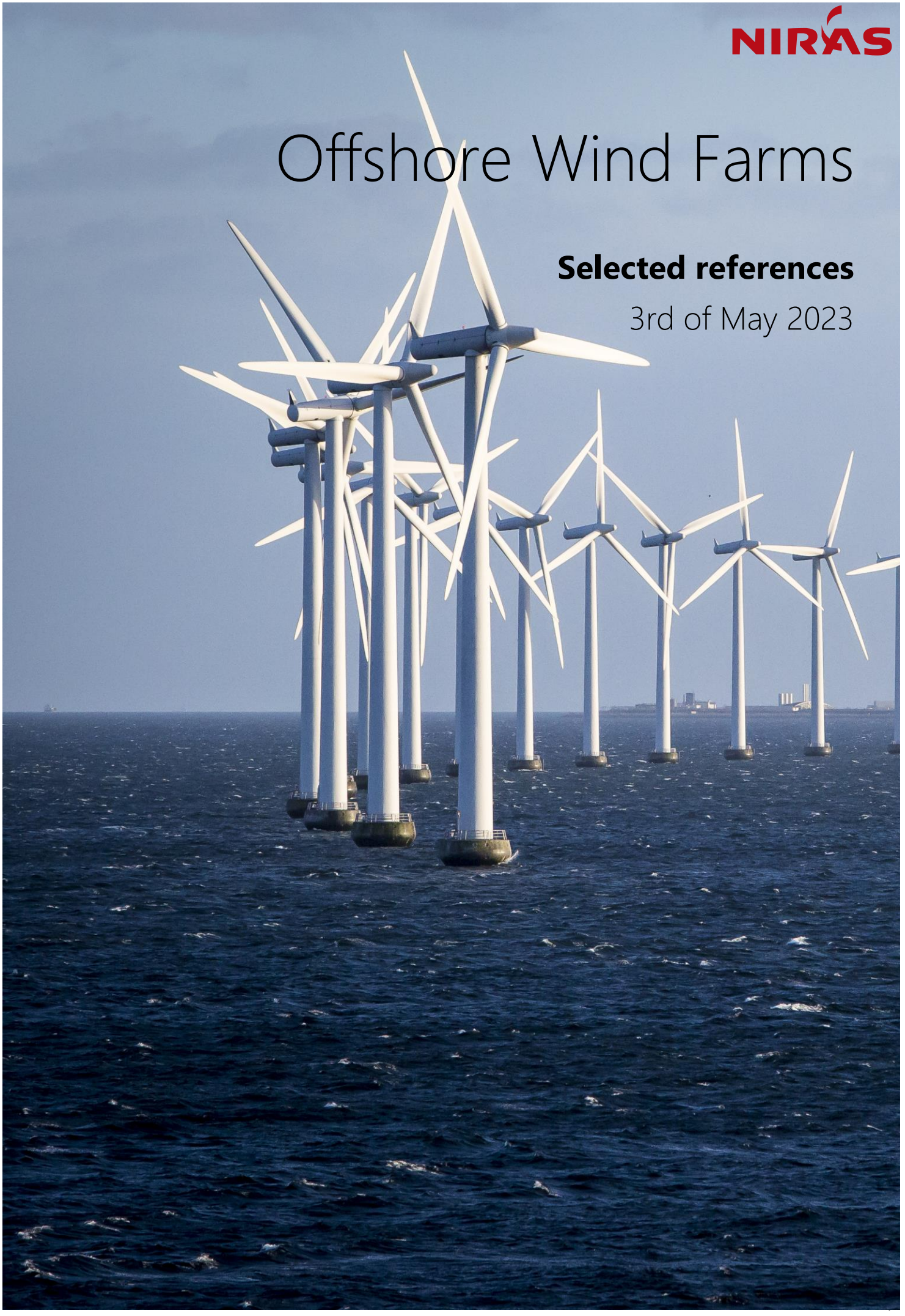

Offshore Wind Farms

Selected references

3rd of May 2023

NIRAS assists in the first phases of establishing new offshore wind farms

When establishing new offshore wind farms, several elements must be taken into account. This includes the impact on the environment, which is usually investigated through an environmental impact assessment. In addition, it is also important to look at sediment when building offshore wind farms.

