Sub sea cables

Selected references

5th of June 2023

NIRAS assists in establishing new offshore cables

When establishing new offshore cables, several elements must be taken into account. This goes regardless of the content of the cable. This includes but is not limited to:

- Burial depths
- Landfall assessments
- Feasibility studies
- Construction methods and dredging
- Environmental Impact Assessments and sediment dispersal
- Scour, scour protection and seabed movements
- Risk assessments
- Input for BOQ
- Input for price assessments
- Hydrodynamic Forces
- Numerical modelling and CFD

The services include everything related to the physical placement and stability of the pipeline.

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Optimized and tailormade solutions

For new offshore cables, there are a number of studies that can be made, and at NIRAS we strive to ensure that our customers are satisfied with the work we put into our projects. We often work with interdisciplinary projects and involve several stakeholders, which is why cooperation and involvement are necessary for further success.

NIRAS emphasizes the importance of establishing a basic understanding of the surrounding environment and local conditions when developing sustainable solutions. We have state-of-the-art numerical models, MIKE software, GIS, CFD, and 3D CAD software that enables us to manage, inspect, develop, optimize and present our assessments and further design.

A wide range of services

Our in-house specialists cover all necessary disciplines and have decades of experience in solving complex challenges. NIRAS is thus not dependent on external input to solve the complex challenges around subsea cables.

EIA for marine part of Baltic Pipe

Baltic Pipe is an upcoming new gas pipeline that will connect Denmark and Poland with the Norwegian gas fields. The gas pipeline consists of new gas pipes in the North Sea, Little Belt, the Baltic Sea and Poland. The expansion will have a capacity of up to 10 billion cubic meters of gas per year. Baltic Pipe is planned to be ready for operation in 2022.
The Baltic Pipe project is a collaboration between Energinet and the Polish gas transmission company GAZ-SYSTEM. Energinet will be responsible for the planning, construction and subsequent operation of the Danish part of the project, which includes facilities on land, in the North Sea and in the Little Belt. GAZ-SYSTEM will construct and own the gas pipeline along the entire Baltic Sea route and the extensions to the Polish gas transmission network. An overall environmental impact report has been prepared for the Danish part of the Baltic Pipe project. The environmental impact report consists of five sub-reports covering the onshore section, the section in the North Sea, the Little Belt, the Baltic Sea and an ESPOO document.
NIRAS has assisted Energinet in preparing environmental assessments for the part of the Baltic Pipe gas pipeline to be established through the North Sea and the Little Belt. As part of the service, NIRAS has prepared a draft scoping memorandum in accordance with the procedure in the new Environmental Assessment Act. For the environmental impact report, NIRAS has described and assessed all relevant disciplines. Among other things, focus has been on sediment dispersion, noise impacts, marine biological conditions, ship traffic, sailing and recreational interests. As a basis for the assessments, NIRAS has, among other things, re-performed noise calculations both on land and at sea.
An assessment of the impact on relevant Natura 2000 areas has been prepared, as well as assessments of the impact on species listed in Annex IV of the Habitats Directive. Furthermore, the project has been assessed in relation to the objectives of the river basin management plans and the Marine Strategy Framework Directive. NIRAS is also preparing an application for a dredging permit for the sediment to be removed as part of the project in Lillebælt.

Year
2018 - 2020

Customer
Energinet.dk

Project / Construction cost
5.442.182 DKK

Project Category
Environmental assessments

#9 Industry, innovation and infrastructure

#14 Life below water

Aflandshage and Nordre Flint Offshore Windfarms, Denmark

Copenhagen Municipality is making a green transition of the capital energy production as a part of their strategy to become climate neutral. The Greater Copenhagen Utility, HOFOR, therefore wants to establish two offshore windfarms in Øresund, Aflandshage and Nordre Flint, with a joined capacity of 410 megawatts. Aflandshage Offshore Windfarm will be located east of Stevns and Nordre Flint Offshore Windfarm between Copenhagen and Malmø, Sweden. The establishment of the offshore windfarms might affect the environment, and HOFOR is therefore making an environmental impact assessment (EIA).

NIRAS is consulting HOFOR Vind A/S about this, and has made the EIA for the two offshore windfarms. Amongst others, the extensive work accounts for the impact on the marine flora, fauna and seabed. Additionally, the windfarms are constructed within the legal framework, which considers existing Natura 2000 areas in Øresund as well as the EU legislation on the Water Framework Directive and the Marine Strategy Framework Directive.

