NnG OFFSHORE WIND

Neart na Gaoithe Offshore Wind Farm

Project Update 2018

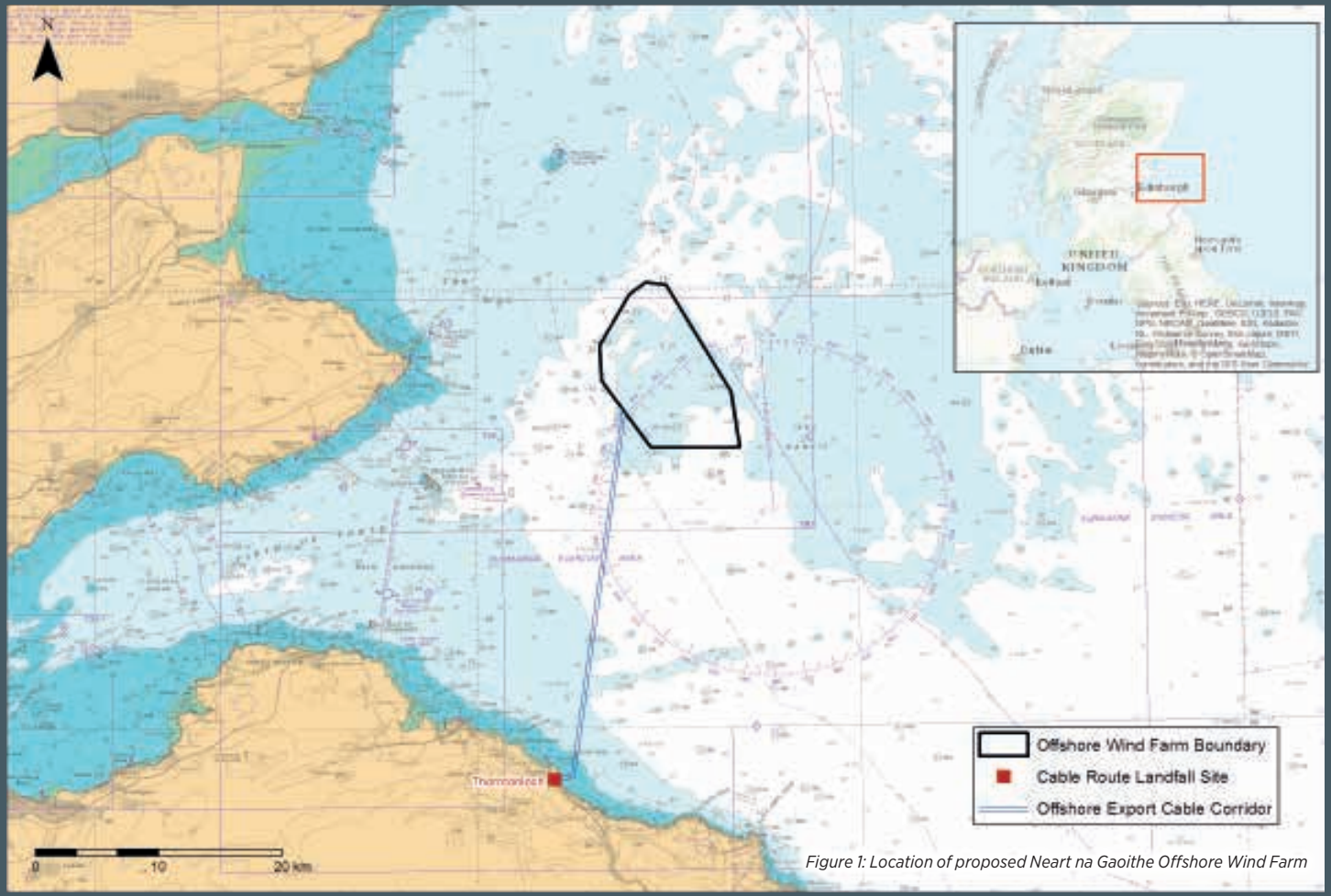

Figure 1: Location of proposed Neart na Gaoithe Offshore Wind Farm

NnG OFFSHORE WIND

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Neart na Gaoithe Offshore Wind Farm

The proposed Neart na Gaoithe offshore wind farm (NnG) site is located approximately 15.5 kilometres (km) from Fife Ness and 28km from Thorntonloch Beach in East Lothian. Mainstream Renewable Power was awarded the site in February 2009 by The Crown Estate. Neart na Gaoithe means 'strength of the wind' and the wind farm will generate up to 450 megawatts (MW) of renewable energy, enough electricity to power more than 370,000 homes – all the homes in Dundee and Edinburgh*. It will offset over 400,000 tonnes of CO_2 emissions each year.

