Offshore TIMES – analysis and optimization of O&M concepts for offshore wind farms

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Summary
Operation and maintenance activities have a large share in the life time cost of an offshore wind farm. The design or the evaluation of a logistical concept is challenging, because of the unclear WTG, BOP and OSS reliability, local weather conditions and sufficient maintenance resources. Therefore in the public research project Offshore TIMES an actor based simulation tool including a novel reliability, control centre and economic module has been developed and will be presented in a brief reference case study.

1. Offshore TIMES concept

1.1 Base concept and features

Offshore TIMES – Transport, Inspection and Maintenance Software – has been developed in a public research project (FKZ: 0325729).
The goal of the project was a tool to simulate an offshore wind farm over the life time, including the major maintenance activities, costs and revenues on an hourly basis. The single wind farm or cluster is physically modelled for each wind turbine taking into account several base harbours and airports. Each wind farm can consist of several turbine types (including individual reliabilities and power curves), the BOP – balance of plant – and the OSS – Offshore Substation. Further each wind farm of a cluster can use a different weather data set.

1.2 Simulation concept

The maintenance requirements of an offshore wind farm are driven by the reliability of its components. If a wind farm component has a failure the corresponding maintenance task will be initiated and scheduled if the required resources are available. Planned maintenance tasks can be modelled as well. The corresponding costs are evaluated and the income/ energy production are calculated. In the post-processing several information and statistics can be derived, e.g.: WTG/WF availability, vessel utilization, energy losses, cash flow, LCoE and further parameters.
In an iterative sensitivity and scenario analysis the O&M logistic concept can be optimized.

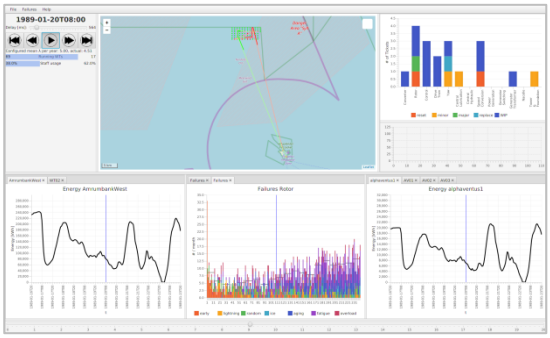

Fig. 1: Offshore TIMES GUI

2. Innovative models

2.1 Reliability module

A novel approach is the modelling of the reliability base by splitting the failure rate into several failure mechanisms, e.g. early, aging, fatigue, overload, and random failures. [1] Basically it determines the bathtub curve including dependencies on the energy production.

2.2 Control centre module

The control centre is the heart of the simulation. An innovative scheduling algorithm has been developed, taking several strategies into account.

2.3 Economic module

A focus area of the development was the economic module to allow a deep analysis of financial factors. Therefor the financing concept can be considered and equity returns can be determined.

The main features and innovations of the Offshore TIMES approach will be presented in a reference case study.

3. References

[1] Faulstich, S.; Berkhout, V.; Siebenlist, D.; Mayer, J. Enhance decision support tools through an improved reliability model
Presentation held at EERA DeepWind 2017