NordLink

The “green link” for exchanging German wind energy with Norwegian hydropower

Frequently Asked Questions

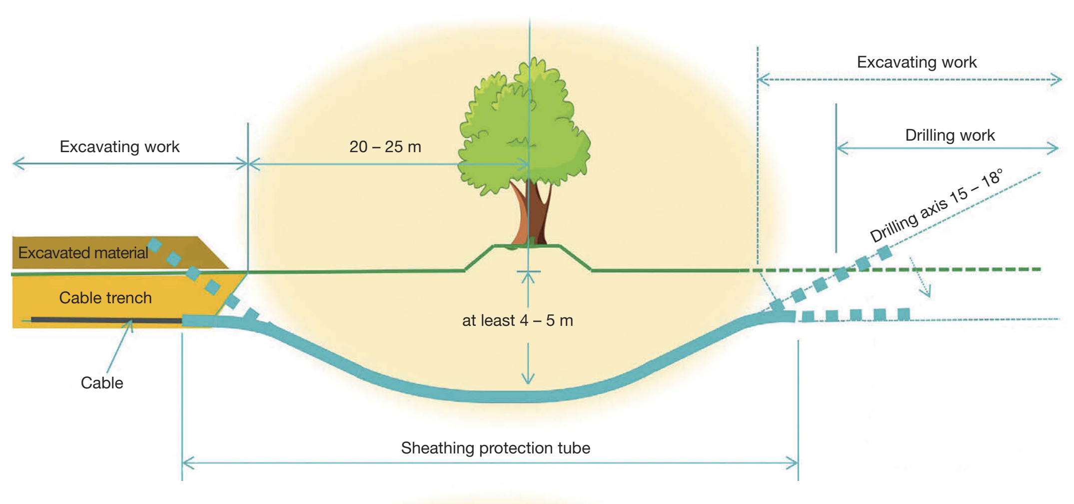
Statnett \ TenneT \ KfW

Data and Facts

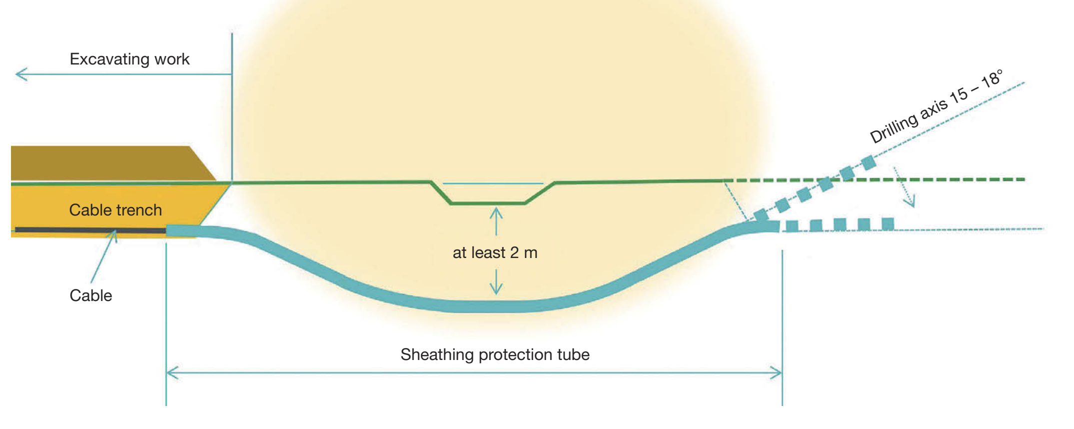
- **Connection:**
  623 km grid connection
  DC (HVDC)
  Capacity: 1.400 MW at ± 525 kV DC
  Onshore: 53 km high-voltage overhead line (Vollesfjord to Tonstad/NO)
  Offshore: 516 km subsea cable
  Onshore: 54 km land cable (Büsum to Wilster/Schleswig-Holstein)
- **Grid connection points:**
  Substations Wilster (DE) and Tonstad (NO)
- **Project status:**
  In operation