Key facts of Neart na Gaoithe

Original Offshore Consent	New Offshore Application
No. of turbines: Maximum 75	**No. of turbines:** Maximum 54
Capacity: 450 megawatts (MW)	**Capacity:** 450 MW
Turbine height: Maximum 197 metres (m) above lowest astronomical tide (LAT) to tip	**Turbine height:** Maximum 208m above LAT to tip
Space between turbines: Minimum 450m	**Space between turbines:** Minimum 800m
Site area: Maximum 105 kilometres $(km)^2$	**Site area:** Maximum $105km^2$
Water depth: Between 45m and 55m	**Water depth:** Between 45m and 55m

NB. only one of these consents will eventually be built out.

*Calculation based of number of households in 2015, National Records of Scotland and using the Renewable UK offshore wind capacity factor of 37.2%.

The NnG site was chosen following detailed analysis of technical, economic and environmental factors. Criteria that informed the site selection process included: shipping routes, sensitive habitats and species, seabed conditions, port facilities, metocean conditions and proximity to a grid connection.

NnG is one of only two Scottish offshore wind farm projects to have won a Contract for Difference (CfD) through auction. It gives the wind farm an inflation-linked price for the electricity it produces for a period of fifteen years. This revenue stream allows investment to build this significant infrastructure project.

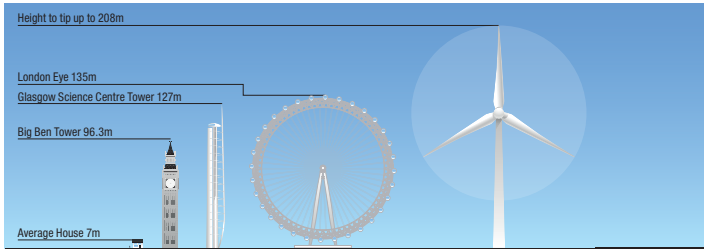


Figure 2: Maximum wind turbine dimensions compared to known landmarks

Key Components of an Offshore Wind Farm

1. Turbine

Three-bladed turbines will be attached to the seabed using the foundation described below.

2. Turbine foundation

The turbines will be constructed using steel jacket foundations, with cables from each turbine connected via subsea inter-array cables.

3. Offshore substation(s)

Subsea inter-array cables will be connected to one or two offshore substation(s).

4. Export cables

Two subsea export cables will run from the offshore substation(s) to the landfall at Thorntonloch Beach in East Lothian.

5. Onshore cables

Two buried cables will cross farmland for approximately 12.3km from the landfall location to the grid connection point at Crystal Rig wind farm in the Lammermuir Hills.

6. Onshore substation

A new onshore substation will be built to connect the wind farm to the grid.

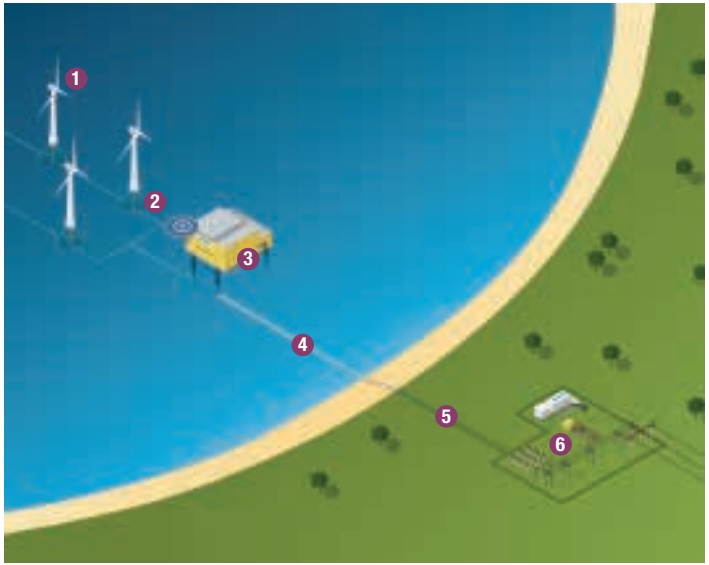


Figure 3: Key components of an offshore wind farm. Graphic is indicative and not to scale.

