Nautilus Interconnector FAQs

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General

Who is National Grid Ventures?

National Grid Ventures is the competitive division of National Grid plc. It operates outside of National Grid's core regulated businesses in the UK and US where it develops and operates energy projects, technologies, and partnerships to make energy cleaner, more secure and more affordable for consumers.

NGV's diverse portfolio of low carbon and renewable energy businesses includes subsea electricity interconnectors in the UK, and battery storage, wind and solar power in the US.

NGV's interconnector fleet gives Great Britain access to secure and affordable energy and will play a critical role in tomorrow's cleaner and smarter energy systems. NGV currently have three interconnectors in operation and three in construction. By 2030, 90 per cent of the electricity imported through these six interconnectors will be from zero carbon sources.

There are different National Grid electricity businesses operating in GB that have different roles

There are three distinct electricity business entities under the umbrella of National Grid plc in the UK, as detailed in the diagram below, all with different roles and responsibilities. The separation between NGV, National Grid Electricity Transmission (NGET) and National GridESO stipulates that NGV is treated the same way as any other energy project promoter.

Electricity Transmission

Owns and manages the high voltage electricity transmission system in England and Wales

Electricity System Operator

Ensures that Great Britain has the essential energy it needs by making sure supply meets demand every second of every day

National Grid Ventures

Operates a mix of energy assets and businesses to help accelerate the development of our clean energy future (e.g., undersea electricity interconnectors with other countries and European transmission partners)

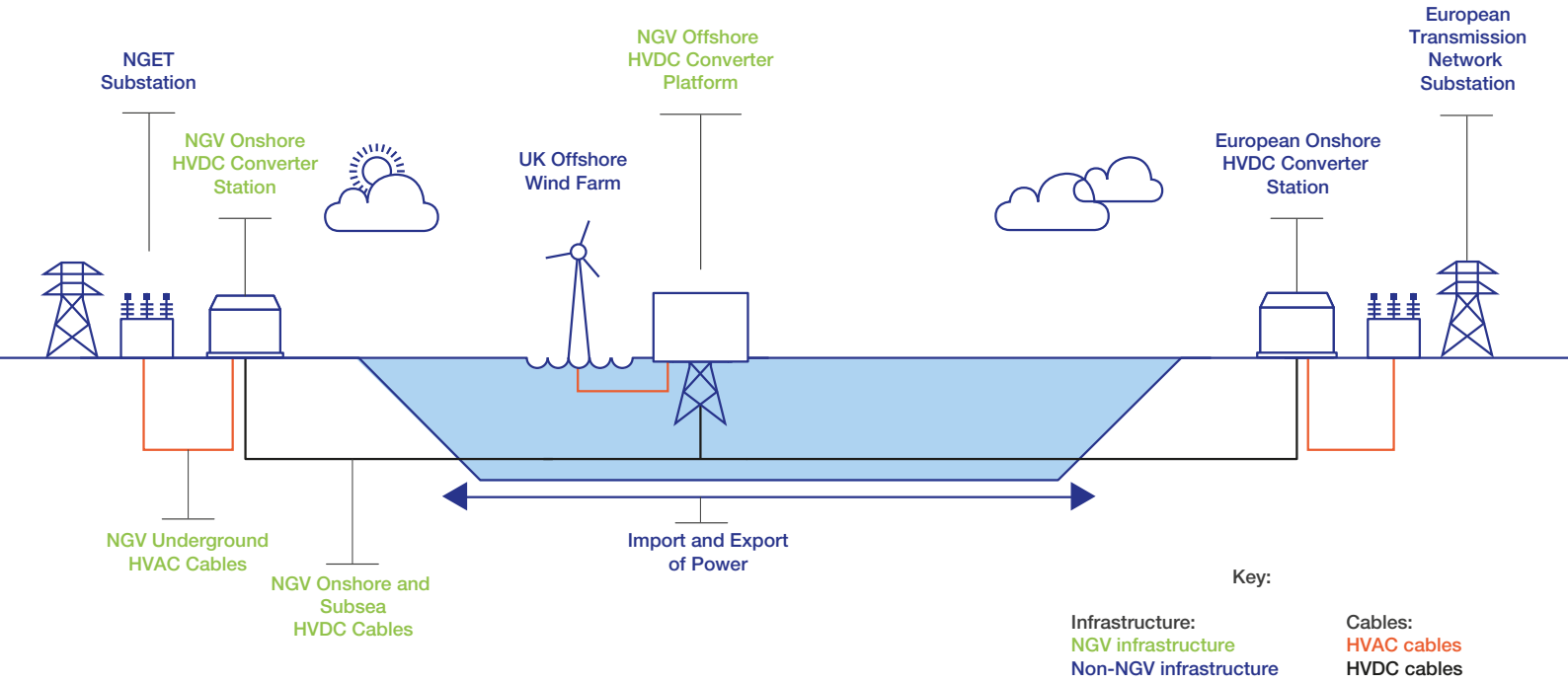
What is Nautilus Interconnector?