Tonstad
NO
DK
DE
Wilster
NordLink
NordLink-interconnector-route
section 1: 187 km overall length
of it 134 km as a seacable
of it 53 km as a overhead line
section 2: 228 km overall length
section 3: 208 km overall length
of it 154 km as a seacable
of it 54 km as a underground cable
border of territorial waters
transmission grid
converter station

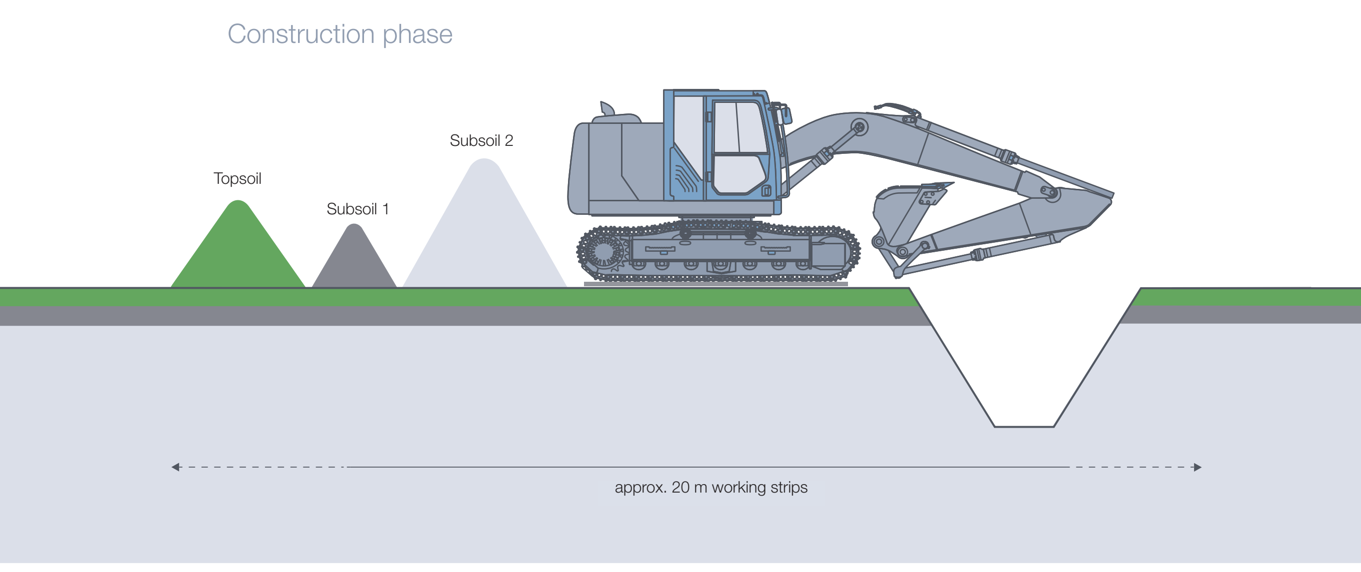
Horizontal drilling under vegetation, hedgerows or federal waterways