As a part of the EIA, NIRAS has made a background report on coastal morphology, sediment spill and hydraulics. To determine these changes, NIRAS has setup a numerical depth-averaged 2D model in MIKE 21 HD FM and MIKE 21 SW by DHI. The results of the model is compared with the existing conditions to determine the impact of the offshore windfarms on the marine environment. Additionally, NIRAS has investigated the spread of sediment through modelling of spill in MIKE 3 MT.

Year
2019 - 2023

Customer
HOFOR A/S

Contract Fee
19.662.034 DKK

Project Category
Green Wind; Wind energy

#7 Affordable and clean energy

#14 Life below water

Joss Bay Sea Cables, UK

A cable is planned to run from Joss Bay (Kent) over towards Belgium (Southern North Sea/Eastern Edge of English Channel) crossing The Marine Conservation Zone 'Thanet Coast MCZ'. NIRAS has been asked to prepare a proposal concerning the sediment spill and the distribution of the plume in time and space. This will be an input to the environmental assessment regarding the plume impact zone in terms of excess turbidity, the plume impact duration in terms of how long the excess turbidity would be in the water column before it is absorbed into background levels and the sedimentation (siltation/smothering) in mm for the benthic habitat in the vicinity of the works.

The cable installation will be done using a rock cutter to cut a 0.7 m wide 2 m deep trench through chalk rock planned to take 5 days working 24 hours for a distance of 12 km from the beach. There will be an increased focus on the first 2 km of the route as this part is within the protected Marine Conservation Zone. Backfilling is not considered in the study.

The model for the sediment spill will be split into two separate models that both will describe the overall tide and current pattern. Firstly, a coarse regional model will be covering the North Sea and the English Channel. The second model will be a finer local model that is used to describe the area of Joss Bay +/- 20 km.

For quantification of the sensitivity two scenarios are simulated:

1) Low tide – Neap e.g. smaller tidal variations and lower current and
2) High tide – Spring e.g. larger tidal variations and higher current speeds

Except for the starting point according to the tide, the input to the two simulations are identical.

Year
2020 - 2021

Customer
NIRAS Group (UK) Ltd.

Project / Construction cost
222 904 DKK

Project Category
Harbours and Marine Structures

#9
Industry, innovation and infrastructure

Thor offshore wind farm - export cable landfall

The offshore windfarm close to Thorsminde in Denmark is proposed to be placed approx. 30 km of the coast of Western Jutland. Two of the export cables from Thor have landfall on the beach just north of Nissum Fjord. The coastal zone at the landfall is characterized by strong longshore currents and high rates of south-going sediment transportation. This makes the beach profiles highly dynamic and subject to constant transformation. The erosion rates have been mitigated by beach nourishment since 1983. Despite shipwrecks and bunkers submerged into the seabed, the site has detached breakwaters, a dune with slope protection and the remains of old groins.

NIRAS has made an analysis of the seabed and shoreline morphology for the landfall of the export cable. This included an analysis of the shoreline evolution 1954 to 2021, as well as a forecast of future movements. Just like the shoreline will be subject to change through the years, so will the seabed. Therefore, an analysis of the seabed movements have been made as well. If there are too many changes in the seabed the cable could become exposed over time, so this needs to be taken into account when planning for the cable installation.

Further, an assessment of the flood risk was included as well, in order to determine whether the risk was only present during the initial phases or during the entire implementation.

Year
2022 - 2026

Customer
Thor Wind Farm I/S

Project / Construction cost
200 000 DKK

Project Category
Wind energy

#7 Affordable and clean energy

#9 Industry, innovation and infrastructure

Barrow offshore windfarm - export cable survey

Barrow offshore wind farm comprises a 10 km^2 area located in the eastern Irish Sea near Barrow-in-Furness. NIRAS was contracted to produce the supporting information to the application for a marine license for emergency inter array cable repairs at Barrow Offshore Wind Farm on behalf of DONG Energy. The Environmental Statement and monitoring reports were reviewed to identify the necessary information for the application, and NIRAS worked closely with DONG's cable engineers and GIS team to ensure an updated method statement. The document provided the Licensing Authority with a comprehensive account of the methods associated with inter array cable repair, a description of the base-line environmental effects and an overview of the expected environmental effects associated with any repair work.

NIRAS made an assessment of the probability for cable damage with respect to depth of burial, fishing activities and traffic density. This included further updating the cable bury based on a new multi beam survey and as-built documentation, calculation of traffic intensity for three intervals of DWT based on 1.5 year AIS data to gain the risk for emergency anchoring/anchor penetration combined to achieve the probability for a cable damage over the life time following the Carbon Thrust guideline CTC835.