At National Grid Ventures (NGV), we are bringing forward plans for Nautilus, a new multi-purpose interconnector (MPI) that could supply enough electricity to power around 1.4 million UK homes.

Nautilus could connect up to 1.4 gigawatts (GW) of offshore wind to the transmission systems of Great Britain and Belgium through a subsea electricity cable called an interconnector. The project would include underground cabling works and onshore infrastructure, located in East Suffolk.

Nautilus will provide two functions in one project: connection of wind and interconnection between the transmission systems of Great Britain and Belgium. The 1.4 GW link between the two countries can facilitate a connection of up to 2.8 GW of offshore wind – with 1.4 GW importing to Britain and 1.4 GW exporting to Belgium. When the wind isn't using the capacity, Great Britain can either import or export up to 1.4 GW from/to Belgium.

As shown in the figure below, a MPI would connect offshore wind farms to an offshore converter station, potentially linking clusters of wind farms into a single connection point, before transporting this electricity to the transmission systems of two European countries through a subsea electricity cable called an interconnector. This would then connect to an onshore converter station at each end of the connection to transform high voltage direct current (HVDC) into high voltage alternating current (HVAC) so that it can be fed into the transmission network of each country.



Is NGV supportive of an alternative and more co-ordinated solution to energy supply in East Suffolk?

NGV is supportive of the efforts to achieve greater co-ordination in energy infrastructure. NGV continue to promote and test alternative solutions with the UK Government and promoters at home and in Europe.

NGV believes that to achieve the UK Government's energy targets (40 GW by 2030 and 75 GW by 2050) there needs to be greater co-ordination of how wind and interconnector projects are connected. This is vital to ensure that the UK can meet both energy and environmental challenges and reduce the impact on coastal communities.

Since 2019 we have been engaging in the area with local authorities, parish and town councils and community groups across East Suffolk to gain a better understanding of their interests and concerns. From this engagement it has been made clear that there is a need for greater coordination and cooperation between energy developers in the region, in particular relating to connections to the electricity transmission network.

Developing Nautilus as a MPI rather than a traditional point-to-point interconnector is our first step in responding to this feedback. Going forward, throughout the consenting, development and construction process we intend to coordinate as far as possible with other developers in the area in order to best address the interests of the environment and local communities.

Who will be the decision-making authority for Nautilus Interconnector?

In March 2019, NGV requested that the Secretary of State for Business, Energy and Industrial Strategy (BEIS) exercise its powers under Section 35 of the Planning Act 2008 to deem that the proposed Nautilus Interconnector will be treated as a Nationally Significant Infrastructure Project (NSIP) and as a development requiring a Development Consent Order (DCO). This means that the final decision-maker for the project will be the Secretary of State.

The DCO regime will require NGV to undertake a thorough Environmental Impact Assessment (EIA) and consultation process prior to any application being submitted. NGV and the Secretary of State acknowledge that the DCO consent process will provide a single, unified consenting process with clear and fixed timescales for the development to engage with stakeholders and bring its application forward.

Multi-purpose interconnectors

What is a multi-purpose interconnector (MPI)?

MPIs are subsea electricity cables which are installed between two countries connecting offshore wind farm/s to both markets. This technology marks an evolution from point-to-point interconnection and radially connected wind.

