

# OFFSHORE TIMES

## Offshore Transport, Inspection and Maintenance Software

Offshore Wind Energy is a main pillar of the “Energiewende – Energy transition” in Germany. The implementation of the German government target, 6.5 GW of offshore wind energy by 2020, is subject to high investments in the young offshore wind market. Offshore projects are associated with high technical and economical risks. The investment confidence is based on the economic prospects and public acceptance of the projects. Both will only be achieved if the costs of offshore wind energy are reduced effectively.

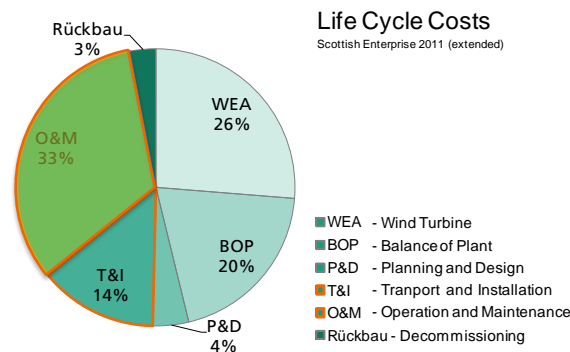


Fig. 1: Life Cycle Cost distribution of offshore wind farms<sup>1</sup>

Essential for a life cycle cost reduction of offshore wind energy is the Operation and Maintenance (O&M) phase, refer to Fig. 1. Especially offshore wind projects with a distance >40sm are associated with a high level of uncertainties in combination with little experience. During the O&M phase, changes are aligned with high costs and only small conceptual modifications are feasible. A reduction of the O&M costs, and thus life cycle costs, requires robust cost estimations already in an early project stage. By analyzing different O&M scenarios and concepts, considering corresponding risk profiles, the life cycle costs can be optimized, please refer to Fig. 2.

Fraunhofer IWES developed the concept „Offshore TIMES” – *Offshore Transport, Inspection and Maintenance Software*. Offshore TIMES is capable of estimating O&M costs effectively by means of a ‘realistic’ simulation of the O&M strategies over the O&M phase in an early project stage. Thus, particular strategies can be tested and optimized. Our Fraunhofer IWES comprehensive experience and project knowledge, for example Offshore WMEP (reliability of offshore wind energy converters) or COAST<sup>2</sup>, will be facilitated in this project.

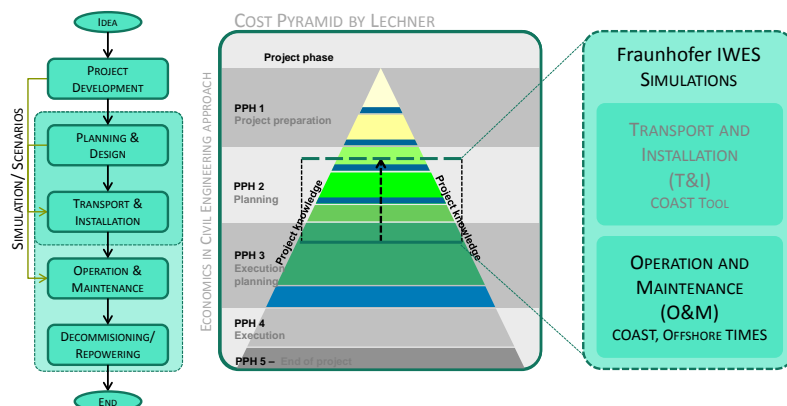


Fig. 2: Life cycle of offshore wind farms and Fraunhofer IWES approaches

<sup>1</sup> Based on Scottish Enterprise 2011 (with amendments): “A Guide to Offshore Wind and Oil & Gas Capability”.

<sup>2</sup> COAST – Comprehensive Offshore Analysis and Simulation Tool

The goal of this project is the development of a tool, which analyzes, evaluates and optimizes O&M strategies for offshore wind farms.

The Offshore TIMES concept is based on four basic principles:

- > Holistic approach, e.g.
  - > Wind Farm Components
  - > Project Life cycle
  - > Financial Engineering
- > Interdisciplinary, along the supply chain
- > Time series based (40...50 years weather and sea state time series)
- > Modular structure

Within the O&M phase activities, procedures and assignment of vessels / personnel for a wind farm are depending on various aspects (for example: reliability, energy yield, weather conditions, available personnel and cost of material, etc.) with sometimes opposing effects on availability and costs. Due to the high complexity of the maintenance strategies (e.g. planned or condition based maintenance), resources (personnel, vessels, spare parts) and environmental conditions (e.g. wind and waves) the O&M costs are associated with a high risk profile for offshore wind farm planners and operators. This is the starting point for Offshore TIMES. It simulates the maintenance activities for an offshore wind farm in a realistic way using a time step based approach.

