Hornsea 3
Offshore Wind Farm

DONG energy

Hornsea Project Three Offshore Wind Farm

What are we proposing?

Hornsea Project Three is a new offshore wind farm project DONG Energy is proposing to develop in the North Sea, approximately 120 km northeast of the north Norfolk coast and 160 km east of the Yorkshire coast.

How big could it be?

If built out to full capacity, Hornsea Project Three could be the world's largest offshore wind farm, providing enough power to meet the average daily needs of well over **2 million** UK homes.

Who is the developer?

DONG Energy is the **global leader** in developing, building and operating offshore wind farms, and our largest fleet is in the UK.

Since 2004, we have invested **£6 billion** in the UK and we expect to double this investment by 2020.

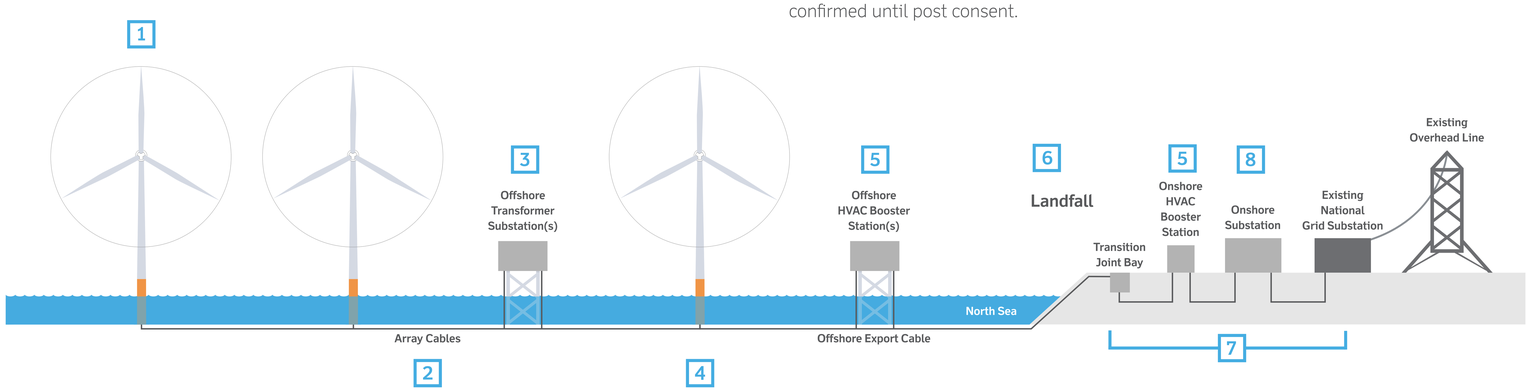
Why are you building a new offshore wind farm?

The Climate Change Act 2008 legally committed the UK to reduce its greenhouse gas emissions by at least 80% by 2050, compared to the 1990 level. Over the next couple of decades, much of the UK's existing generating plants are set to close and the UK urgently needs to replace large volumes of its existing electricity infrastructure with low carbon generation. The UK has an abundant natural wind resource, and offshore wind power has the potential to contribute significantly towards this low carbon transition.

Our Proposed Development

1. Up to 342 offshore wind turbines, with tip height of up to 325 m, their foundations and up to 19 offshore platforms will be located in the array area. The array area has a total area of 696 km^2 and is located approximately 120 km northeast of the Norfolk coast and 160 km east of the Yorkshire coast.

Generic offshore wind farm layout.



2. A new network of subsea array cables will connect the wind turbines, offshore substation(s), offshore converter stations and offshore accommodation platforms.

3. Electricity generated by Hornsea Project Three will be transported via either a high voltage alternating current (HVAC) or high voltage direct current (HVDC) transmission system. The offshore platforms (depending on final design) will accommodate up to 12 transformer substations and up to 3 accommodation platforms. In the HVDC transmission system there could also be up to 4 offshore HVDC converter stations.

4. Electricity generated at the offshore wind farm will be transmitted to shore by up to 6 subsea export cables within a corridor 1.5 km in width (via either a HVAC or HVDC electrical connection) running in a south-westerly direction for approximately 145 km, from the south-western boundary of the array area to the proposed landfall.