By combining offshore wind generation with interconnector capacity between GB and Belgium, Nautilus will reduce the amount of infrastructure required both onshore and offshore. In doing so we will be able to reduce the impact on the affected community and environment as well as delivering a pathway towards a more integrated offshore network.

At present, offshore wind and interconnectors operate alongside each other. MPIs will enable offshore wind and interconnectors to work together. This will help to:

- Support the UK to achieve its 40 GW of offshore wind by 2030 and net zero by 2050 climate targets.
- Reduce impacts on coastal communities and the environment by avoiding the need for every project to have its own separate connection infrastructure.
- Increase security of supply by ensuring energy flows from where it is being generated to where it is needed the most.
- Promote more affordable energy bills in the UK by providing access to the lowest priced energy between GB and Belgium.

Read more about National Grid's vision for MPIs by visiting: nationalgrid.com/our-businesses/national-grid-ventures/interconnectors-connecting-cleaner-future/multi-purpose-interconnectors

Will the onshore infrastructure be different for a MPI?

The onshore infrastructure for a MPI is no different to that of a point-to-point interconnector. However, by connecting with offshore wind farms at sea, it would avoid the need for additional offshore wind farm cables and other individual infrastructure such as onshore project substations, meaning the MPI would reduce the impact onshore as compared to two individual projects. With every offshore wind project connected offshore to the MPI, the amount of infrastructure necessary in both marine and terrestrial environments diminishes.

Why do we need interconnectors?

Interconnectors are making energy more secure, affordable and sustainable for consumers. Great Britain has experienced success from existing interconnectors which have connected energy between Great Britain, Belgium, France, Ireland and the Netherlands.

These projects have helped to lower electricity prices in Great Britain, increase the security of supply and stabilise energy in the Great Britain transmission network. Interconnectors are vital in making electricity networks more flexible and are increasingly needed to offset the lack of investment in substantial electricity generation plants in the UK, along with addressing the higher demand for cheaper wholesale energy from Europe.

Electricity normally flows from the market with lower prices to the market with higher prices. On average, UK electricity prices are higher than those in mainland Europe, which typically means that the UK benefits from receiving cheaper electricity.

If you would like to find out more about interconnectors developed by NGV and its European partners you can download NGV's interconnectors information pack here.

Why use HVDC for interconnectors?

Interconnectors use HVDC lines. The link between the UK and Belgium will exceed 100 miles end to end. The use of HVDC cables to transport 1.4 gigawatts (GW) over this distance is proven to be more efficient for losses and will require a much smaller number of cables than HVAC.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Connection point and transmission

Why East Suffolk?

We applied for a connection point for Nautilus to the National Grid ESO. National Grid ESO then undertook an appraisals process to identify a point of connection on its network for each application. This included an assessment of environmental, technical and cost factors, which concluded that East Suffolk was the best connection point. As a result of this process, NGV has grid connection agreements to a new 400 kilovolts (kV) substation located close to the Sizewell 400kV network, provisionally referred to as 'Leiston 400kV'. The legal entity which holds the connection agreements with National Grid ESO is called National Grid Interconnectors Holdings Limited (NGIHL) – which is a NGV business.

Our connection agreement for Nautilus refers to an area rather than an exact location.

Further feasibility studies are being undertaken over the course of 2021, including due diligence on the options available for connection in the Leiston area in line with the connection agreements. While NGV have engaged in discussions with stakeholders and maintained a dialogue with the ESO, at no point has this translated into a confirmed connection at Friston.

Initial routeing and siting work for Nautilus has been based on the reasonable assumption of a potential connection location at the proposed Friston substation. It is yet to be confirmed whether the proposed Friston substation presents a feasible connection point for Nautilus.

What does an interconnector need to do to connect to the onshore grid?

For Nautilus to connect to the proposed NGET substation at Friston, the proposed substation would require an extension.

NGV understand that typically the maximum land take required to facilitate extensions to NGET substations is approximately 1.3 hectares (3 acres) for each connection offered at a location.

Decisions on changes and upgrades to the National Transmission System (NTS) are made by NGET in its role as the Transmission Owner. NGV remain in dialogue with NGET to understand if any changes or upgrades may be required to the NTS as a result of NGV's connection agreements.