Electrical Transmission System

The turbines will be connected via buried High Voltage Alternating Current (HVAC) cables both offshore and onshore to the grid connection point at Crystal Rig wind farm in East Lothian. Figure 5 shows the key components of an HVAC transmission system.

Within the wind farm, a number of inter-array cables will connect the turbines to one or two offshore substation(s). Subsea export cables will run between the offshore substation(s) and the landfall location at Thorntonloch Beach in East Lothian. Close to the landfall, the export cables will connect to onshore cables which will be buried for 12.3km between Thorntonloch and a new substation. The new substation will be located adjacent to an existing substation at Crystal Rig wind farm in the Lammermuir Hills, where the grid connection will be made (Figure 5).

Figure 4: Offshore substation

Key components of HVAC transmission system

- Inter-array cables
- Offshore substation
- Export cables
- Onshore cables
- Onshore substation

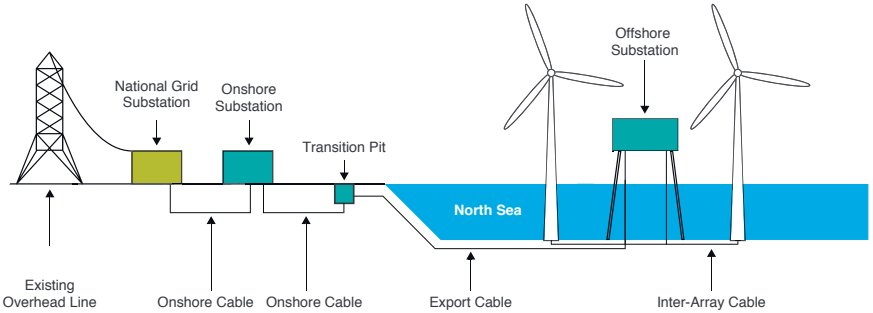


Figure 5: HVAC transmission system

Onshore Grid Connection

In June 2013, Mainstream was granted planning permission by East Lothian Council for the onshore works to connect the Neart na Gaoithe offshore wind farm to the national grid. The planning permission was implemented in August 2016.

Figure 6 shows the planning application boundary for the onshore works and Figure 7 below shows a visual representation of the new substation. Land along the onshore cable route will be restored to its previous condition following construction with the exception of a number of manhole covers required for inspection.

Figure 6: Application boundary for the onshore works.

Figure 7: Visual representation of the new substation.

Planning and Consenting

Offshore Consents – Original Application

In 2009, three years of offshore environmental surveys commenced to gather information on habitats and species, physical conditions and human activities at the NnG site.

This information was collected to inform a detailed Environmental Impact Assessment (EIA), which was submitted with an application for consent for the offshore elements. This information is set out in an Environmental Statement, which can be viewed on our website.

The application for consent for the offshore elements of the project was submitted to the Scottish Ministers (Marine Scotland) in July 2012. Consent was granted in 2014 for a maximum of 75 turbines. A variation to the consent was granted in March 2016 allowing NnG to deploy 64 7MW turbines.

Judicial Review

January 2015	A Judicial Review of the Scottish Ministers consenting process was raised by the RSPB, which delayed NnG along with three other offshore wind farm projects.
July 2016	The RSPB's concerns were initially upheld in a decision of the Outer House of the Court of Session. This was appealed by the Scottish Ministers.
May 2017	The Inner House of the Court of Session overturned the original decision.
June 2017	The RSPB sought leave to appeal to the Supreme Court which was denied by the Inner House of the Court of Session.
August 2017	The RSPB sought leave to appeal to the Supreme Court directly.
November 2017	The application for leave to appeal was rejected.

Offshore Consents – New Application

A new application for consent, recently submitted to Marine Scotland, will allow for an updated design for the offshore elements to incorporate recent advances in technology. Central to this is the inclusion of higher generating capacity turbines, meaning that fewer turbines are required to generate the same output. The updated design will comprise a maximum of 54 turbines, compared with the current consent for 75 turbines.