Regarding the O&M offshore logistics part, Offshore TIMES is based on the findings and results of the ongoing COAST project. Offshore TIMES inherits methods with respect to the basic O&M processes as well as transport and installation activities and extends the developed planning methods in the O&M phase. The WaTSS<sup>3</sup> method, a concept mapping and evaluating activities into weather time series, was established in the COAST project. The Offshore TIMES approach is based on the WaTSS technology and will be further extended by various effects, please refer to Fig. 3.

As result of the simulated execution of the analyzed O&M concept, information regarding activity dates, durations, costs, vessel usage, degree of utilization and other factors, including their spectra (risk profile), will be provided.

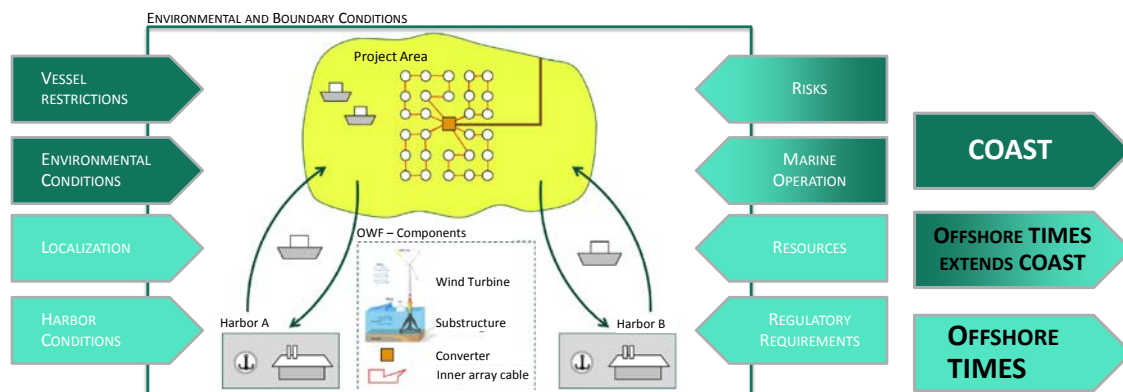


Fig.3: Basic principles and influencing factors on Offshore Logistics

The basic principle of the Offshore TIMES project is depicted in figure 4. The maintenance work is determined by the reliability of the wind turbines and consists of planned and condition based/ corrective maintenance tasks. In parallel, a wind farm operator develops an overall O&M concept, including vessels, personnel and additional infrastructures, to cover the maintenance work requirements. Furthermore additional boundary conditions (e.g. wind and waves) and strategies (e.g. equipment pooling or wind farm clustering) influence the maintenance works.

<sup>3</sup> WaTSS – „Weather Time Series Simulation“

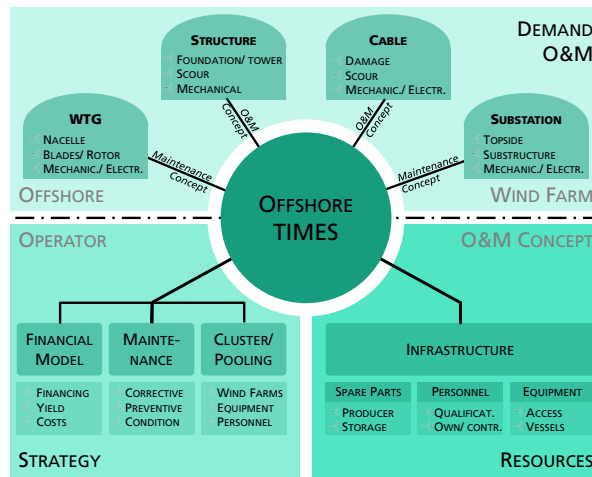


Fig. 4: Basic principles and influencing factors of the Operation and Maintenance phase

In order to analyze and evaluate the O&M tower concept costs as well as their efficiency, it is necessary to establish a simulation method with a close connection to actual offshore O&M activities and procedures. In the Offshore TIMES proposal, a basic draft was already developed, refer to Fig. 5.