What is the difference between HVAC and HVDC?

HVAC stands for high voltage alternating current. HVDC stands for high voltage direct current.

HVAC technology is the principle means of power transmission in all modern power systems. The vast majority of all electrical power is generated, transported and consumed as alternating current. HVDC technology is an alternative to HVAC for point-to-point power transmission and may be appropriate in some circumstances for bulk power transfer over long distances or between different grids.

Most electricity is generated as alternating current, therefore it is necessary to convert the direct current back to alternating current for onward transmission in the national grid at a converter station.

Working with other local projects

How are you working with other energy projects planned in East Suffolk?

We are already working closely with the other promoters in the area including ScottishPower Renewables and EDF as well as East Suffolk and Suffolk County Councils, and NGET. NGV regularly meet with all the promoters in the area, alongside East Suffolk Council and Suffolk County Council, at the Suffolk Energy Forum.

How is Nautilus working with the Offshore Transmission Network Review?

We have been working with the Department for Business, Energy and Industrial Strategy (BEIS) and the industry regulator, Ofgem, to provide our expertise into the emerging policy framework surrounding coordinated solutions for offshore transmission. This includes our membership on the working group for the Offshore Transmission Network Review (OTNR).

As part of the OTNR we have also made a submission to National Grid ESO which promotes Nautilus as a MPI.

Siting and routeing

How has the siting and routeing produced these search area and site options?

We began with a search area for potential converter station sites within five kilometres (km) of the proposed NGET substation in Friston. We looked at all of the known environmental features in this five km search area to identify areas which featured constraints that we would want to avoid if possible, such as environmentally designated sites, heritage assets, hydrology features, recreational areas, landscape designations, villages, towns, and existing and known infrastructure.

For potential landfall locations our search area consisted of coastline adjacent to this five km search area in order to keep the cable route as direct as possible and to limit the potential impact. This process included desk-based research and a series of ecological surveys.

We undertook a further assessment of these locations to evaluate and identify a shortlist of the most suitable converter station search areas, landfall site options and cable corridor options. Key criteria used for selecting the most suitable options included:

- The potential to affect the Suffolk Coast and Heath AONB and Heritage Coast
- Visual impacts
- Proximity to Public Rights of Way (PRoWs) and cycle routes
- Proximity to residential properties, existing infrastructure and future developments
- Impacts to local heritage and archaeological assets
- Ecologically designated sites and sensitive features
- Flood risk
- Conformance with Local Development Plan (LDP) policies

For our landfall site options, nearshore constraints were also considered including:

- Shipping and vessel activity
- Commercial fishing and recreational usage
- Marine archaeology

Where will the project connect to in the scenario where EA1N and EA2 are not consented or a connection to the proposed Friston substation is not feasible?

We recognise that the Friston substation has not yet been consented. We participated in the Development Consent Order (DCO) Examinations for East Anglia One North and East Anglia Two as an Interested Party and continue to monitor the outcome. Scenarios depending on the outcome of the examination are being considered, including where an alternative connection point to the National Transmission System may be required. Parallel to our siting and routeing work, we are continuing to consider the potential coordination opportunities associated with our connection area. MPIs present the opportunity for coordination of multiple projects. For Nautilus this means both providing a connection opportunity for offshore wind farm/s (integration) and exploring the ability to co-locate with projects to reduce potential impacts both onshore and offshore (collaboration). Currently, our work involves exploring different scenarios for potential coordination.

This work is ongoing and we are not able to share further details during this consultation. However, the feedback you provide now will help inform our work on this.

If a connection at Friston is not considered achievable, we would need to discuss alternative sites and options available with National Grid ESO.