5. Depending on the mode of transmission, a HVAC booster station may be required onshore and/or offshore to ensure that the cables are able to carry all the power from the wind farm over such long distances and to mitigate against power losses between the offshore wind farm itself and connection point. For the offshore HVAC booster station the closest it could be to shore would be 27 km. The mode of transmission will not be confirmed until post consent.

6. At the landfall, the subsea export cables will cross underneath the beach and terminate at the onshore electrical cable transition joint bays. Up to 6 of these joint bays will house the connections between the offshore subsea export cables and the onshore underground export cables. Along the route, there will be jointing pits (including linking boxes) which will ultimately connect the export cables to the substation.

7. Onshore export cables will be buried underground in up to 6 trenches, running in a south / south westerly direction from the proposed landfall area at Weybourne in north Norfolk for approximately 55 km, before connecting into the national grid. The Project is currently consulting on a 200 m onshore cable corridor search area, however this will be further refined to an 80 m cable corridor for the final application, of which 20 m will be used for temporary working areas.

8. A new onshore substation (HVDC converter/HVAC substation) will be required near to the existing Norwich Main National Grid substation (Dunston / Mangreen). This substation will convert and connect the export cables that originated from the landfall at Weybourne to the final National Grid connection.

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Onshore Export Cable Corridor

How wide will the final export cable corridor be?

The cables will be installed underground within an 80 m corridor. This includes both the permanent installation area (~60 m) and temporary working area (~20 m). The width of the permanent and/or temporary areas may change where obstacles are encountered, for example an ecological constraint such as a wood or major crossings.

How many cables will there be?

Up to six trenches will be required to accommodate up to six circuits, each containing individual cables and fibre optics to enable communication between the wind farm and the control system.

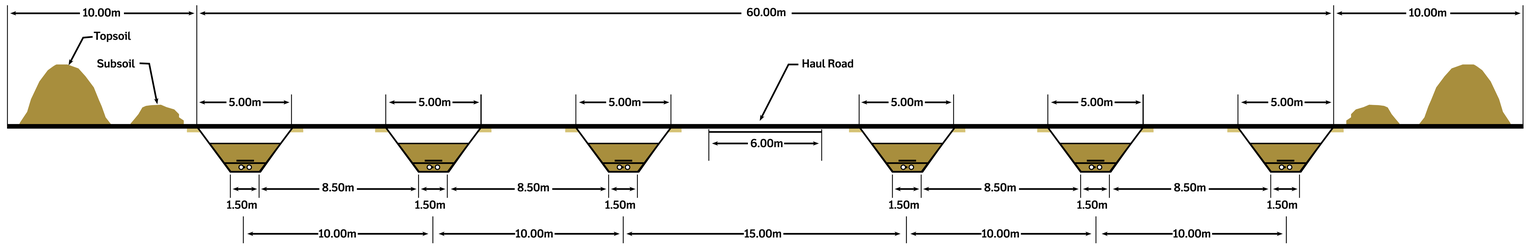
How big will each trench be?

Each trench could be up to 5 m wide at the surface reducing to 1.5 m at the bottom. The circuits must be spaced out in order to minimise the mutual heating effect. This enables the cables to effectively carry the large power volumes required without overheating and damaging the cable. The final width and location of each specific trench will be determined closer to the construction phase.

How long will it take to install the cables?

The export cables will be installed in sections of between 750 and 2,500 m at a time. The installation of the cables is expected to take up to 30 months in total, however work is expected to progress along the route with a typical works duration of three months at any particular location. Construction may be carried out by multiple teams at more than one location along the cable route at the same time.

Onshore export cable corridor indicative layout



How will you preserve the soil structure?

During construction of the cable trenches, the topsoil and subsoil will be stripped and stored on site within the temporary working corridor as construction of each linear section of the route advances. The topsoil and subsoil will be stored in separate stockpiles.

How will you access the corridor?

During construction temporary haul roads will be installed along the 80 m corridor to facilitate the movement of construction vehicles to the site and to allow trench excavation to take place. These haul roads will also help minimise interactions with the local road networks. The topsoil will be stripped and stored before any required temporary roadways are created. We are in the process of developing our plans for accessing the cable route to understand how best to facilitate movement of construction vehicles to and from the site.

How deep will the cables be buried?

