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- 1 Construction of a wind farm in the North Sea
- 2 Erection of a foundation at the alpha ventus wind farm

ENVIRONMENTAL CONDITIONS FOR OFFSHORE ENERGY PLANTS

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Tasks

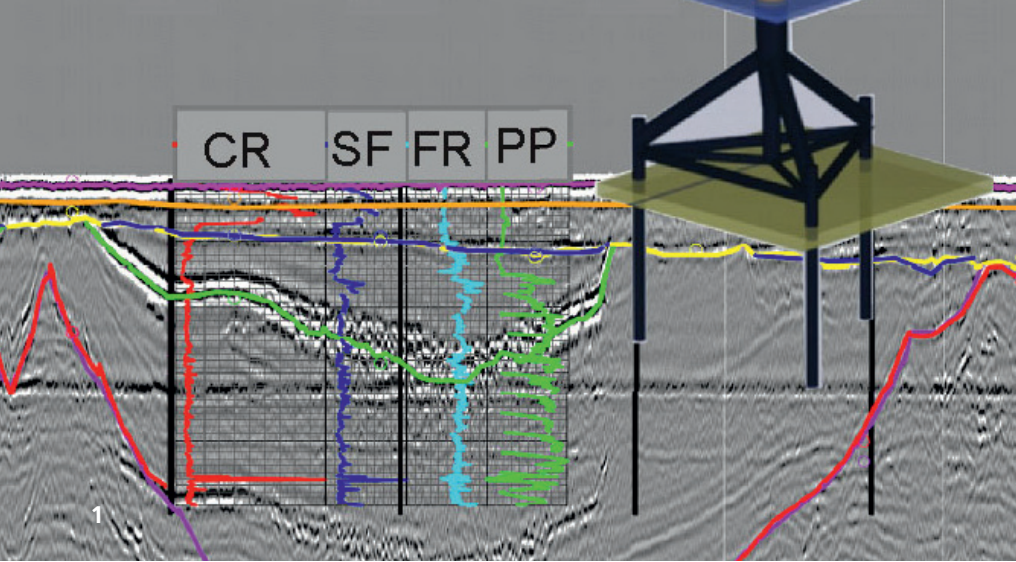
Precise knowledge of the environmental conditions at a selected site is imperative for the planning, commercial viability, and risk assessment of an offshore wind farm. This information is required in various phases of a project: site assessment, project planning, construction, operation, and maintenance. This information is also vital for the optimum design of the turbine, support structure, and foundation.

Characterization of environmental conditions

Fraunhofer IWES characterizes, analyzes, and assesses all environmental conditions of relevance for the planning, construction, and operation of an offshore wind farm. For project planners and operators, a total concept including the environmental conditions at the relevant site is developed.

Fraunhofer IWES provides support from the initial idea to the operating phase. This approach brings synergistic effects, and helps with the project scheduling. Therefore the necessary flexibility can be guaranteed. The relevant information for each phase of a project is made available. Relevant data from measurement and modeling is evaluated, taking into account maximum values and time windows. This data serves as a basis for the construction and maintenance logistics.

For planning construction and maintenance activities, data from measurement and modeling from earlier phases of the project is evaluated for the probability of specific weather windows. At the request of manufacturers and planners, Fraunhofer IWES determines key site parameters and characterizes detailed wind conditions (e.g. height profile and turbulence) for different load cases.



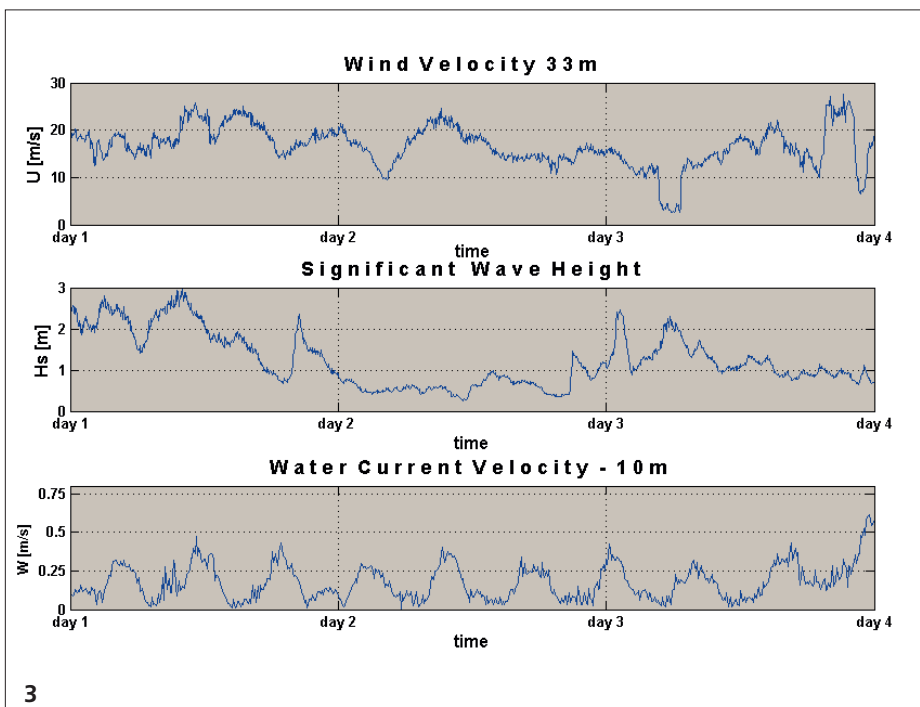
Comprehensive characterization

Wind, waves, and currents are important parameters for the planning, construction, and operation of an offshore wind farm. To calculate the acting loads, measurements are made at the site or close to it. The results are combined with modeling data. Reasoned evaluation and prudent selection of data sources ensure reliable results. If there is no in-situ measured data available at hub height at the site, then meteorological extrapolation methods are employed. They take into account specific offshore conditions such as atmospheric stability and turbulence. The characteristics of the seabed are required for calculating the stability of the site and for designing and optimizing the foundation. For this, surface data from seismic scans is combined with spot

checks and data from cone penetration tests (CPT). A seismic method specially developed for offshore wind farms allows characterization of the seabed structure. This enables the number of expensive spot checks to be reduced, resulting in improvement of data quality and considerable cost-saving. The information acquired about the seabed is used to provisionally select the type of foundation and to size the foundation structure. In addition, the data is used as material parameters in a 3-D seabed model, which allows simulation of the site stability, usage feasibility, and service life of wind turbines from a geotechnical viewpoint. With regards to seabed evaluation, Fraunhofer IWES collaborates very closely with MARUM Research Center at the University of Bremen, in particular on geophysical scanning and special geotechnical measurements.

Our services

- Development of concepts for the acquisition, assessment, and evaluation of all site conditions for wind farm projects
- Calculation of wind, wave, current, and seabed data
- Seismic scans at planned sites
- In-situ seabed testing using both direct (drillings) and indirect methods (CPT)
- Assessment and evaluation of meteorological and oceanographic data from measurements and models
- Detailed data analysis for determining design parameters



- 1 Seismic scan of the seabed
- 2 Measurement mast: Darsser Schwelle
- 3 Wind and wave measurement data