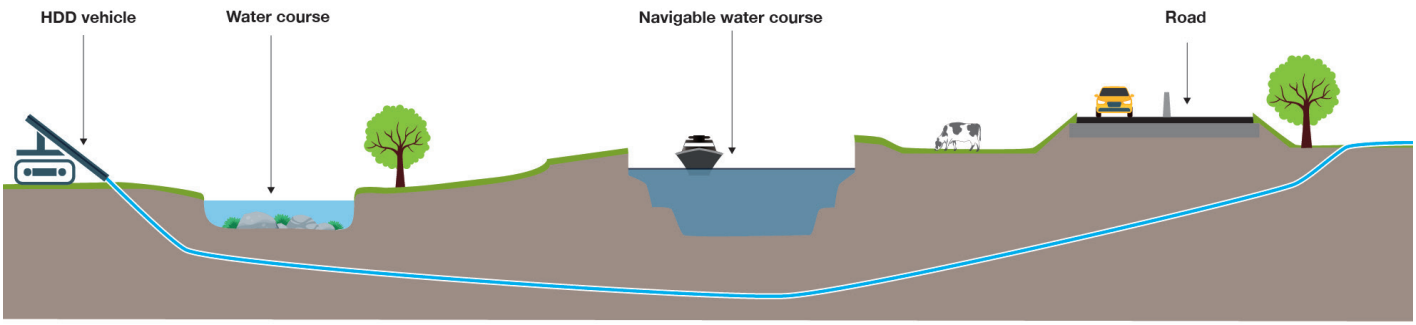
Cable installation

What are the differences between the crossing techniques of Horizontal Directional Drilling (HDD) and open cut?

Horizontal Directional Drilling (HDD) is a construction technique that involves drilling underneath particularly sensitive areas and infrastructure that the project may encounter along the cable route to lay the onshore cable with minimal disruption. This technique avoids the need for digging deep trenches and allows construction to operate through different ground conditions.

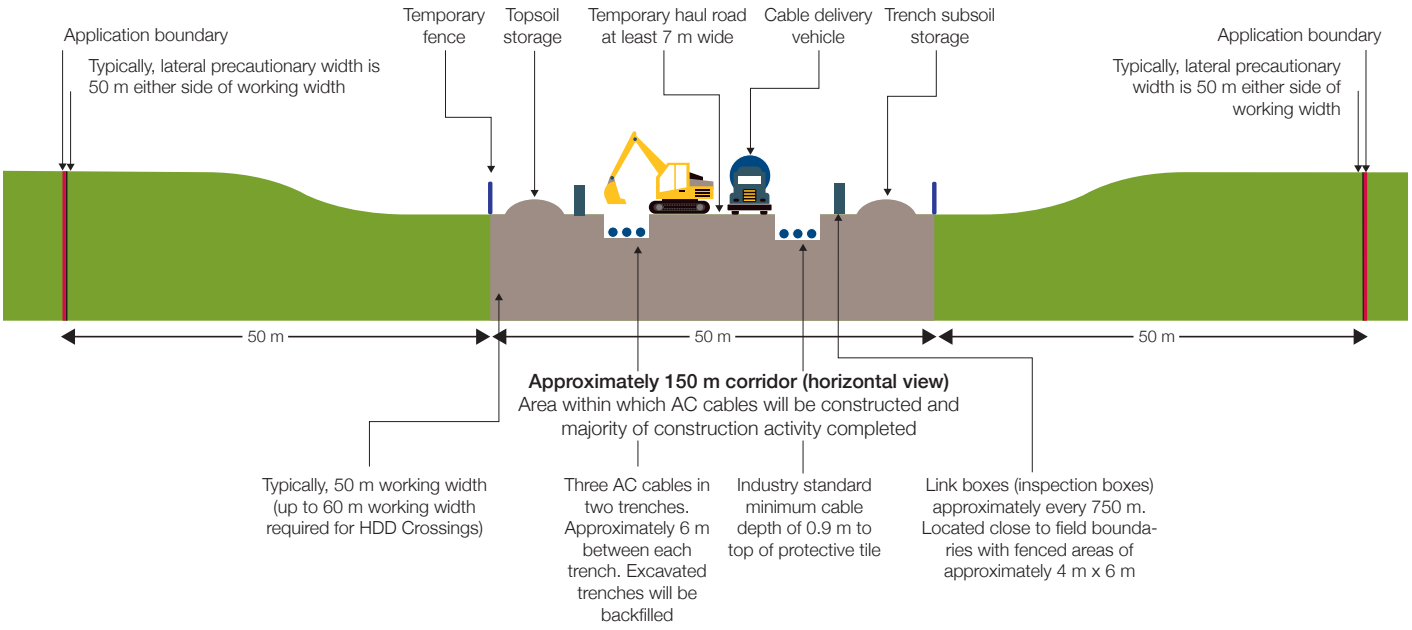
Open cut trench excavation offers an alternative method of cable installation which can be used instead of HDD, particularly in more rural areas and where there are no major obstacles. It consists of excavating a trench section-by-section as the cable is laid. This excavation is then backfilled once the cable laying is complete.