An identification of exposed cable sections along the 26 km cable route based on a TSS440 survey was made, along with a comparison of bathymetric surveys to classify the seabed along the cable route due to erosion/accretion, a risk assessment according to the Burial Protection Index (BPI) and afterward a probabilistic assessment based on ship traffic (AIS data) to point out sections where remedial works are required. At this location the most appropriated protection was recommended based on the seabed's geological conditions – in this case either jetting or rock berm. For sections with rock berm this was designed according to local metocean conditions extracted from an in-house model.

Year
2011 - 2014

Customer
Barrow Offshore Wind Limited

Project / Construction cost
$200 mill

Project Category
Harbours and Marine Structures

#7 Affordable and clean energy
#9 Industry, innovation and infrastructure
#14 Life below water

West of Duddon Sands management support

West of Duddon Sands Wind Farm (WoDS), is an offshore wind farm located 14 km south west of Walney Island off the coast of Barrow-in-Furness in Cumbria, in the Irish Sea, England. The site comprises of 108 turbines (3.6 MG Siemens), it was developed by Morecambe Wind Ltd, a partnership between Scottish Power Renewables and Dong Energy.
NIRAS provided management of internal interfaces between the packages and external with respect to the contracts. This included maintenance of interface database with a focus on responsibility, communication and implementation. Moreover, resources regarding geophysical surveys, geotechnical issues, GIS, park layout, metocean data, wave buoys (Axys), wind gauge (Lidar), sediment transport, project planning concerning offshore installation, pre and post cable burial risk assessment etc. were provided.

NIRAS performed the lead site management during the planning phase, including planning of site and commissioning organisation, resources and the preparation of a site fact book for the CAPEX budget, as a basis for the final investment decision as well as manuals for site and offshore logistics. This further included planning of the construction base harbour setup in Barrow-in-Furness, planning of offshore logistics and transfer requirements and no. of transfer vessels, preparation of the scope of works for the marine warranty surveyor, contract negotiations and variations, and preparing reports on site and commissioning progress.
The Port of Belfast was chosen to be the hub-harbour, NIRAS undertook a design evaluation of the structure and layout. This included the assessment of quay structures for loads by very large crawler cranes, assessment of bearing capacity of storage areas for monopiles and planning of site layout for site offices, traffic, monopile storage, TP storage and WTG components.

Year
2013 - 2017

Customer
Ørsted Wind Power A/S

Project / Construction cost
$880 mill

Project Category
Wind energy

#7 Affordable and clean energy
#9 Industry, innovation and infrastructure
#14 Life below water

East African Crude Oil Pipeline Project

The EACOP Project consists of the design and construction of an oil pipeline originating in Uganda and traversing eastwards across Africa for 1450 km, delivering crude oil exports to a vessel loading terminal at Tanga, Tanzania. NIRAS had developed conceptual studies for the for the Oil Terminal Load-out Facilities (LOF) together with budgetary analyses to produce a Class 4 cost estimate, and has subsequently been awarded the FEED design for the LOF. This was accepted within the challenging context of delivering a 28" oil export pipe-line through an environmentally and culturally sensitive shore area, and to an off-shore vessel-loading facility. All of this with minimum impact on local traditional fishing activities.

NIRAS investigated and developed a flexible FEED concept accommodating unconfirmed current conditions which enabled vessels up to SuezMax size to approach a loading terminal extending 2 km into Tanga Bay. One of the key requirements was to eliminate any necessity for dredging or disturbance to coral formations. Several vessel approach options were considered as part of a detailed navigational study and an optimized route established with zero seabed impact.

During the FEED process NIRAS has overcome challenging design data on soil conditions, current conditions and seismic requirements by incorporating maximum design flexibility. This was provided by engineered layout alternatives which ensured structural integrity through the use of dynamic analysis. NIRAS has specified all topsides equipment, process and safety control systems and topsides constructions required, including welded supports and secondary steel. As a support to the project Class 2 cost estimate NIRAS also supplied information on site preparations, construction philosophies, final project scheduling and environmental compliances.

Year
2016 - 2017

Customer
Gulf Interstate Engineering Company

Project / Construction cost
600,000,000 DKK

Project Category
Harbours and Marine Structures

#9 Industry, innovation and infrastructure

#14 Life below water