Innovative floating offshore wind energy

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Introduction

A major international collaborative project involving 12 partners from eight countries and worth €7.3 million is set to drive forward development of the next generation of floating wind substructures. The European Horizon2020-funded programme LIFES50+, led by Norway's MARINTEK, will run for 40 months starting 2015 and will focus on proving the innovative technology that is being developed for floating substructures for 10MW wind turbines at water depths greater than 50 m.

Partners:

Objectives

- Optimize and qualify to Technology Readiness Level (TRL) of 5, two innovative substructure designs for 10MW turbines.
- Develop a streamlined and KPI (Key Performance Indicator) based methodology for the evaluation and qualification process of floating substructure.

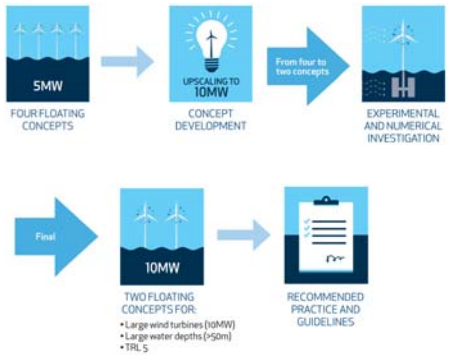
The focus of the project is on floating wind with large turbines (10 MW) installed at water depths from 50 m to 200 m. Increasing the turbine size is expected to be one of the most effective way of reducing LCOE in short term.

Approach

Four existing substructure concepts at TRL of at least 4 that can support 5MW wind turbines are used as input to the project. These floating substructures are upscaled to accomodate the 10MW DTU reference turbine[1]. This activity will be driven by concept owners, benefitting from the presence of strong research and industrial partners within the consortium, ensuring innovation both from a scientific and industrial point of view.

In parallel, a methodology for the evaluation of substructures, based on KPI's, will be developed. These KPI's include important parameters such as, but not limited to, CAPEX and OPEX, technology performance and integrity, deployment and installation performance, logistics and O&M costs, industrial capacity for production, Technology Readiness Level (TRL) and Manufacturing Readiness Level (MRL), time to market, adaptability to various turbines, life-cycle environmental impacts, and more. The four substructures developed in the project will undergo an evaluation based on this methodology.

Two concepts will be selected, based on the evaluation results, for further verification in order to reach the TRL level put as goal for this project. This includes numerical analysis with a range of simulation tools from simplified design simulators to high-fidelity models for specific load effects and experimental investigation based on a novel approach using Real-Time Hybrid Testing[2] in both wind tunnel and wave tank facilities. All relevant load effects and the corresponding models will be collected for a best-practice of the numerical design process for FOWTs.



The models of the two selected concepts will also be delivered as open source versions. A review of the two selected substructures will be performed after the model test campaign, with focus on the manufacturability of the concepts.

The project will also focus on uncertainties and risk assessment of the design at economic, technical and environmental levels.

The findings from the project will be included in guidelines/recommended practices written to support designers in their work and allow efficient qualification of large offshore wind substructures.

Research challenges

To realize the project goals, there is a need and clear ambition to move forward the state-of-the-art in the following:

- Multi-fidelity numerical tools in the context of qualifying and optimizing large substructures.
- Experimental techniques specific to floating offshore wind turbines.
- Concept industrialization, as an early focus in the design.
- Uncertainty and risk assessment related to unprecedented large wind turbine substructures.

Concepts

References:

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For more information: www.lifes50plus.eu