Typical HDD Construction



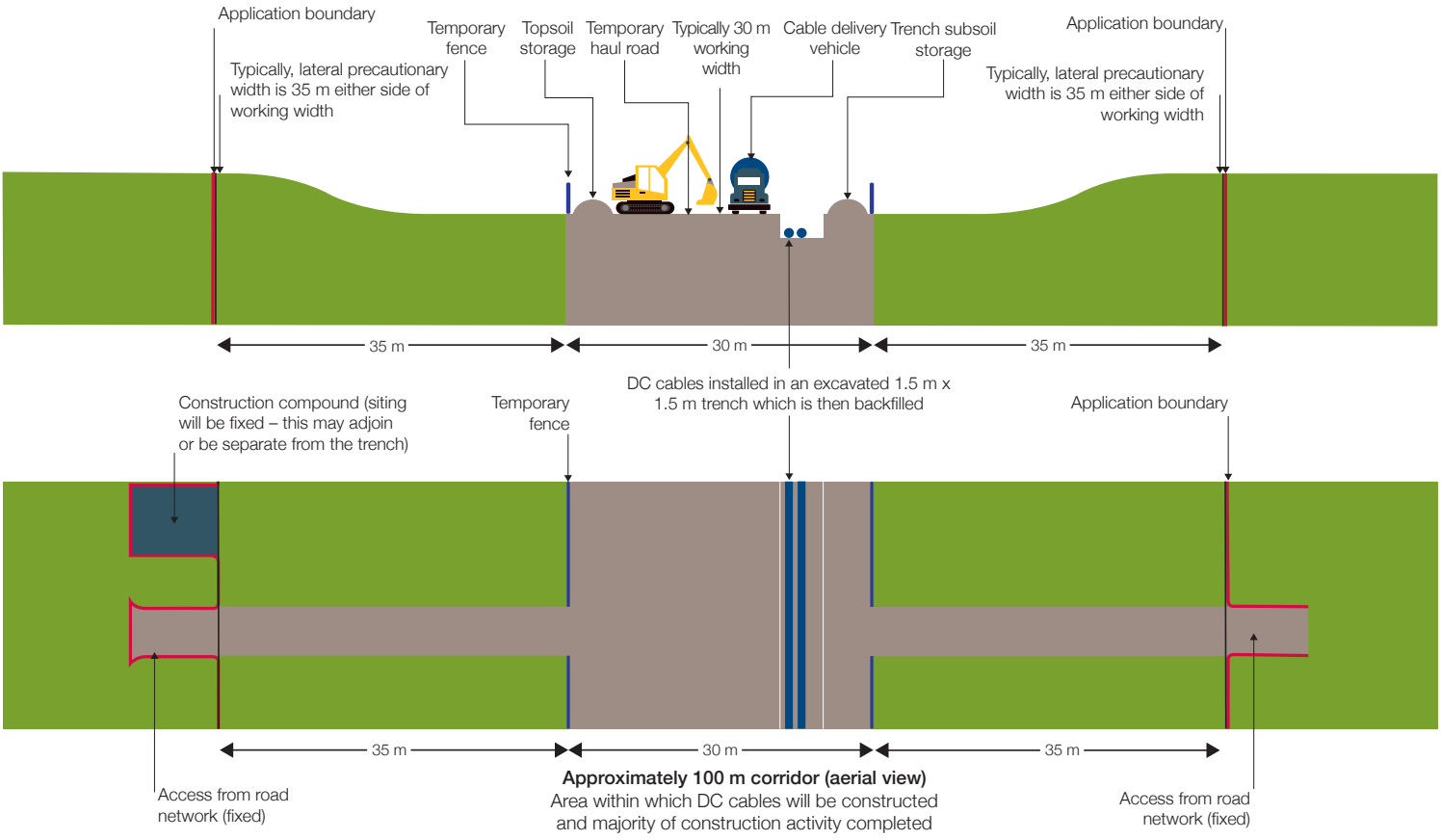
How do the construction of AC and DC cables differ?