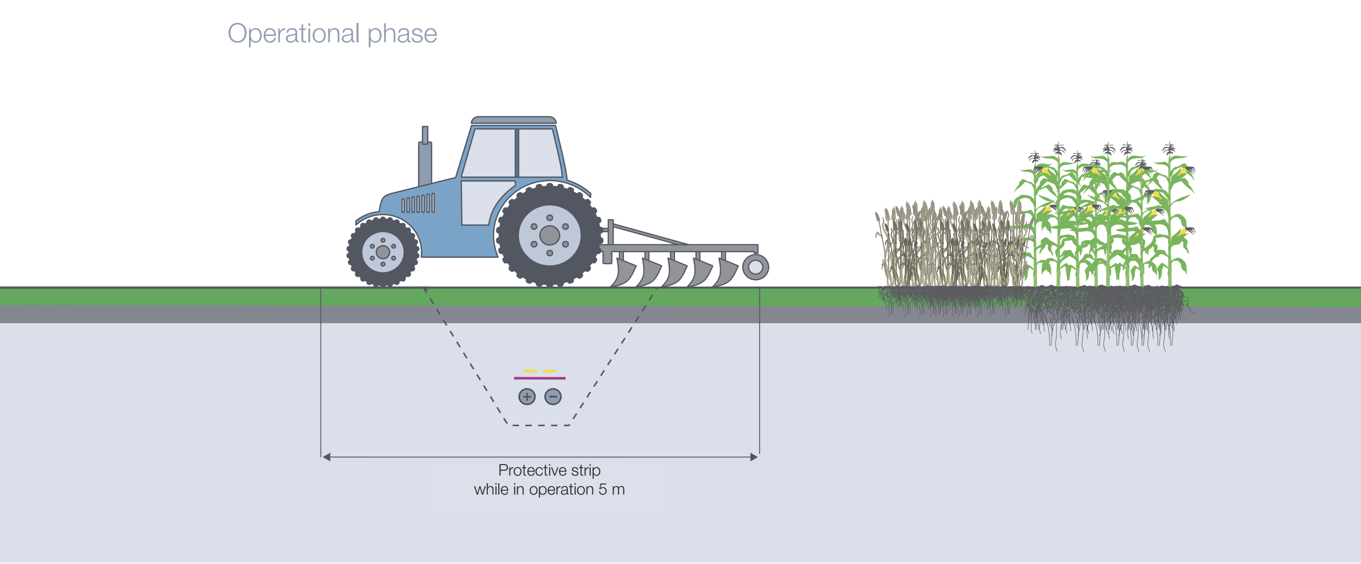


Horizontal drilling under small bodies of water and ditches



The horizontal drilling method allows infrastructures – such as railway installations or federal waterways, but also protected areas – to be underpassed in a gentle manner. The length of the required boreholes depends on the width of the infrastructure to be underpassed. NordLink involved drilling boreholes in some sections of approximately 50 to 560 metres (e.g. land-protection dike approximately 480 metres, Kiel Canal approximately 560 metres).





How many boreholes were required in the underground cable section using the horizontal directional drilling (HDD) method?
On the 54 km-long section of underground cable, 200 underpassings were carried out using the HDD method. Since the positive and negative poles were each laid as a separate cable strand, a total of 400 bore tunnels were drilled, each with 400 intake pipes, into which the land cable was inserted.

How were existing drainage systems be dealt with?
After the cable was laid, TenneT restored drainages to the state of functionality in which they were found. This could mean that entire areas had to be re-drained in order to properly restore the overall drainage structure.

How much does the land cable weigh per strand per metre?
A metre of land cable weighs 48 kg.

How warm will the outer sheath of the underground cable get during normal operation and at full load?
The temperature of the cable depends on the transmission rate and the cable’s surroundings. The temperature at the outer cable sheath of NordLink under constant full load will range between 32°C and 39°C, depending on the particular ground conditions. In normal operation, the temperature at the outer cable sheath will be lower because the cable will not be permanently operated under full load.

How does the underground cable react to electric and magnetic fields? Will limit values be adhered to?
Electric and magnetic fields (EMFs) are created wherever electricity flows. This applies to both household appliances and HVDC lines. All underground connections were planned and built – and will now be operated – by TenneT in such a way that they will not only comply with, but also be much lower than the legal limits. With underground cables, the electric field will be completely blocked by the cable sheathing and will have no impact on the surroundings. Magnetic fields have been reduced to a minimum by laying the positive and negative poles of each connection in parallel already in the cable trench. The remaining values will be similar in strength to the Earth’s natural field.

What happens if there is a disruption in the cable system?
The first step will be to locate the fault, as the disruption is often only found at a single point. This will be professionally remedied through targeted interventions. All the requirements stipulated in the original permit will continue to be met.