Individual cables will be buried on land at a minimum depth of 1.2 m depending on ground conditions. Where necessary, due to there being rock, concrete or other obstacles close to the surface, the cables may need to be laid at a shallower depth of no less than 0.7 m. We have increased the minimum burial depth following feedback from farmers who had concerns about the potential interaction with land drains and any deep soil cultivations that they undertake.

What happens after the cables are installed?

Once the cables are installed, the land will be reinstated to its previous use. It would not be possible to place any type of construction (i.e. buildings) or deep rooted trees above the cables in case we needed to perform maintenance in the future and to avoid damaging the cables themselves. However, it would be possible to continue to farm over the cables.

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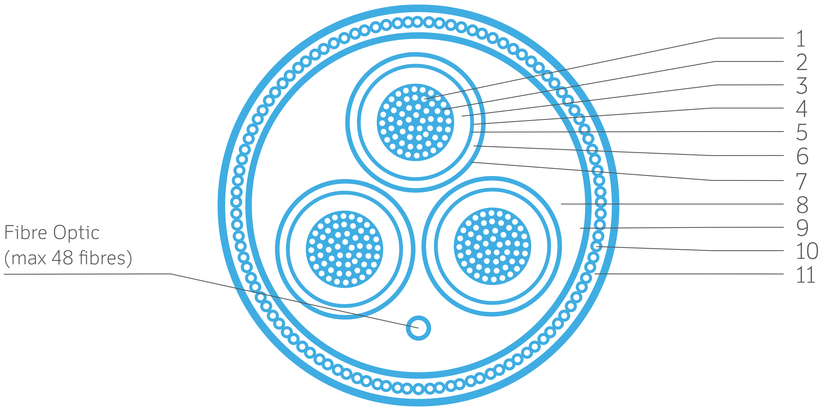
Export cable cross section

The cables themselves consist of copper or aluminium conductors wrapped with various materials for insulation, protection, and sealing.

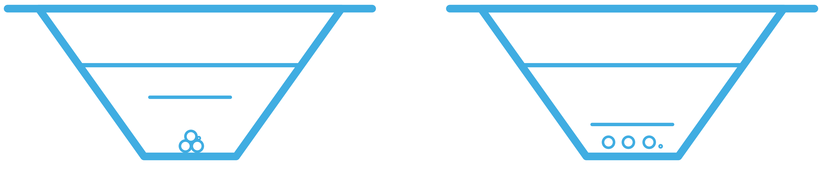


(Diagrammatic only - not to scale)

1.	Plain Copper conductor	2.	Conductor screen
3.	XLPE Insulation	4.	Insulation screen
5.	Longitudinal water barrier	6.	Lead sheath
7.	PE semi conductive sheath	8.	Fillers
9.	Binder tape and string bedding	10.	Galvanised wire armour
11.	String serving in double layer		

Cross section through a typical offshore alternating current (AC) (220 kv) export cable (Courtesy of Prysmian)

The three cables of a HVAC circuit may either be installed in 'trefoil' formation, whereby two cables sit side by side, with a third sitting above the two cables, or in flat formation where the three cables will all sit side by side at the same level in the trench. This arrangement differs from the offshore export cables which are typically installed as a single cable.



AC Trefoil Formation

AC Flat Formation

Onshore export cable HVAC trench layouts.

The two cables required for HVDC circuits will sit side by side in the trench.

DC Flat Formation

Onshore export cable HVDC trench layouts.

The circuits must be spaced out in order to minimise the mutual heating effect of one circuit on another. This enables the cables to effectively carry the large power volumes required without overheating and damaging the cable.

The potential generation of electro-magnetic field (EMF) effects are a factor of cable burial depth and cable current. This effect is considered within the EMF Compliance Note, which confirms that Hornsea Project Three will comply with national guidelines (see Preliminary Environmental Information Report Volume 4, Annex 3.3).

Cable Installation Techniques

Open cut installation

The onshore cables will be installed using an open cut method. The trenches will be excavated using a mechanical excavator, and the export cables will be installed into the open trench from a cable drum delivered to site via Heavy Goods Vehicles (HGVs).

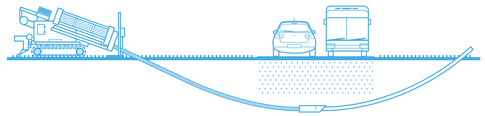
The cables are buried in a layer of stabilised backfill material that ensures a consistent structural and thermal environment for the cables. The remainder of the trench is then backfilled with the excavated material. Hard protective tiles, and marker tape are also installed in the cable trenches above the cables to ensure the cable is not damaged by any third party. Once the export cables are installed and the trenches backfilled, the stored topsoil will be replaced and the land reinstated back to its previous use.