Onshore Planning Permission

An application for the onshore grid connection infrastructure was submitted to East Lothian Council in November 2012. This includes 12.3km of buried cable and a new substation. Planning permission was granted in June 2013. The planning permission was implemented in August 2016.

Offshore Physical Environment and Resource

To understand the attributes of the offshore physical environment, Mainstream commissioned both desk and field based studies to assess the wind resource, sea and weather conditions and the seabed type and substrate.

Studies investigating the seabed ground conditions of the site were undertaken; geophysical assessments were carried out in August 2009 and more in-depth geotechnical studies were undertaken in 2010, 2012, 2013 and 2014. A further bathymetry survey was undertaken in 2015.

'Metocean' (meteorological and oceanographic) data was collected using a number of metocean buoys deployed on and near the site. This informed the physical processes modelling. The information gathered had specific reference to potential changes to seabed forms and coastal processes.

The geology and sediments will not be changed by the proposed development, so the assessment concentrated on potential impacts on the coastline, sandbanks and water quality. The modelling within the physical processes study showed that the offshore infrastructure and construction works would not cause any effects that reached the coastline. Changes to the metocean conditions (water levels, currents and waves) due to the presence of structures on the seabed may have the potential to alter the sediment regime although modelling has suggested that such changes would not be significant.

In April 2014, Mainstream deployed a floating LiDAR (FLiDAR) at the offshore wind farm site. The technology is designed to capture valuable hub height wind resource data and remained on site for ten months in support of the Neart project development. The FLiDAR consisted of state-of-the-art measurement equipment including a buoy adapted LiDAR mounted on a standard marine buoy and was powered by its own renewable energy system comprising solar photovoltaic and wind power technology.

Figure 8: FLiDAR installed at the Neart na Gaoithe site from April 2014 to February 2015.

Offshore Environment Studies

Between 2009 and 2012 an extensive campaign of environmental surveys was undertaken to inform a detailed Environmental Impact Assessment (EIA). These included surveys of seabed habitat, geotechnical analysis of the seabed, surveys to identify the presence of seabirds and marine mammals, studies of shipping routes and commercial fishing activity, plus analysis of the seabed to identify any archaeological features such as shipwrecks.

The findings of the EIA were presented in an Environmental Statement, which was submitted to the Scottish Government with the original application for consent to build and operate the wind farm.

A Scoping Report to inform the EIA for the new offshore consent application was submitted to Marine Scotland in May 2017. This reviewed the findings of the original EIA and proposed the content of the new EIA.

Documents related to the EIAs and our latest Scoping Report are available to download from the project website: www.nngoffshorewind.com.

Seabed habitat - 'Dead Mens Fingers'