Typical AC cable construction



This illustration is for illustrative purposes only and is intended to show the typical construction of AC cables for interconnectors in the UK

Typical DC cable construction



This illustration is for illustrative purposes only and is intended to show the typical construction of DC cables for interconnectors in the UK

Can you use the same cable route as ScottishPower Renewables (SPR)?

The proposed Nautilus Interconnector and the East Anglia ONE North (EA1N) and East Anglia Two (EA2) offshore wind farm projects are different technologies being brought forward by different developers with different timeframes. This means Nautilus Interconnector is not able to share the same cables or cable trenches. There may be potential to locate the proposed cables within an appropriate distance from SPR's cable route which will be considered as NGV assess different options for cable routeing. NGV is studying the applications for both offshore wind farms in detail and liaising directly with SPR to understand as much as possible about its proposed cable route corridor. This is so that NGV can identify any opportunities for joint working and reduce any disruption. In some places, Nautilus may need to cross the cables for EA1N and EA2.

Whilst SPR has already selected its preferred route, Nautilus does not yet have a defined cable route (for either DC or AC cables), and it must undertake its own detailed environmental and technical assessment to progress its project routeing and siting options. NGV will work to reduce impacts on local communities and the environment where possible and will liaise and consult with communities and stakeholders when the project is ready to discuss the proposed cable route options.

How are the cables buried offshore?

The interconnector will comprise of HVDC submarine cables. These will be installed between the two respective landfall locations in Belgium and East Suffolk and, where possible, will be buried within the seabed. Where burial within the seabed is not possible, additional cable protection may be required such as the placement of rocks on top of the cable.

Landfall

Will there be any visible equipment at the landfall site?

Landfall is where the subsea cables are brought onto the land and are connected to the onshore cables. As all the cables will be buried underground at the landfall site, very little will be visible once works are completed, although there may be some relatively small-scale equipment visible above ground. A kiosk type structure (similar to a telephone exchange) may be required at the landfall location to boost the signal for the subsea fibre optic communication system. It is too early to confirm if this would be required at this stage.

Cable joint bays will need to be made at sections along the route during installation. Cable joint bays will be buried for the HVDC cables and will likely require a manhole cover for operations and maintenance access, these manhole covers may require fencing. The manhole covers would be visible above ground. Joint bays on the HVAC cables will require above ground link boxes (see typical AC cable construction figure on page 9).

Why can landfall location E not be discounted?

While Landfall E has not been discounted, it is heavily constrained from an onshore perspective. Landfall E is located within an Important Bird Area (IBA), RSPB reserve and Site of Special Scientific Interest (SSSI). It is also located close to a Special Protection Area (SPA) and County Wildlife Site. These ecological features present substantial siting and routeing challenges. As such, Landfall E is not preferred from an onshore perspective.

However, due to environmental features and technical constraints in the marine environment we need to consider landfall options from an offshore perspective in order to confirm that one or more of the landfall options that have been identified are achievable. We will also consider any engineering measures which could reduce potential effects onshore if it emerges that there is a need for Landfall E to be progressed.

Converter station

How big is the converter station for Nautilus Interconnector?

Nautilus Interconnector is at the very early stages of development. The design for the converter station has not yet been developed. A typical footprint for a converter station covers an area of five hectares (12 acres) with height of up to 24 metres. The exact size and height will depend upon the specific proposals for mitigation and construction.

NGV is constantly challenging its supply chain to bring down the size of converters. The final design of the converter station will be influenced by a thorough consultation process with the local community and other stakeholders, as well as through collaboration with the supply chain.

Why does the converter station need to be within five km of the substation?

