or decommissioning of the onshore elements of the project that you think we should consider? Please suggest any specific mitigation measures you consider appropriate in regard to these impact(s)?

We welcome any further feedback on the Norfolk Vanguard Offshore Wind farm Proposal you may wish to provide at this stage.

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 30th October 2017 to Monday 11th December 2017 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 and 1.30-7:00pm **Tues and Thurs**: 9.30am-12.30pm and 1.30-5:00pm **Wed:** 1.30-7:00pm **Sat:** 9.30am-4:00pm **Sun:** 11:00am-2:00pm
Dereham Library	59 High St, Dereham, NR19 1DZ	**Mon, Wed and Thurs:** 9.15am-5:00pm **Tues and Fri:** 9.15am-7:00pm **Sat:** 9.15am-4:00pm
Norwich Millennium Library	The Forum, Millennium Plain, Norwich, NR2 1AW	**Mon-Fri:** 10:00am-7:00pm **Sat:** 9:00am-5:00pm
Norwich City Council	St Peters Street, Norwich, NR2 1NH	**Mon-Fri:** 8:45am-5:00pm
North Walsham Library	New Rd, North Walsham, NR28 9DE	**Mon and Thurs:** 9:30am-7:30pm **Tues and Fri:** 9:30am-5:00pm **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 **Wed:** 10:00am-5:00pm **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, Norfolk, NR19 1EE	**Mon-Fri:** 9:00am-5:00pm
Great Yarmouth Borough Council	Town Hall, Hall Plain, Great Yarmouth, NR30 2QF	**Mon-Fri:** 9:00am-5:00pm

*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
Dereham Sixth Form College, Crown Rd, **East Dereham** NR20 4AG	7th Nov 1pm-7pm
The Bircham Centre, Market Place, **Reepham**, NR10 4JJ	8th Nov 1pm-7pm
Aylsham Town Hall, Town Hall, Market Place, **Aylsham**, Norwich NR11 6EL	9th Nov 1pm-7pm
Necton Rural Community Centre, 13 Tun's Road, **Necton**, Swaffham, PE37 8EH	10th Nov 1pm-7pm
The Wenn Evans Centre, Blacksmiths Ln, **Happisburgh**, Norwich NR12 0QY	11th Nov 11am-5.30pm
University Technical College Norfolk, Oldhall Rd, **Norwich** NR4 6ES	14th Nov 2pm-7pm
East Coast College, Great Yarmouth Campus, Suffolk Road, **Great Yarmouth**, NR31 0ED	15th Nov 1pm-7pm
North Walsham Community Centre, New Road, **North Walsham**, Norfolk, NR28 9DE	16th Nov 1pm-7pm

Pop-up events during formal consultation:

Several bespoke events have been organised, and in addition we are going to have a small presence at the following venues:

Venue details	Date/time
The Forum, Millennium Plain, **Norwich**, NR2 1TF	13th Nov 10am-3pm
Market Gates Shopping Centre, **Great Yarmouth**, NR30 2BG	15th Nov 11am-4pm
Market Place, **North Walsham**, NR28 9BP	16th Nov 9am-3pm

Electronic copies of the PEIR and NTS can also be viewed or downloaded from the Project website **www.vattenfall.co.uk/norfolkvanguard**. Where a copy of the documents is requested, this can be provided free of charge on a USB device. The documents can be made available in hard copy format on request at a cost of:

- Non-Technical Summary of Preliminary Environmental Information – £22
- Full Preliminary Environmental Information Report with annexes – £1030
- A set of 18 no. (A4) Indicative Cable Corridor Plans – £15

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

1. Addressed to: **Norfolk Vanguard, The Union Building, 51-59 Rose Lane, Norwich, NR1 1BY**
2. By email to: **info@norfolkvanguard.co.uk**
3. Through completion of a consultation questionnaire available at public events noted on this page, drop in locations, and on the Project website **www.vattenfall.co.uk/norfolkvanguard**

If you have queries about the consultation process, please call **01603 567995** for clarification.

Any response or representation in respect of the proposals DCO must **(i) be received before 11.59pm on 11th December 2017** (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 details will be held securely by the Applicant and any appointed agent of the Applicant in accordance with the Data protection Act 1998 and will be used solely in connection with the consultation process and all applicable and relevant DCO application(s).

The deadline for comments is 11.59pm on the 11th December 2017.