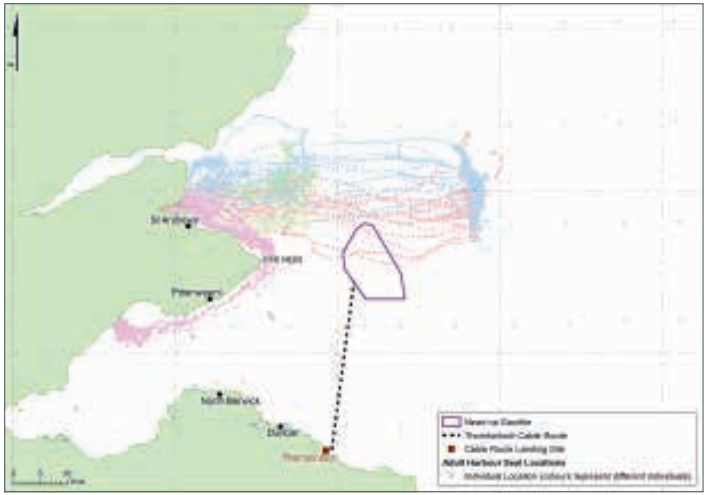


Figure 9: Harbour Seal Tracking Data

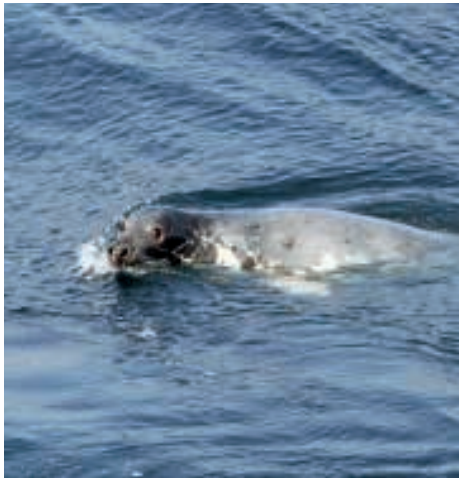
Birds, Marine Mammals and Fish

Monthly boat-based bird and marine mammals studies were carried out for three years. A total of 38 species of seabird were recorded within the Neart na Gaoithe study area, with the three most common species being gannet, guillemot and puffin. Additional studies were undertaken, including fitting electronic tags to seabirds and seals to record their movements relative to the wind farm boundary.

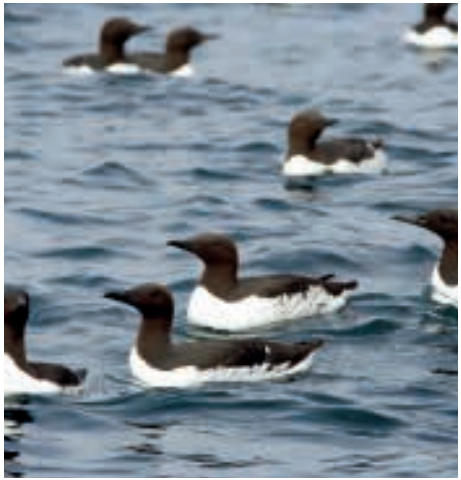
Ten marine mammal species were recorded in the Neart na Gaoithe study area, with harbour porpoise and grey seal being the most common species. Harbour seals were also regularly recorded in lower numbers throughout the study area.

Noise modelling was undertaken to assess the potential impacts of construction on marine mammals and noise-sensitive fish species.

Through the original application, the number of turbines was reduced from 125 to 64 and the 'air gap' between the sea and the turbine blade was increased to avoid more common flight heights for species such as gannet. The new application will seek to reduce this again to a maximum of 54 turbines, and further increase the air gap.



Grey Seal



Guillemots

Kittiwake tagging

Shipping and Commercial Fishing

Large vessels emerging from the Firth of Forth select courses to avoid the Isle of May and therefore these courses generally avoid the Neart na Gaoithe site boundaries. Shipping data has been gathered and the map below shows ship movements through the Firth of Forth over a period of 4 weeks in 2017.

Figure 10: Map of shipping routes

Fishing Vessel

Information on commercial fishing has been collated through comprehensive consultation with the fishing community and supported by additional data collection and analysis. Any potential interaction between the offshore wind farm and commercial fisheries is a key concern for the project team and consultation with fishermen and their representative bodies will continue throughout the project.

In order to continue the constructive dialogue with the commercial fishing industry, the Forth and Tay Commercial Fisheries Working Group was established, comprising members from local and regional fisheries, as well as Marine Scotland and the Forth and Tay offshore wind farm developers. This group will help to manage the interaction between commercial fisheries and offshore wind farm developments in this area.

Seascape, Visual, Archaelogy and Cultural Heritage

A series of photomontages have been created to give an indication of how the wind farm will look from a number of viewpoints along the east coast (Figure 11 below). Consultation was undertaken with the local councils and Scottish Natural Heritage (SNH) to develop a comprehensive list with appropriate viewpoint locations.

The archaeology considered within the Neart na Gaoithe offshore site is broadly divided into two main areas: maritime archaeology such as shipwrecks, and submerged prehistoric archaeology, which considers the potential inhabitation of humans on land which is now submerged. Survey data collected over the Neart na Gaoithe site provided a detailed picture of the seabed topography, allowing archaeologists to better understand the landscape below the sea.

The archaeological assessment has identified a number of features. These include six wrecks of which the most noteworthy are the remains of the SS Einar Jarl and two First World War K class submarines (Figure 12), which sank in 1918. Archaeological features have been assessed in greater detail during the analysis of geophysical, geotechnical and video survey data. No turbines will be located in the vicinity of protected wrecks.