For many years, NIRAS has been involved in assessing the impact of new wind farms in the sea. This has been done through close cooperation with experts in several fields and has helped to ensure that offshore wind farms can be built responsibly with regard to the environment.

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Optimized and tailormade solutions

For new offshore wind farms, 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, including:

- Environmental impact assessments
- Sustainability requirements
- Noise modelling
- Sediment dispersal
- Erosion protection

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

Environmental Impact Assessment of Frederikshavn Offshore Wind Farm, Denmark

Frederikshavn offshore wind farm is planned to be built in Kattegat approximately 4 km east of Frederikshavn. It will include 5 offshore wind turbines with a capacity of up to 72 MW, as well as high-voltage power cables in the ocean and on land. The plan is to have everything finished by 2024.

The offshore wind farm with the connecting high-voltage power cables will possibly have a large impact on the environment. For this reason the Danish Energy Agency has determined due to a preliminary study, that the wind farm can have large environmental impact on the environment, and therefore they have decided that there is a need for an EIA. The preliminary study is made on an area of 5,5 km^2 and is about 4 km of the coast from the expanded Frederikshavn Harbor. The water levels In this area can vary from 11 to 21 m, however the water levels of the cable route vary from less than half a meter closests to land up to above 18 m at the site of the wind turbines. The cable route through the land area is expected to be 5 km and it will run through a Natura-2000 area.

NIRAS has in collaboration with European Energy prepared an environmental impact assessment. This report will show how the offshore wind farm project will possibly impact the environment. The report has been divided into areas that are seen as being the most important focus areas of the environment, this includes: the animals, fishing, sailing conditions, air traffic and the visual impact of the wind turbines as seen from land.

Year
2020 - 2023

Customer
Frederikshavn OWF ApS

Contract Fee
3.358.951 DKK

Project Category
Environmental assessments

#7 Affordable and clean energy

#14 Life below water

Offshore Wind Farm Hesselø, Denmark

Energinet has developed a plan for a new offshore wind farm in Kattegat, with a cable connection to the Northern part of Zealand. Before the project can begin, a pre study is necessary in order to determine the impacts on the environment, both in the ocean and on land. The plan for the offshore wind farm, Hesselø, is that it will include the wind turbines, transformer platform, cables, both sea- and land-cables, and expansions of a high-voltage station, along with a new one closer to the coast.

NIRAS has produced two separate sub reports for the environmental assessment, one was based on the environment in the ocean, and the other was based on the environmental impacts on land. The impact on the environment from the installation and operation of the wind turbines, transformer platform, and sea cable, was investigated form the following aspects: visually, noise, air safety, sailing conditions, hydrography, sediment, water quality, flora and fauna at the sea bottom, sea mammals, noise impact on sea animals, fish, birds, bats, air and climate, as well as fishing conditions amongst other. The visual impact from the wind turbines was investigated both at night and day, from North Zealand, Anholt and Kullen in Sweden. The cables are going through a Natura-2000 area and due to this it is necessary to include an environmental impact assessment of the area.

The establishment of more wind farms is in agreement with the Danish governments initiatives to include more green energy in Denmark, as well as the SDG of increasing access to green energy for everyone across the world.