How is the NordLink underground cable being constructed, and how does it differ from the planned SuedLink or SuedOstLink underground cables?
The NordLink underground cable is a 525 kV mass impregnated underground cable (MI cable). For the SuedLink and SuedOstLink underground cables, the use of plastic-insulated cables is planned. This insulation material is already used for German offshore connections (at a voltage of 320 kV). For the 525 kV voltage level, all four German transmission system operators are currently conducting prequalification tests on plastic-insulated cables in order to prove that they are technically ready for the market.

Why is NordLink necessary?
NordLink – the “green link” – creates a connection to the capacities of the hydropower plants in Norway and will counteract bottlenecks in the German transmission grid. This interconnector increases the possibilities for the exchange of renewable energies while contributing to the reduction of CO2 emissions and the achievement of climate goals.

How will NordLink benefit the two countries involved?
NordLink – the “green link” for exchanging German wind energy with Norwegian hydropower – is a connection of two optimally complementary systems. NordLink is a lighthouse project and enormously important building block of the European energy transformation to compensate for dark periods and at the same time to make green energy available safely and affordably in Europe In addition to having a positive impact on energy prices, NordLink also further advances the integration of the European electricity market.

What is the capacity of NordLink?
NordLink has a capacity of 1,400 megawatts and can supply more than 3.6 million German households with renewable energy. This is roughly equivalent to the feed-in capacity of 466 wind turbines of three MW each. This means that the interconnector’s capacity is roughly equal to that of one and a half large conventional power plants.

When was NordLink be connected to the power supply, and when were the tests initiated?
The tests were started in the second half of 2020 and successfully completed in spring 2021.

How long are the NordLink cables expected to remain in operation?
The system is designed for an operational lifetime of 40 years.

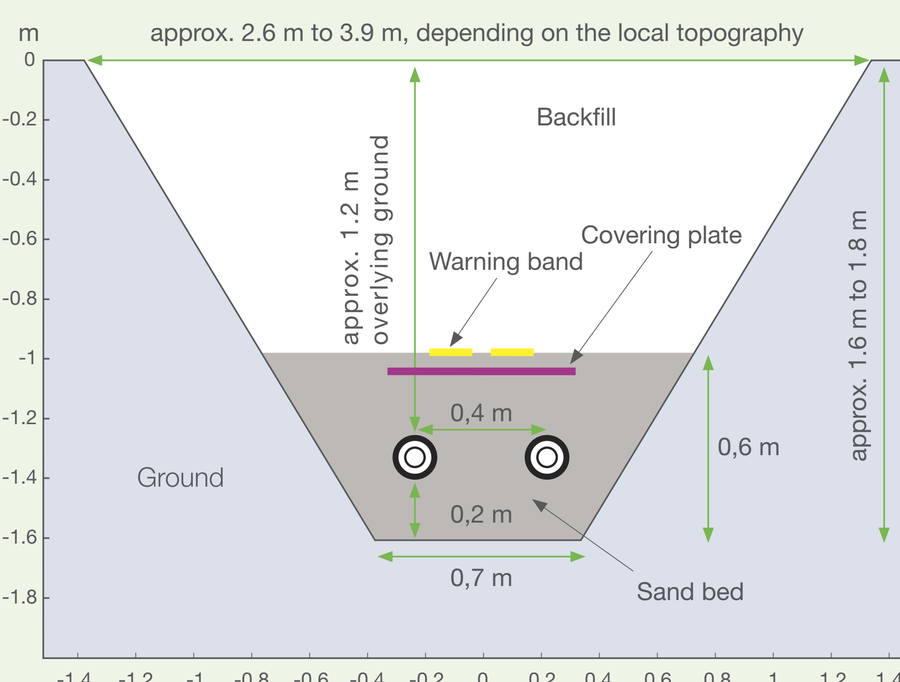
What land-based construction measures took place on the German side?
First, a temporary construction road was built before excavating the trench in which the cable would be laid. Then the entire 54 km-long section of underground cable was laid. It started from the dike in Büsum and now runs to the converter station in Wilster. Commencement of work: Summer 2019. Completion: 2020.