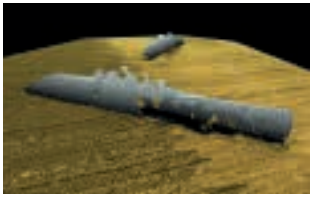


Figure 12: First World War K-Class Submarine wreck.

Aviation and Radar

Additionally as part of the EIA, civil and military radar and aviation interests were assessed, primarily via a desk based study and through ongoing consultation with the Ministry of Defence, National Air Traffic Control Services and the Civil Aviation Authority.

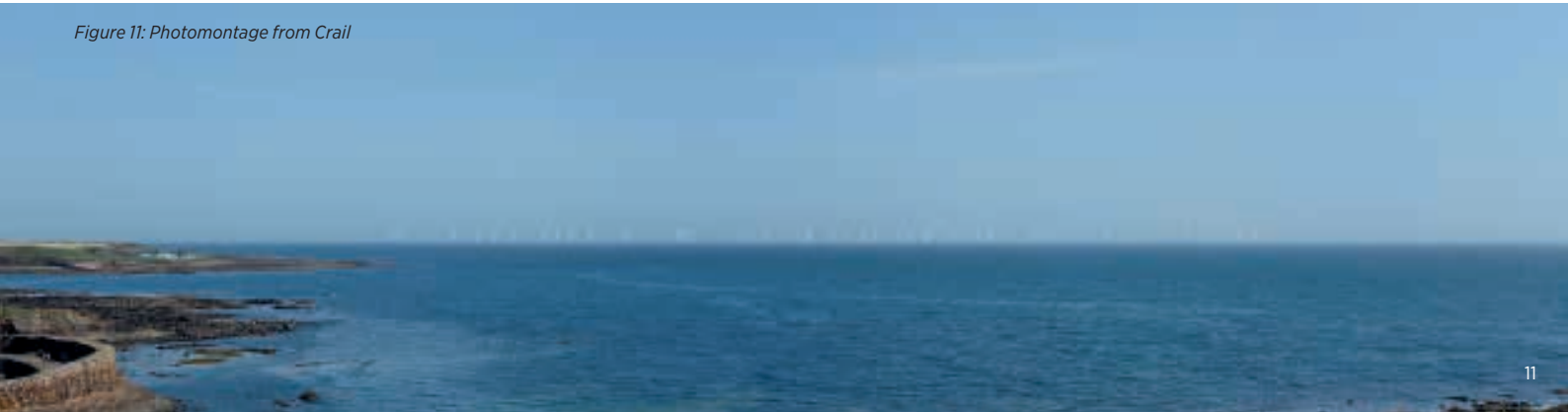


Figure 11: Photomontage from Crail

Onshore Environment

An application for planning permission to construct the onshore works between Thorntonloch Beach and Crystal Rig was submitted to East Lothian Council in November 2012. As with the offshore application it was accompanied by an Environmental Statement setting out the findings of an EIA, which was carried out under The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011. Planning permssion was granted in June 2013.

An Environmental Impact Assessment (EIA) was undertaken as part of the planning application for the onshore works. This included survey and assessment for a number of key aspects such as:

- Ecology;
- Agriculture and land use;
- Construction noise;
- Cultural heritage;
- Landscape and visual; and
- Traffic and transport.

In August 2016, advance construction work was undertaken to coincide with the installation of new buried cables for Torness nuclear power station. Before those new cables were laid, a concrete block incorporating several ducts was placed in the ground, allowing the wind farm cables to be fed through at the time of construction, reducing future disturbance.

Figure 13: Advance construction work, August 2016.

Construction

The Neart na Gaoithe offshore wind farm will be built out in a number of stages. Construction of onshore works will commence in 2019 at the earliest while offshore works will commence in 2020 at the earliest.

1. Installation of turbine foundation

Construction will start with the installation of up to six jacket piles at each of the turbine locations.

Jacket foundation pile: large steel tube up to 3.5 metres (m) diameter, up to approximately 50m long.

2. Lifting of turbine foundation

A large installation vessel will lift each of the foundations into place over the pre-installed piles.

Steel jacket foundation: lattice support structure.

3. Installation of cables

A cable installation vessel will start the process of laying the inter-array cables that will connect the turbines to the offshore substation(s). Specialist equipment such as a cable plough may be used to cut a trench in the seabed, lay the cable into the trench then backfill to cover the cable.