At certain locations, alternatively bespoke tools may be used. These are usually tracked vehicles, that excavate a trench, lay the cable, and then bury the cable simultaneously. Alternatively, they may excavate a trench in advance, then lay the cable after it is pulled into the Transition Joint Bay (e.g. at the landfall).

Trenchless techniques: Horizontal Directional Drilling (HDD)

Hornsea Project Three is considering a number of different trenchless methods for installing the cables at certain points along the cable route. This could include rivers, woods and major roads.

Horizontal Directional Drilling (HDD) is a steerable trenchless method of installing underground cables that enables you to install cables underground over short distances with minimal impact on the surface infrastructure and surrounding area.



Horizontal Directional Drilling HDD

HDD is generally accomplished in three stages:

1. Directionally drilling a small diameter pilot hole along a designed directional path.
2. Enlarge the pilot hole to a diameter suitable for installing the cable.
3. Pull the cable through the enlarged hole.

Construction compounds

Construction compounds of various sizes will be required along the onshore export cable corridor for laydown and storage of materials, plant and staff, as well as space for small temporary offices, welfare facilities, security and parking. This includes crossings of other infrastructure, joint bay and link box construction.

We are considering a number of potential sites to locate the main construction compound, which will operate as a central base for the onshore construction works. This does not have to be on the route itself, but a suitable site in close proximity to the route. The construction compounds will be removed and sites restored to their original condition when construction has been completed.

Access

Access routes will be required from the nearby road network at various places along the onshore export cable route in order to access the construction works as well as the various compounds along that route that will be set-up in advance of the cable laying.

The route and design of these access roads will be agreed with the relevant landowners in advance of construction and where possible we will seek to use existing roadways and tracks. The requirements for access are currently being developed and further detail will be provided in the Environmental Statement.

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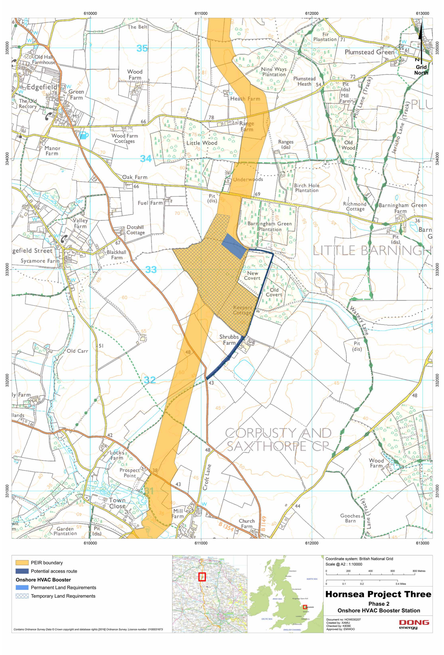
Onshore HVAC Booster Station

If Hornsea Project Three is built out using a High Voltage Alternating Current (HVAC) transmission system, a booster station near to the coast could be required to mitigate against power losses between the offshore wind farm and the national grid connection point.

Where could it be located?

Our proposed site for locating the onshore HVAC booster station is to the west of Little Barningham, just north of Corpusty in North Norfolk (previously referred to as option C). This site has been identified following extensive environmental surveys, technical and feasibility studies and ongoing consultation with landowners, statutory bodies and members of the local community.



How did you identify this site?

To identify a potential site for locating the onshore HVAC booster station, we conducted a constraint mapping exercise. This exercise indicated that the southern half of our original search area (approximately 10 km from the coast) as least constrained and three potential sites were subsequently identified.

In March 2017, we presented and sought feedback on the three sites and we have since further refined this to a preferred site based on the feedback received and other considerations. More information on our site selection process can be found in our PEIR, Volume 1, Chapter 4: **Site Selection and Consideration of Alternatives.**

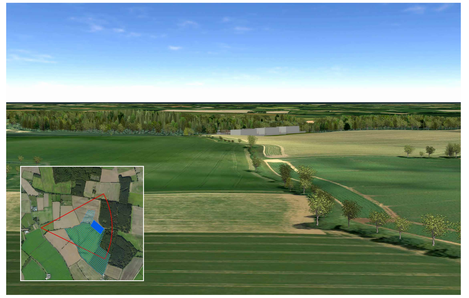
Will there be any noise?

