

An advanced ice model for application in design of offshore wind turbines (SHIVER)

Publieke samenvatting / Public summary

The objective of the SHIVER project is to develop an experimentally validated simulation model for dynamic ice-structure interaction and a method for application of the model in the design of offshore wind turbines. Combined, these can replace the current existing design approaches for offshore wind turbines loaded by ice, allowing for optimized design of offshore wind turbine in ice-prone regions.

A series of ice basin tests have been performed at the Aalto ice tank in Finland, creating a benchmark dataset for offshore wind turbines in ice. Testing was done with a real-time hybrid test setup, allowing to simulate the behaviour of an offshore wind turbine including wind loading and rotor-nacelle-assembly dynamics. The results showed the development of a new regime of ice-induced vibrations where the ice interacts with the first and second global bending modes of the turbine support structure. This type of interaction can govern the design of the structure when ice is considered and is currently overlooked by approaches in design standards which have been defined based on experience with much stiffer lighthouse and oil and gas structures.

In addition, an ice laboratory at TU Delft has been established with the purpose of enabling small-scale testing of ice failure against structures. Ice samples have been collected from the IJsselmeer in the winter of 2021 nearby the foundations of Windpark Fryslân and brought to TU Delft for material testing. The aim of this part of the project is to establish the

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input parameters for the numerical simulation model based on physical ice properties, allowing to apply the developed model for different ice conditions around the world.

The simulation model for dynamic ice-structure interaction under development in the SHIVER project has been validated with the obtained model-scale data and applied in the design of the Windpark Fryslân offshore wind farm and several Baltic Sea projects. The added value of this approach is that it allows for design of offshore wind support structures in mild ice conditions without mitigation measures for ice such as ice cones, thereby reducing the LCoE of the projects.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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