Array Cable: up to a depth of 2m – up to 140 kilometre (km) to be installed.

A cable installation vessel

4. Installation of turbines

A turbine installation vessel will transport several sets of turbine components from the base port. A turbine can be installed whole or, as is more common, in several sections. The bottom tower section is lifted into place and bolted to the foundation. The nacelle is then bolted to the top piece of the tower. Each of the three blades are lifted up to the nacelle (or 'hub') in turn and bolted on. The inter-array cable is then connected to the turbine at the transition piece.

Tower: cylindrical steel sections

Nacelle: contains the direct drive generator and all control systems – up to 126m high (from lowest astronomical tide [LAT]).

Blades: up to 80m long Glass Reinforced Epoxy (GRE) – 3 blades per turbine – 21,904m^2 swept area.

Tip Height: maximum 208m above lowest astronomical tide.

5. Offshore substation

An offshore substation will be installed to coincide with the first turbines being installed. The offshore substation consists of a jacket foundation and a 'topside'. The jacket foundation, a larger version of the turbine foundation, will be installed in a similar way. The 'topside' is likely to be in excess of 2,000 tonnes and require a specialist heavy lift vessel. All of the array cables will be routed to the offshore substation and connected into the electrical equipment on the 'topside'.

Offshore Substation: up to 60m high (LAT) – in excess of 2,000 tonnes.

6. Export cables

Two export cables will be installed from the offshore substation(s) to the landfall location at Thorntonloch Beach in East Lothian. They are larger versions of the inter-array cables and will be installed in a similar way. At the shore they are connected to two onshore cables.

Export Cables: buried up to 3m deep – 43km to be installed.

7. Onshore infrastructure

All the onshore infrastructure will be installed with two cables from Thorntonloch Beach to Crystal Rig wind farm in the Lammermuir Hills. An onshore substation will be built to allow the connection of the onshore cables to specialist transformers to connect to the National Grid.

Onshore Infrastructure: 12.3km onshore cable.

Onshore Substation with transformers.

Project Timeline

The milestones within the scheduled timeline for the Neart na Gaoithe project are presented below:

2008	– Site selection
2009	– The Crown Estate exclusivity agreed
2009	– Original offshore Scoping Report submitted
2010	– Grid connection signed
2011	– Agreement for Lease (AfL) signed
2009–2012	– Surveys & Environmental Impact Assessment
2012	– Onshore planning application submitted
2012	– Original offshore consent application submitted
2013	– Onshore planning permission granted
2014	– Original offshore consent granted
2015	– Contract for Difference (CfD) signed
2015	– RSPB commenced Judicial Review proceedings
2016	– Original offshore consent variation granted
2016	– Outer House Judicial Review decision
2017	– New offshore Scoping Report submitted
2017	– Inner House Judicial Review appeal decision
2017	– RSPB application for leave to appeal to Supreme Court rejected
2017	– New offshore consent submission
2018	– New offshore consent decision expected
2019–2021	– Onshore construction
2020–2021	– Offshore construction
2021–2022	– First generation expected
2021–2022	– Fully operational

Consultation

Consultation has been a key element in the development of this project. Mainstream has sought the views and inputs from all stakeholders and other bodies as well as individuals to ensure they are fully aware of the project and kept up-to-date with all aspects of its development.

Over the years, Mainstream has held a number of community consultation meetings across the region and participated in a number of public events on the east coast of Scotland (Fife, Angus and East Lothian) to publicise the project and keep the public informed on the project development.

Meetings have also been held to inform interested groups such as natural heritage bodies, commercial fishermen, community councils, surfers, shipping representatives and recreational sea users of the project.

Benefits

Neart na Gaoithe is a £2 billion capital project that will have a major positive impact on the Scottish economy.

It is anticipated there will be around £510m spent in Scotland during construction, with around a further £610m spent in Scotland during operations and maintenance.*

Neart na Gaoithe will create 2,000 Scottish jobs every year during the 4 year construction period and 236 Scottish jobs every year during operation.*

It is estimated that over the lifetime of this project NnG will support the equivalent of 0.6% of the total value of Scottish Onshore GDP in 2016.*

Turbine nacelle workers

Turbine installation

The project will have a major role in carbon emissions abatement and play a key part in meeting the emission reduction targets of both the Scottish and UK governments. It will displace some 400,000 tonnes of CO_2 every year and provide enough power for all the homes in Dundee and Edinburgh**.

