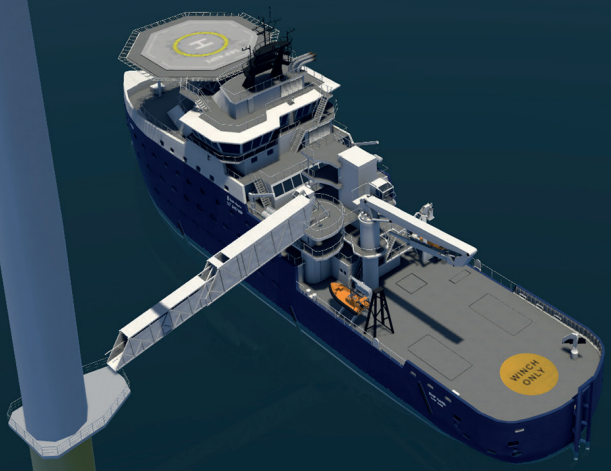
The National Decommissioning Centre

Innovation through Partnership

Renewables

Case Studies



The NDC has been making full use of its marine modelling and simulation expertise to support the offshore renewables sector through collaboration with companies on projects to trial and de-risk technologies, optimise operations and logistics and to understand better any ecological impacts. The NDC's simulator provides a safe, virtual and repeatable environment with the ability to vary the climatic and sea state conditions.

Complex operations can be simulated, ranging from dockside turbine assembly to system change out scenarios for novel turbine designs. One example is a feasibility study to tow and swap out T-Omega Wind's single point mooring turbine design. Working with functional models the NDC has helped to de-risk turbine swap over operations through a range of sea holding simulations.

Our ability to simulate at a detailed component level has allowed developers to trial unique enabling technologies through a range of scenarios. As well as developing bespoke working models of the technologies themselves, the complexity of these scenarios has required the input of a range of marine vessels and large port infrastructure, models of which are all available within the simulator. Quick mooring cable connectors and load reduction devices have benefited from virtual technology trialling, providing rapid and detailed outputs for developers, something that would be prohibitively expensive if real world testing was the only option.

The capability to build virtual environments for users that reflects their real world working conditions has developed through close working with project partners. Results have included working port models to simplified facilities for proof of concept analysis. Common to all the work is the confidence that partners have expressed that modelling, and simulation has had a positive impact on their design processes, product development and operational workflows.

Case Study 1

Design optimisation of floating offshore wind turbine (FOWT) mooring systems

Challenge

To make FOWTs economically competitive, it is important to minimise the cost of installation and operations. The procurement, installation and maintenance of the mooring system accounts for 10% of the total FOWT cost. Opportunities to reduce the cost of the moorings could have a favourable impact on the levelized cost of electricity.

What we did

This joint project with ORE Catapult is optimising the design of a mooring system to find a low-cost solution while maintaining the turbine's efficiency and lifespan. An optimisation method has been developed and simulations run to identify an optimal design. By incorporating an electrical cable into a FOWT model and setting constraints in the turbine optimiser, the mooring system can be designed to protect the cable, thereby improving the cable's integrity and potentially leading to reduced component insurance cost.

Outcomes and benefits

This new method is being advanced to enable design optimisation of mooring systems for multiple turbines in a wind farm. Longer term, this project will develop an optimisation toolset that can be used by industry to obtain a low-cost solution for a specific site with a chosen turbine design and substructure within a faster timescale.

Case Study 2

Load reduction device

Challenge

Mitigating shock loads in offshore mooring systems is a challenge.

What we did

A functional model of Dublin Offshore Consulting's (DOC) Load Reduction Device (LRD) was built in the NDC's simulator. The LRD is connected in-line between the anchor and the floating platform and puts a compliant element in the mooring line which reduces the loads caused by excessive waves.

Outcomes and benefits

The modelling allowed the team at DOC to develop, test, and comprehensively evaluate through virtual trials, the requirements and complexity of LRD's port deployment (Port Talbot, Celtic Sea) and its subsequent site installation.

Case Study 3

Port Infrastructure - Peterhead Port Authority

Challenge

All offshore renewable systems require port infrastructure from which they can be deployed. With the huge scale of offshore wind deployment required by the UK there is a challenge, in terms of port capacity with the potential for competition between the twin priorities of decommissioning oil and gas assets and the deployment of renewable energy systems.

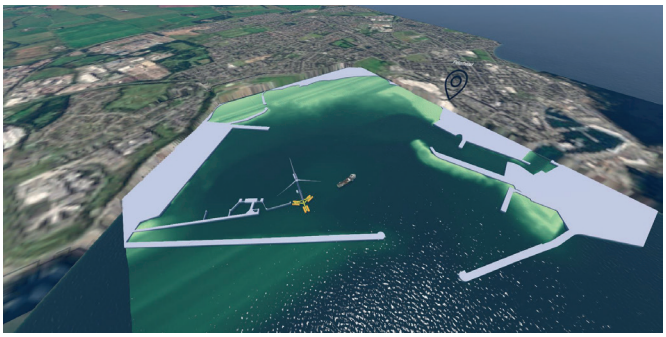
What we did

The collaboration with Peterhead Port Authority focused on building a realistic model of Peterhead Port, based on the detailed design and recent bathymetry data provided by the port. This allowed for a virtual functional port model to be created that can be used in the future for modelling of offshore wind deployment, assembly, maintenance and integration that can support current and future offshore wind projects in Scotland.

Outcomes and benefits

Virtual functional models of ports and harbours and their associated infrastructure offers risk-free, low-cost environments to simultaneously trial multiple operations and scenarios. The data and visual evidence generated will assist port operators to optimise their quayside layout to maximise efficiency or provide flexibility for a wider range of operations.

Our state-of-the-art marine simulator



NDC simulates image of Peterhead Port