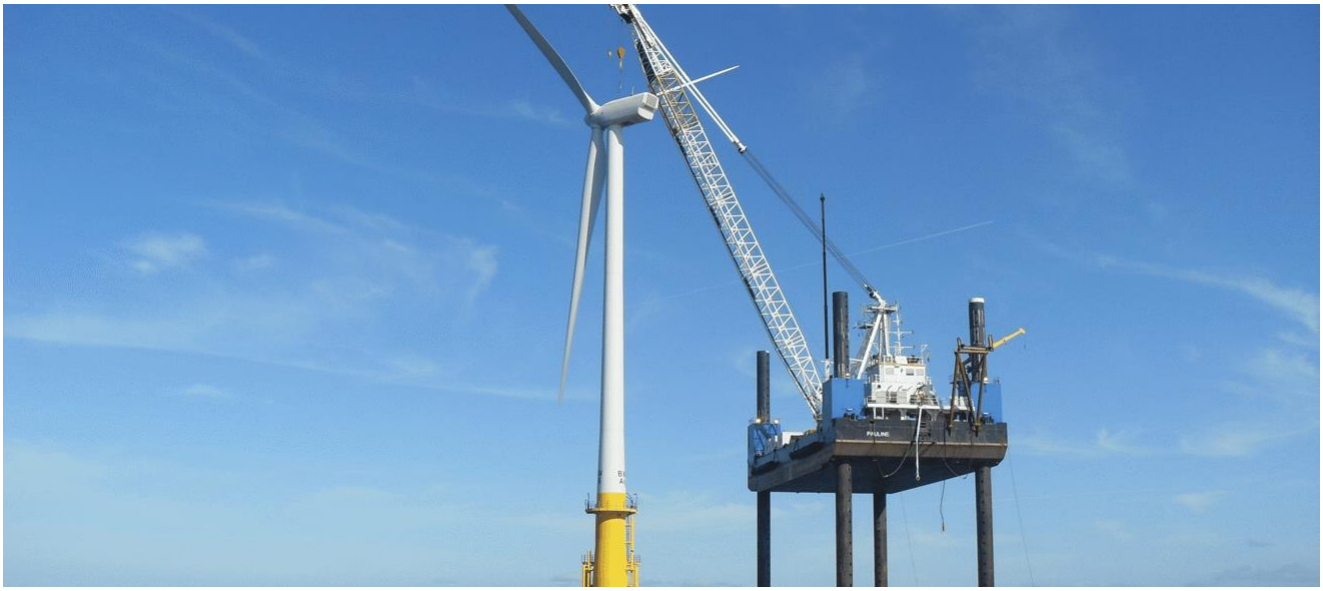
Year
2020 - 2023

Customer
Energinet Eltransmission A/S

Contract Fee
13.743.975 DKK

Project Category
Wind energy

#7 Affordable and clean energy
#14 Life below water
#15 Life on land



Sustainability Requirements for Offshore Wind Farm Tenders

The Danish Energy Agency has asked NIRAS to investigate how sustainability requirements can be imposed in future tenders for offshore wind farms, particularly how requirements for the reduction of CO_2e emissions can be implemented. Documentation and assessment of sustainability is a complex process that requires methods, procedures, and data that affect the entire value and supply chain and therefore requires time to develop. The offshore wind industry is facing this development now.

Until now, there has been limited focus on imposing or documenting sustainability in the offshore wind industry. Therefore, NIRAS has conducted a thorough analysis aimed at gaining the experience, data, and systems required to make objective, transparent requirements at the appropriate level. The requirements should on the one hand provide the industry with motivations to innovate and reduce the environmental, climate, and resource consumption footprint of offshore wind farms, and on the other hand be possible to comply with without creating unintended negative effects, such as delays or reduced competition.

The analysis include mapping where the largest environmental effects occur in the value chain, examining the systems used in other sectors in relation to sustainability, and conducting interviews with industry actors about their perspectives. Finally, advantages, disadvantages, and challenges of using different models and criteria have been identified. Based on the analysis, NIRAS has developed proposals for possible concrete sustainability requirements and criteria that can be used in future tenders for offshore wind farms. This contributes to UN Sustainable Development Goal 9, which focuses on promoting sustainable industrialization and infrastructure.