If the UK fails to decarbonise its power sector it will not meet the statutory climate reduction goals in the Climate Change Act, and will not meet its other global commitments to greenhouse gas emissions reduction. Neart na Gaoithe is an integral part of that decarbonisation strategy.

*Based on a 25 year operational period – Fraser of Allander Report, August 2017. The new offshore consent application is for a 50 year operational period.
**Calculation based of number of households in 2015, National Records of Scotland and using the Renewable UK offshore wind capacity factor of 37.2%.

Supply Chain

Local procurement is at the heart of our development strategy and we are actively working with the Scottish Government, local authorities, local suppliers, potential manufacturers and other parties to maximise the economic benefit to Scotland, and in particular the east of Scotland.

This will help position the region to benefit from longer term UK and international opportunities.

Many of the local supply chain companies' employees will bring skills developed in the construction of the Forth Crossing and the aircraft carrier projects, as well as other offshore wind farms, to help deliver Neart na Gaoithe. These highly skilled engineering jobs will be sustained by Neart na Gaoithe, and added to with opportunities across the region's supply chain.

Other Offshore Wind Farms in the Region

In addition to Neart na Gaoithe, three other offshore wind farms are proposed off the Angus coast.

The Inch Cape Offshore Wind Farm is being developed by Red Rock Power. The Seagreen Alpha and Seagreen Bravo Offshore Wind Farms are being developed by a joint venture between Scottish and Southern Energy and Fluor Corporation.

All four projects received consents together in 2014. A Judicial Review (summarised on page 6) raised by the RSPB in relation to the Scottish Ministers' consenting process has delayed all four projects. It is anticipated that new applications will be submitted by all four projects. This will allow all projects to be built with fewer larger capacity turbines. Compared with the original applications, the new applications will reduce the maximum number of turbines by 50%.

Of the four projects, only Neart na Gaoithe holds a Contract for Difference.

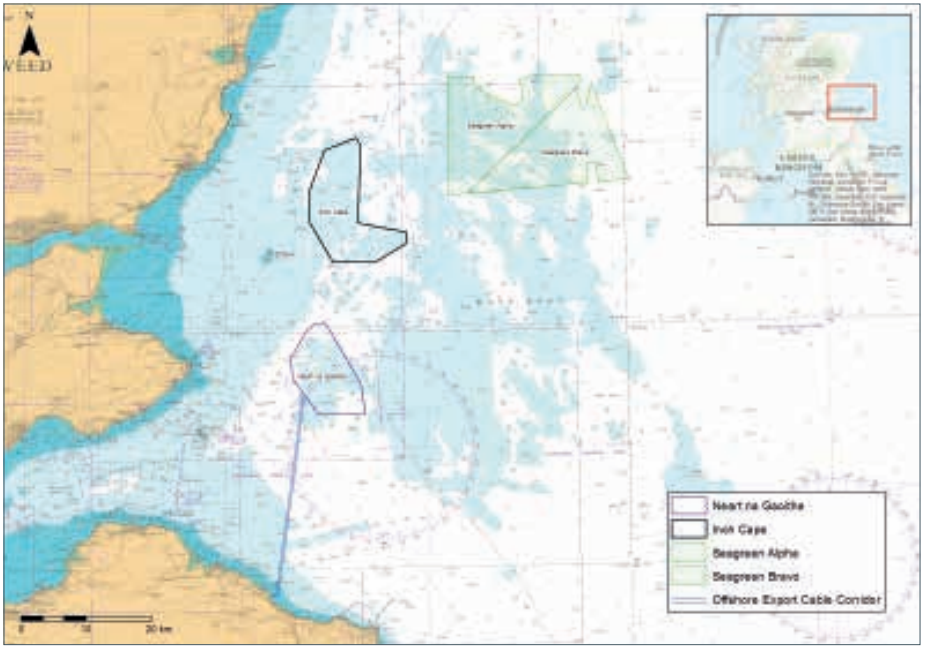


Figure 14: Map of Neart na Gaoithe wind farm and other wind farm locations in the area

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