We have undertaken noise assessments near to the proposed site for the onshore HVAC booster station and onshore substation assuming no mitigation with the loudest realistic equipment that we might use. The assessments are based on a worst-case scenario and currently indicates that a significant effect is likely. Based on these initial assessments, we will now refine our design in order to reduce these impacts to an appropriate level.

This could include housing nosier elements, adding additional insulating materials to the inside of buildings or introducing outdoor shielding. We will consult on the proposed mitigation measures with your local planning authority before submitting our final application. This is part of the ongoing engineering design work.

What could it look like?

The onshore HVAC booster station could require an area of up to 25,000 m^2 and could be up to 12.5 m in height. The equipment for the onshore HVAC booster station could be housed within a single or multiple buildings, in an open yard or a combination of these.



Viewpoint taken at a height of 40m looking East from the edge of Edgefield

The exact location, as well as requirements for landscaping, will be determined based upon a wide range of human, biological and physical constraints as well as technical and commercial considerations. We have prepared an indicative visualisation of the booster station based on the maximum dimensions stated above to give you an idea of what it could potentially look like. This does not include any visual mitigation.

The above visualisation is indicative only and has been produced to inform this consultation. It should be noted that the onshore HVAC booster station design will only be finalised post consent but will be within the confines assessed in the final application.

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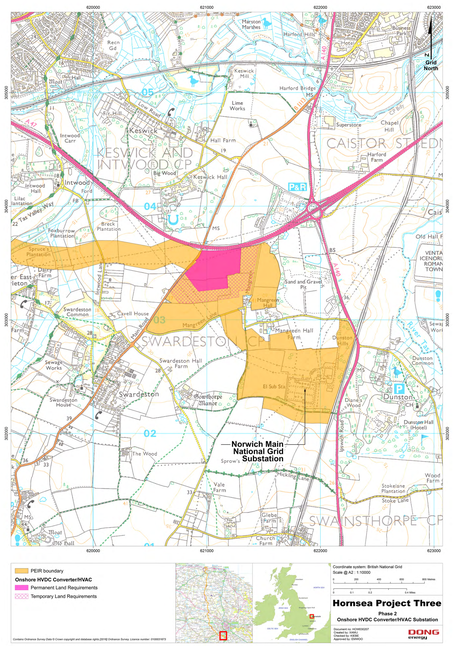
[1] This figure assumes a load factor of 42% and a household consumption of 4.1MWh per year. Source: DECC (July 2015).

Onshore Substation

Hornsea Project Three will require a new onshore substation near to the existing Norwich Main National Grid substation at Dunston / Mangreen, just south of Norwich.

Where could it be located?

Our proposed site for the onshore substation (HVDC converter/HVAC substation) is located just south of the A47 to the north east of Swardeston. This site has been identified following extensive environmental surveys, technical and feasibility studies and ongoing consultation with landowners, statutory bodies and members of the local community.



How did you identify this site?

To identify a suitable site for locating the onshore substation, we developed a set of guiding principles to establish a search area (approximately 3 km from the existing Norwich Main substation). A constraints mapping exercise was then applied to this search area, which involved layering known constraints / sensitivities on top of one another to identify the potentially least constrained zones.

The results of this exercise were presented at our March 2017 consultation events, where members of the local community were invited to highlight aspects that they would like us to take into consideration. This feedback was considered by the Project alongside environmental, commercial and technical considerations.

More information on our site selection process can be found in our PEIR, Volume 1, Chapter 4: **Site Selection and Consideration of Alternatives.**

What is the visual impact?

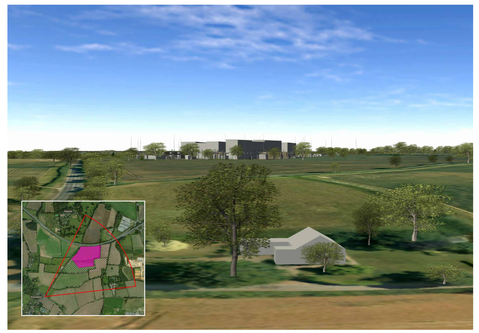
We have undertaken a Landscape and Visual Impact Assessment (LVIA) near to the proposed site for the onshore HVAC booster station and onshore substation. The assessments are based on the worst-case scenario and currently indicate that a significant effect is likely. We will use these findings to further refine our designs in order to reduce this effect to an appropriate level.

