



Data and facts

Performance Analysis and Optimization of Logistics Concepts for the O&M Phase of Offshore Wind Farms

Fraunhofer IWES offers performance analysis services for offshore wind farms (OWFs) that are either in development or already in operation. Our post-construction analyses are based on an evaluation of ship position and tracking data and provide information about the performance and efficiency of the OWF. These results can then be applied to optimize the offshore logistics of operation and maintenance (O&M) tasks. In addition, we can employ our proprietary software OffshoreTIMES to simulate the complete O&M phase of an OWF, in order to design, examine, and optimize O&M strategies and logistics concepts through efficient asset utilization and the minimizing of O&M costs.

AIS-based analysis of O&M logistics

Utilizing the power of Automatic Identification System (AIS) data, we provide insights into logistics operations. We offer independent analyses of the diverse logistics concepts employed by wind farm operators. The data is scrutinized to gain insights into transit and waiting times, transit distances within the OWF, positioning and transition times at the turbines, etc. Further combining the AIS data with weather data allows us to extract weather-related constraints of the vessels during transit or various operations within the OWF. The developed benchmarking framework facilitates the evaluation of logistics efficiency, resilience, and sustainability, thereby contributing to the identification of best practices in offshore wind O&M logistics.

By providing a transparent and data-driven mechanism for benchmarking offshore wind O&M logistics, we can help identify inefficiencies and develop strategies to enhance logistics operations.

Overview of services

- AIS-based analysis of current logistics concept
- Benchmarking of logistics performance relative to similar OWFs
- Performance analysis for individual O&M vessels
- Virtual optimization of logistics concept based on real O&M requirements extracted from AIS data
- Consulting on the optimal O&M strategy for OWFs
- Added value assessment of different vessels and innovative technologies

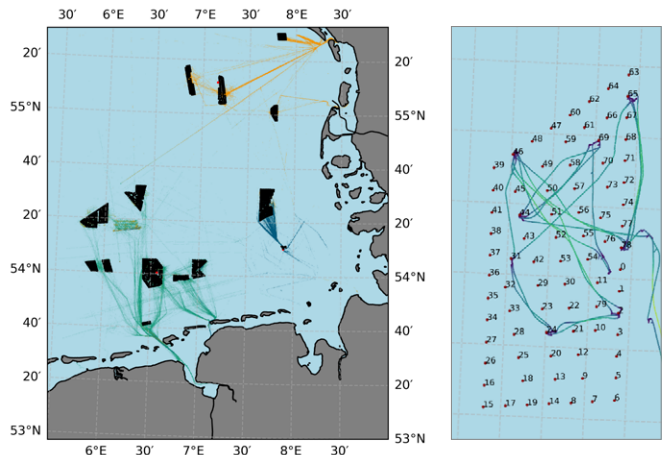


Figure 1: Vessel track of an O&M vessel within an OWF based on our captured AIS data

Independent benchmarking: Through AIS data analysis, we benchmark offshore wind farm O&M logistics, identifying best practices and areas for improvement across the sector.

Logistics efficiency assessment: Our research decodes the complex web of logistical operations, revealing key factors that influence the efficiency and reliability of O&M.

Vessel performance analysis: We assess the functionality and performance of vessels used for O&M tasks. This includes analyzing operational patterns, operational weather limits, and downtime due to maintenance or weather delays.

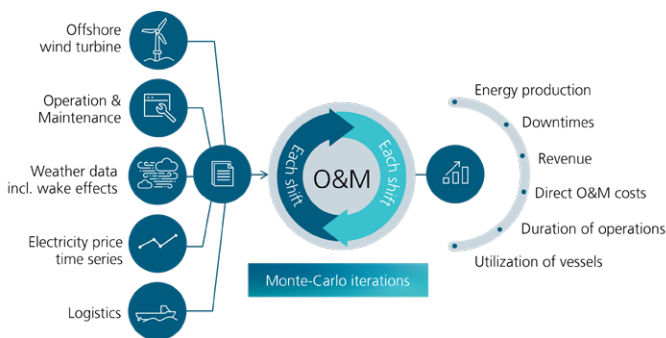


Figure 2: Model inputs for an OffshoreTIMES simulation and key performance indicators that are computed by OffshoreTIMES

Simulation-based O&M optimization with OffshoreTIMES

The purpose of OffshoreTIMES is the numerical evaluation and optimization of the logistics processes during the O&M phase. The software represents the complex system of an O&M in operation in a high-resolution simulation down to the level of individual turbine components, technicians, and spare parts. OffshoreTIMES is designed to provide a holistic view of the O&M's performance considering preventive, corrective, and condition-based maintenance tasks, asset utilization, energy production costs, and O&M costs throughout its entire life cycle. With OffshoreTIMES, we can compare different O&M strategies with each other and assess the added value of innovative main-tenance technologies like drones. This approach enables us to advise wind farm developers and operators, particularly on a strategic level.

Figure 2 provides an overview of the various model inputs and the key performance indicators that are being computed. Each of the wind farm's turbines is represented by a wide range of individual components, the need for maintenance of which is tracked and modeled based on their age and fatigue. Component failures may arise in different severities, with different implications for the turbine's energy production and the necessary corrective measures. Different activities may require different types of ships, which are represented in the simulation with their respective properties. Both historical and artificial weather data can be used as boundary conditions during the simulation to take weather-related operational restrictions into account and to track the energy production of each turbine.

OffshoreTIMES has an interface to the Fraunhofer IWES model FOXES, which allows us to consider wake effects in the calculation of energy production.

We offer comprehensive services for O&M. With our experience and expertise, we can conduct post-construction and performance analysis to optimize the efficiency and performance of O&M. Additionally, we offer the design and assessment of maintenance concepts to ensure the smooth operation of O&M. Our O&M logistics optimization helps reduce costs and make operations more efficient, which includes performance analysis and KPI evaluation to maximize the profitability of the offshore wind assets.

Further information

Fraunhofer IWES secures investments in technological developments through validation, shortens innovation cycles, accelerates certification procedures, and increases planning accuracy by means of innovative measurement methods in the wind energy and hydrogen technology sectors. At present, there are more than 300 scientists and employees as well as more than 100 students employed at the nine sites: Bochum, Bremen, Bremerhaven, Leer, Görlitz, Hamburg, Hannover, Leuna, and Oldenburg.

Supported by:



on the basis of a decision
by the German Bundestag

Picture credits Photo: © Paul Langrock, infographics: © Fraunhofer IWES 02/2024

Contact

Jonas Kaczenski
Group Manager
Offshore Logistics
Phone: +49 471 14290-311
jonas.kaczenski@iwes.fraunhofer.de

Dr. David Baumgärtner
Research Associate
Offshore Logistics
Phone: +49 471 14290-279
david.baumgaertner@iwes.fraunhofer.de

Fraunhofer Institute for Wind Energy Systems IWES
Am Seedeich 45, 27572 Bremerhaven, Germany
www.iwes.fraunhofer.de