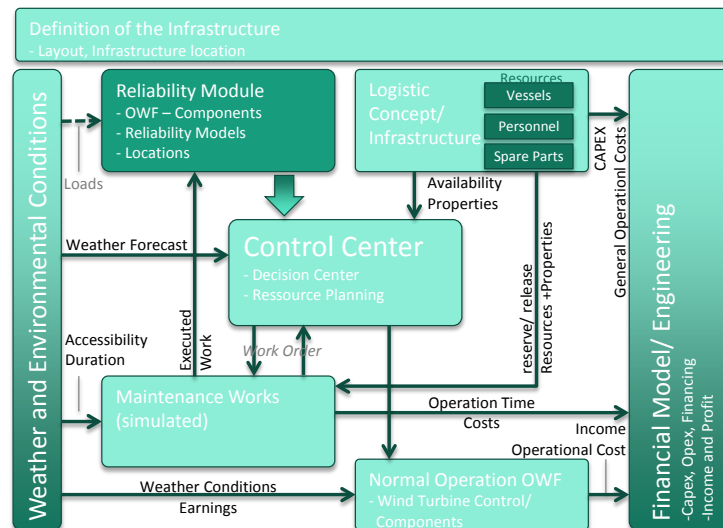


Fig. 5: Basic structural concept of the Offshore TIMES method

Currently there are no planning methods or tools available on the market to fulfill the requirements of a holistic, robust and reliable O&M concept design for the maintenance phase. There are many models, commercial and scientific, for nearly all aspects of an offshore wind farm. None of these existing models, however, is able to reflect the overall complexity of the wind turbine reliability, the maintenance logistics and the financial framework.

That is why Fraunhofer IWES developed the Offshore TIMES concept and presented a draft to the public granting body PTJ / BMWi<sup>4</sup>. We successfully issued our final "Offshore TIMES" research proposal and secured a public grant for the project. The project already started on 01. October 2014 and has a project duration of 3 years. To realize the Offshore TIMES research project in close cooperation with the offshore wind industry, a network of industry partners, along the supply chain, has been established. We ask our partners to support and consult the project by providing offshore experience, industrial requirements and real life examples. In regular meetings once or twice a year we discuss up-to-date topics and the project progress.

<sup>4</sup> PTJ – Projektträger Jülich (<http://www.ptj.de>); BMWi – Federal Ministry for Economic Affairs and Energy (<http://www.bmwi.de>)

**Conclusion:**

The Offshore TIMES project goal is the **development of a holistic, modular and time series based planning and evaluation method** including a software tool to optimize particular O&M concepts designs for offshore wind farms.

With the development of the Offshore TIMES methods a tool will be provided, which is efficiently capable of analyzing and evaluating the potential of new strategies and concepts, advantages of innovative equipment, improved access systems, etc. The influence of different parameters such as distance to shore, vessel strategy, personnel strategy and spare parts strategy on costs, availability and profit can be identified. Furthermore wind farm clustering and pooling of resources can be considered in the investigation process.

Shortcomings of existing tools in the following areas, consideration of economical aspects, feasibility calculation, reliability, modeling of O&M resources, consideration of environmental / weather conditions and the interaction of these elements, will be avoided by the development of independent and expandable modules.

The Offshore TIMES projects:

secures the **applicability of the new methods in daily, real life offshore wind projects**, by a close cooperation with the offshore wind industry considering their requirements. The software can directly be used for O&M planning of offshore wind farms by participating companies.

provides a **broad acceptance and usage of the Offshore TIMES software along an interdisciplinary supply chain** of offshore wind farms by the support of the industrial network. The members are recruited as a cross section of the supply chain.

uses, extends and combines the Fraunhofer IWES know-how of several realized projects in the area in a **holistic and easy-to-use software**.

is based on a **holistic approach in the analysis and simulation of the O&M phase**. This enables a multidimensional optimized planning and analysis of offshore wind farms.

considers the important sequence of activities and events for offshore works by **modeling the processes in a time step domain** and thus enables a demand orientated simulation approach including the individual planning of offshore works.

facilitates a **flexible** agile software development process. The high quality requirements of professional application software are assured through the usage of newest technology and methods.

If you have further questions please do not hesitate to ask us.

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