We will consult on the proposed mitigation measures (e.g. natural screening by planting trees) with your local planning authority before submitting our final application.

What could it look like?

The onshore substation station could require an area of up to 128,000 m^2 of permanent land take, which includes area for visual mitigation and could be up to 25 m in height. The equipment for the onshore HVAC booster station could be housed within a single or multiple buildings, in an open yard or a combination of these.

The exact location, as well as requirements for landscaping, will be determined based upon a wide range of human, biological and physical constraints, as well as technical and commercial considerations. We have prepared an indicative visualisation of the onshore substation, based on the maximum dimensions stated above, to give you an idea of what it could potentially look like. This does not include any visual mitigation.



Viewpoint taken at a height of 15 m looking North-East from the edge of Swardeston

The above visualisation is indicative only and has been produced to inform this consultation. It should be noted that the onshore substation design will only be finalised post consent but will be within the confines assessed in the final application.

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[1] This figure assumes a load factor of 42% and a household consumption of 4.1MWh per year. Source: DECC (July 2015).

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Construction phasing

Hornsea Project Three could be built out in a number of phases:

- a single phase,
- in two phases, or
- up to three phases.

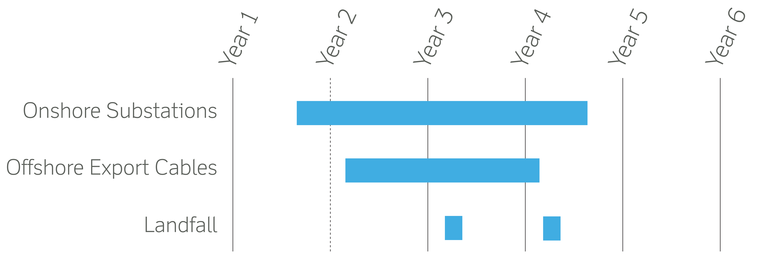
There are various reasons for phasing, including constraints within the supply chain and how the Project would be brought forward within the current regulatory framework.

Where built in phases, these may overlap or have a gap between the completion of construction of one phase and the start of construction of another. It is possible that some activities may be carried out during an earlier phase for the benefit of a later one.

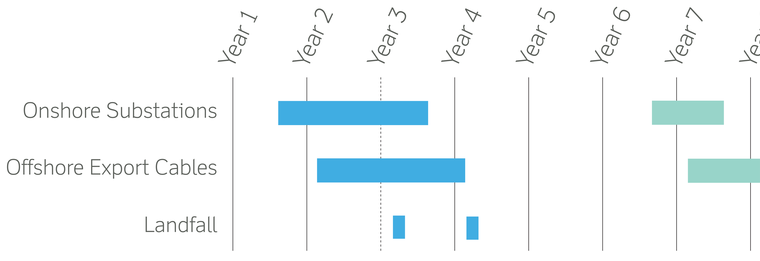
Importantly, if the Project were to be built out in multiple phases, as demonstrated below, it would still be within the total maximum design scenario duration for one phase. For example, even if built out over three phases, construction of the onshore substations would not exceed three years.

Indicative construction programme

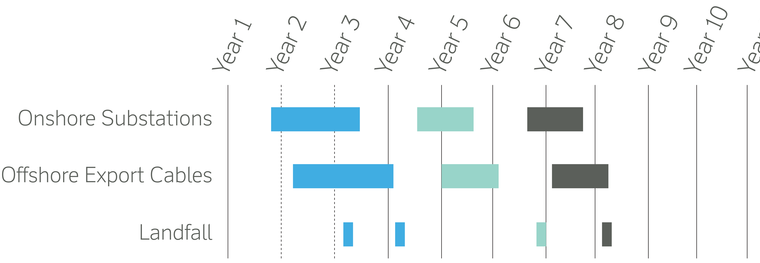
Indicative programme if Project built out in a single phase