What construction steps were taken before the underground cable was laid?
First, the planned route and the associated construction sites were surveyed and marked out. Second, the laying route was examined for explosive ordnance and, where necessary, cleared of old munitions. Lastly, archaeologists surveyed the area along the cable route to secure potential archaeological remains.

Was the construction work professionally supervised?
Yes, the construction work was professionally supervised by archaeological, environmental and pedological (i.e. soil) experts.

How deep was the cable laid, and can the area above the cable trench be used during operation? What should be paid attention to?
The cables were laid in an open cable trench approx. 1.6 metres deep in the ground. The working strip during the construction phase was usually 20 metres wide, although it was slightly wider when necessary if there was a larger number of piles of separated soil. The protective strip in the operational phase is five metres wide. The depth at which the cable has been laid ensures that the land can still be used for conventional agricultural purposes. When underpassing roads, railway lines, canals, deeper trenches, undercrossings or similar structures that could not be underpassed using an open cable trench, the cable was laid by means of horizontal directional drilling (HDD).

Schematic depiction of the open laying method
The working strip for the laying work was approximately 20 metres wide.
The protective strip will be five metres wide during the operational phase of the NordLink cable.



How was the soil excavated and backfilled for the open laying method? Was attention paid to the different soil layers?
The trench was dug step by step using excavators. The individual soil layers were carefully removed in the process and placed in separate piles. In addition to separating the soil into topsoil and subsoil, other layers were also placed in separate piles depending on the composition and quality of the soil. After the cable was laid, all the soils were put back into the ground in the same layers as before the earthworks were started. After filling the trench and completing the earthworks, the sustainable renaturation of the area was begun. The entire area can now be used for agricultural purposes again. However, it must be kept free of deep-rooted woody plants and structures. The reasons for this are:
- It must be possible to uncover the route for repairs and maintenance easily and at all times; large root system would make this work considerably more difficult.
- Deep-rooted plants can also entwine themselves around the cable and cause long-term damage.

All work was exclusively carried out with the necessary official permits.

How long is a single underground cable strand from jointing to jointing?
For NordLink, approx. 1,200 metres of cable strands were laid from jointing to jointing in a so-called section. The length of the underground cable was limited by the weight and diameter of a cable drum, as the drum had to be able to be transported on streets, roads and bridges as well as to still be able to pass under road bridges.

How were the individual cable strands connected together?
The cable strands were connected with sleeves called “jointings” using the so-called “jointing method”. This was done in clean room containers to prevent the jointings from being contaminated with sand or the like on the construction site. Now the jointings, like the entire cable, lie on the bedding sand in the cable trench. There are no inspection shafts or the like here. The diameter of the jointings is only slightly larger than that of the cable.

German-Norwegian cooperation
The NordLink project was implemented by the Norwegian TSO Statnett and DC Nordseekabel GmbH & Co. KG, each with 50% ownership. TenneT and KfW each have a 50% share in DC Nordseekabel. DC Nordseekabel was responsible for the construction and approvals on the German part of the project.

Über TenneT
TenneT is a leading European grid operator. We are committed to providing a secure and reliable supply of electricity 24 hours a day, 365 days a year, while helping to drive the energy transition in our pursuit of a brighter energy future – more sustainable, reliable and affordable than ever before. In our role as the first cross-border Transmission System Operator (TSO) we design, build, maintain and operate 23,900 km of high-voltage electricity grid in the Netherlands and large parts of Germany, and facilitate the European energy market through our 16 interconnectors to neighbouring countries. We are one of the largest investors in national and international onshore and offshore electricity grids, with a turnover of EUR 4.5 billion and a total asset value of EUR 27 billion. Every day our 5,700 employees take ownership, show courage and make and maintain connections to ensure that the supply and demand of electricity is balanced for over 42 million people.
Lighting the way ahead together.

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