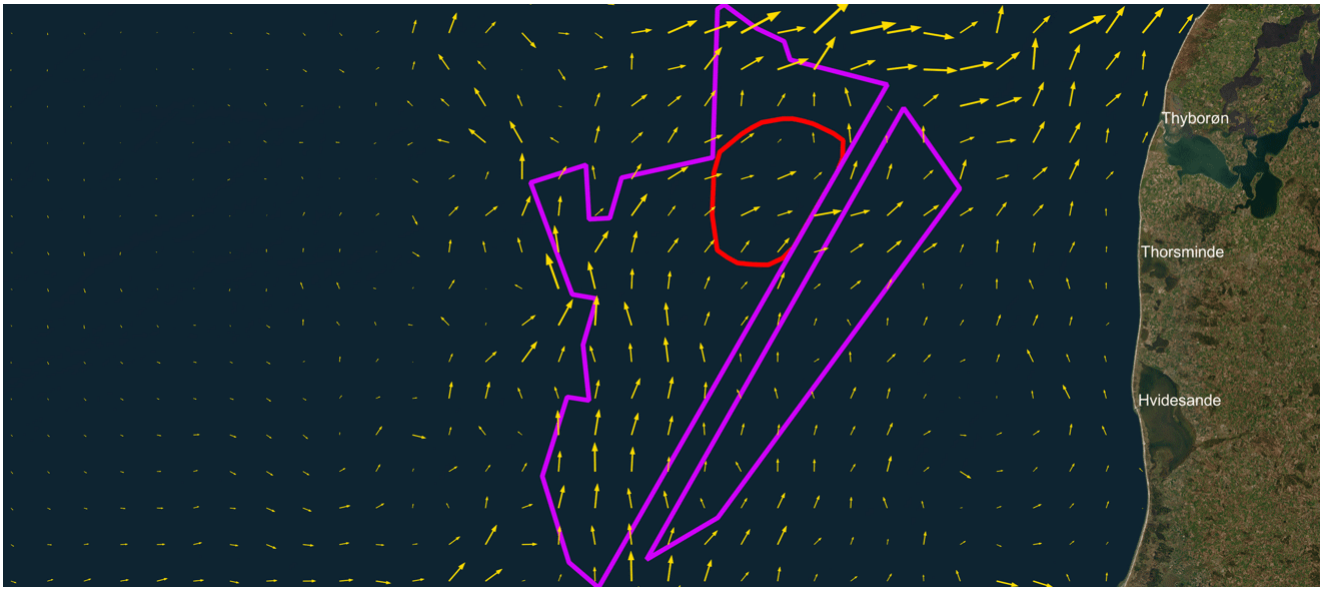
Year
2022 - 2022

Customer
Energistyrelsen

Contract Fee
400.000 DKK

Project Category
Environmental and Socio Economy

#7 Affordable and clean energy
#9 Industry, innovation and infrastructure
#13 Climate action



Energiø – Hydrodynamics and Sediment Dispersal, Denmark

The Energiø will be located in the Eastern part of the North sea of the coast of Jutland. Phase 1 of the project will consist of the island itself and 12 GW offshore wind, further Phase 2 will consist of Phase 1 plus an additional 28 GW offshore wind. Energinet decided to undertake a preliminary study of the impact on the marine environment during both the construction and operation phase.

The study will include models of changes in currents, wave conditions, sediment transport, seabed composition, and the overall transport of water due to the construction and operations of the island and the wind turbines. The sediment spill during the construction phase is modelled in MIKE 2D hydrodynamic model and MIKE Particle is used for the sediment. To estimate the pressure in the operation phase on the hydrodynamics and the dispersal of sediment three types of numerical models are used: a hydrodynamic model to simulate the water level and currents, a wave model to simulate the wave climate, and a sediment model to simulate the spread and deposit of the sediments dispersed due to the installation activities.

By installing offshore wind turbines in the ocean around Denmark NIRAS is working towards creating more sustainable and clean energy in the world. The purpose of Energiø is to supply Denmark and other European countries with clean and affordable energy. This is aligning with the SDG number 7, which is working to ensure affordable, reliable and clean energy to the world.

Year
2022 - 2023

Customer
Energinet Eltransmission A/S

Contract Fee
642.920 DKK

Project Category
Wind energy

#7 Affordable and clean energy

#14 Life below water