Indicative programme if Project built out in two fully sequential phases



Indicative programme if Project built out in three partially parallel phases



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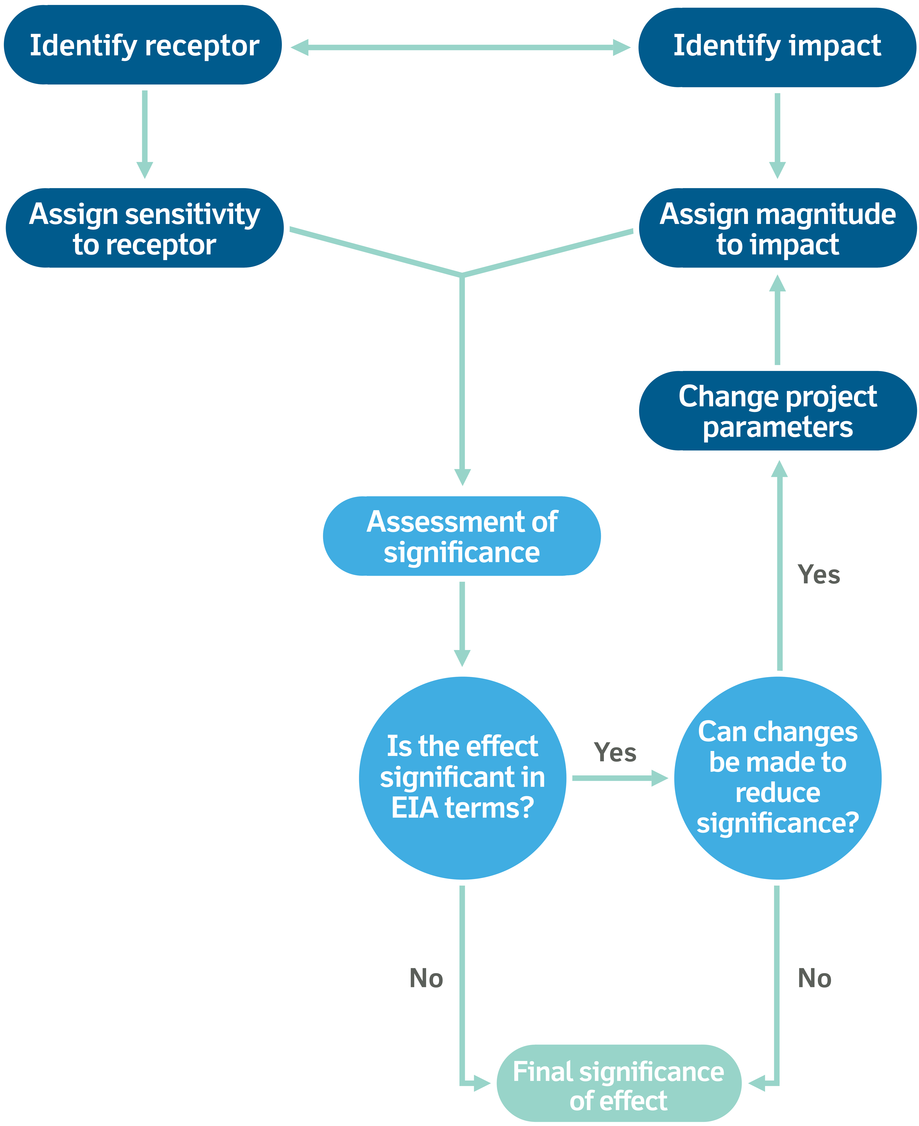
Environmental Impact Assessment

We are undertaking an Environmental Impact Assessment (EIA) of Hornsea Project Three for both offshore and onshore elements.

An EIA is an assessment of the likely positive or negative impacts that a development may have on the environment. It considers environmental, social and economic aspects.



More information on the assessments undertaken and initial results is available in our Preliminary Environmental Information Report.

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Site selection process

Stage 1:
Identification of the former Hornsea Zone

Stage 2:
Identification of the Hornsea Project Three array area within the former Hornsea Zone

Stage 3:
Identification of Grid Connection Location and Strategic Landfall Appraisal

(High level connection options, National Grid connection offer and landfall appraisal)

Stage 4:
Refinement of Project Options

Stage 5:
Identification of Project for Scoping, Statement of Community Consultation and Phase 1.A Consultation

Stage 6:
Refinement of Project for Phase 1.B Community Consultation Events & EIA preparation

Stage 7:
Refinement of Project for PEIR; s42 and s47 Consultation (Phase 2 Consultation)

Stage 8:
Further refinement of Project Design following review of Consultation Responses & EIA Studies

Stage 9:
Submission of final preferred option(s) as part of the DCO application

For more information on our site selection process, see Volume 1, Chapter 4 "Site Selection and Consideration of Alternatives" in our Preliminary Environmental Information Report.

