Introduction

Over the past 20 years the wind energy industry has changed dramatically, moving offshore and into deep water. Technology has improved significantly with large wind turbines installed in large, distant wind farms. Despite these advances in scale, the Levelised Cost of Energy (LCOE) remains high due to high capital (CAPEX), high operating expenses (OPEX), and slowly improving availability. The complexity of new wind farms - located far from shore and creating substantial revenue, means a real time optimization O&M model can have a measurable impact on turbine availability.

For example, improving the availability of a modern offshore wind farm (for example 100 WT, total capacity of 300MW) by 1%, the annual production value would increase more than €2,000,000.

Approach

Based on offshore industry trends and clear market needs, SeaEnergy PLC, via the Knowledge Transfer Partnership (KTP) with Robert Gordon University, has developed an innovative O&M optimization model in order to improve delivery of offshore technicians, and as a result, to improve turbine availability.

In this presentation, the SeaEnergy PLC O&M optimization model performance will be analysed by comparing model output against both the guaranteed best strategy and the operators' strategies. We will then discuss the innovative metaheuristic model which allows for a quick, real-time optimisation of offshore technician delivery while creating opportunities to improve current offshore strategies.

Main body of abstract

Metaheuristic methods provide optimal solutions with minimal processing time but they do not guarantee the absolute optimum result. One of the first questions that must be answered deals with the relative nearness of the method's proposed solutions to the absolute optimum. The second question looks at how SeaEnergy PLC's proposed solutions (O&M optimization outputs) improve upon the operators' solutions. Last but not least, the processing times between the analytical and SeaEnergy PLC models will be compared and findings discussed.

Based on metaheuristic methods, the SeaEnergy PLC O&M optimization model solves the vessel routing and technician delivery problem by providing a list of notionally superior route solutions then selecting a pseudo-optimal route from these.

Among the variety of SeaEnergy PLC O&M model input parameters include, but are not limited to: maintenance task list, vessel details, weather forecast, and operator's strategy. The model analyses these inputs and provides information (cost, vessel waiting time, technician waiting time etc.) about proposed O&M strategies versus the operator's strategy.

Conclusion

SeaEnergy PLC, via the Knowledge Transfer Partnership (KTP) with Robert Gordon University, has developed an innovative O&M optimization model in order to simplify and improve vessel management and technician delivery, consequently reducing the LCOE for the life of the wind farm.

Model performance will be tested by comparing model output with operators' strategies and a guaranteed best solution.

According to market needs and the degree of innovation present in the project, an oral presentation is recommended.

Learning objectives

Offshore wind O&M optimization modelling

Machine learning model

Vessel management

Supply chain management

Metaheuristic solutions validation

Approach vessel routing problem