The most efficient technical solution is to locate the converter station as close to the substation extension bays as possible – although this is not always feasible. This reduces the length of the HVAC cable circuits needed to connect the converter station to the substation. Longer HVAC cable routes result in reactive power transmission losses which require extra equipment in the converter station, such as shunt reactors, to compensate these losses. A five km radius reduces the likelihood of needing this equipment.

HVAC cable routes typically require a larger working width than that of HVDC cables. A longer HVAC cable route between the converter station and the NGET substation therefore has the potential to impact a larger area. Bundled underground cables will need to be installed between the converter station and the NGET substation. Therefore, minimising the distance between the infrastructure helps reduce disruption and the land take required for cable burial.

Can the converter station be buried?

There are a number of environmental, technical and cost factors which must be considered when designing the converter station, and partially or entirely burying the building presents significant challenges relating to keeping the building free from water and moisture.

NGV is constantly challenging its supply chain to consider, develop and review innovative engineering and design techniques. Further work is being undertaken to assess the feasibility of burying converter stations. Site specific constraints and safety will also have an impact on the feasibility of burying a converter station. Converter stations have not previously been buried due to concerns over water ingress into buildings accommodating electrical infrastructure, concerns over the effectiveness of firefighting and ventilation systems, and the additional associated costs. NGV would be required to undertake a cost benefit analysis to assess additional cost against potential benefits in order to meet Ofgem requirements.

The final design of the converter station will be consulted on with the community in detail before submitting any application for a Development Consent Order (DCO). This will include the opportunity to provide feedback on items such as visual appearance and landscaping.

Will the converter station be noisy?

The converter station will be designed to reduce noise. Noise modelling assessments will be undertaken as part of the EIA process. Noise levels will be consulted on with environmental health bodies and the local authority to ensure that any noise does not exceed unacceptable levels.

Offshore

What is included in the project offshore?

Offshore components for Nautilus will include:

- Offshore convertor station platform/s
- A submarine high voltage direct current (HVDC) interconnector

There are a number of factors which will influence the infrastructure required in the marine environment including ongoing discussions with the supply chain, technical assessment and discussions with offshore wind farm developers.

What will the offshore converter station platform/s look like?

The design and configuration of the offshore HVDC converter station platform is still in its early stages. The approximate maximum dimensions for an offshore HVDC converter station could be 110 metres in length and 80 metres wide, with a height of 45 metres. Note that the converter station will be installed on foundations (jacket) elevating it above the water surface and the height of the jacket, and therefore total platform structure will depend on water depth at the chosen location.

The aim is to site the offshore HVDC converter in proximity to offshore wind and so we would anticipate this to be at least 20 km from the coast.

If Nautilus connects more than one offshore wind farm then it may be necessary to have two separate offshore converter platforms in order to reduce the length of cabling connecting the offshore wind farms. This would be subject to further engagement with stakeholders and relevant offshore wind farms.

Our engagement with engineering specialists is ongoing as we continue to discuss and refine what the detailed infrastructure requirements are in the offshore marine environment.

The location of the offshore platform will be informed by the alignment of the interconnector cables and the proposed location of the wind farm schemes.

Environment

How will the impact on the environment be considered?

NGV will be undertaking an Environmental Impact Assessment (EIA) process to ensure that matters relating to the environment are considered when developing the proposals for Nautilus Interconnector. An EIA is a legal requirement for some developments and is strictly regulated. A wide range of environmental subjects will be taken into consideration including traffic, landscape and visual impact and ecology. The results of these assessments will be consulted on in a Preliminary Environmental Information Report (PEIR), before being refined and submitted in an Environmental Statement (ES) which will form part of the DCO application.

Project timeframes

When will the project be completed?

Nautilus Interconnector is currently at a very early stage of its development. Should consent be granted, a Final Investment Decision by NGV for the project is planned for 2024. Following this, construction will commence, and the project could be operational by 2028.

What does Brexit mean for Nautilus Interconnector?

NGV has undertaken a thorough analysis of potential risks relating to Brexit, and the results of this analysis highlight that electricity Interconnectors will be able to operate post-Brexit under any outcome.

NGV is confident that the energy markets in the UK, France, Netherlands, Belgium and Norway will continue to operate as they do now. NGV interconnectors will continue to have the right export and import power to and from those markets.