Hornsea Zone - The Hornsea Zone was one of nine offshore wind generation zones around the UK coast identified by original area leased by The Crown Estate .
Environmental Impact Assessment (EIA).
Preliminary Environmental Information Report (PEIR).
s42 & s47 - Consultation with statutory bodies and local communities.
Development Consent Order (DCO) - An order made under the Planning Act 2008 granting development consent for Nationally Significant Infrastructure Projects.

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How we engage with the community

At DONG Energy, we believe in open and proactive engagement with the local communities in which we work. Whether consulting on the development of new offshore wind farms or supporting the regeneration of local areas through volunteering, funding and sponsorship, we want to ensure that we make a positive contribution to the areas in which we operate.

What happens after we submit our application?

On many of our offshore wind farm projects, we have established voluntary community benefit funds. These are set up to ensure that local people can directly benefit from our wind farms under construction in their local area. These community benefit funds are managed and administered by an independent grant-delivery organisation to ensure impartiality during the process.

Supply Chain

We are committed to engaging with local suppliers and utilising local talent wherever possible. As the offshore wind farm industry develops, the demand for specialised services can bring new opportunities for local entrepreneurs and existing businesses.

On previous projects, we have held “Meet the Buyer” events early on in the construction phase to encourage our top tier suppliers to utilise local suppliers and to help facilitate contact between local UK suppliers and top tier suppliers so they can form business relationships.

Community Liaison Officer (CLO)

Our CLO’s act as a first point of contact for members of the local community for all queries and issues regarding our offshore wind farms during construction. They provide a link between the local community and the Project team, whilst also liaising with all the principal contractors during the works. We would seek to appoint a local-based CLO in the future to assist the Project and communities.

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How to respond to this consultation

Have your say on our proposed development

DONG Energy welcomes your comments on our proposals. Any responses, or other representations, should be sent to DONG Energy:

By email:
HornseaProjectThree@dongenergy.co.uk

By post:
Hornsea Project Three Offshore Wind Farm, DONG Energy,
5 Howick Place, London, SW1P 1WG

By completing a feedback form today or online:
(www.dongenergy.co.uk/hornseaproject3)

The consultation closes on **20 September 2017**.

Please note that responses and other representations may be made public.

Next Steps

After the consultation closes, we will review all the feedback we have received. Your comments will be considered and incorporated where possible into the final design, which we intend to submit to the Planning Inspectorate in 2018.

A Consultation Report will be produced and submitted as part of our application. This report will provide a summary of the responses received and will explain how we have taken your feedback into account in developing our final proposal.

What happens after we submit our application?

28 days

The Planning Inspectorate has 28 days to accept the application.

If accepted, interested parties wishing to be involved in the examination will be invited to register their interest to the Planning Inspectorate.

Anyone who has registered their interest will be invited to submit their views on our proposal in writing and may be asked to speak at one of the public hearings.

The Planning Inspectorate will hold an examination and then has three months to make a recommendation to the Secretary of State for Business, Energy and Industrial Strategy. The Secretary of State then has a further three months to make a decision on whether to grant consent.

If approved, construction of Hornsea Project Three could start in 2021 and could be operational as early as 2025.

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Next steps

After the formal consultation closes on 20 September 2017, we will further refine the Hornsea Project Three design and Environmental Impact Assessment (EIA), taking account of the consultation responses received. The final results of the EIA will be presented in an Environmental Statement and a summary of the consultation responses received will be presented in a Consultation Report, both of which will accompany the Development Consent Order (DCO) application to be submitted in 2018. We will:

- Continue to engage with landowners and occupiers as well as other consultees, to further refine our onshore cable corridor search area to the final 80 m cable route.
- Continue to collect data to inform our environmental surveys.
- Use the outputs from the Preliminary Environmental Information Report and ongoing consultation to identify appropriate levels of mitigation for significant effects.
- Further develop our understanding of the requirements for access and construction compounds.