



leanwind

Logistic Efficiencies And Naval architecture for Wind Installations with Novel Developments

Project acronym: **LEANWIND**
Grant agreement nº 614020
Collaborative project
Start date: 01st December 2013
Duration: 4 years

Floating Platform Design framework Work Package 2 - Deliverable 2.5

Lead Beneficiary: Iberdrola Renovables Energía
Due date: 31-05-2016
Delivery date: 31-05-2017
Dissemination level: Confidential



This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No. 614020.

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Executive Summary

The “LEANWIND” (Logistic Efficiencies And Naval architecture for Wind Installations with Novel Developments) project has been developed in the 7th EU Framework Programme with the purpose of providing solutions & technologies that help to reduce costs across the offshore wind farm lifecycle and supply chain. This is being achieved through the application of lean principles and the development of state of the art technologies and tools.

As noted in the state of the art study performed in this deliverable, floating structures represent a real opportunity for reducing offshore wind energy cost as well as for increasing the utilization of the offshore wind resource by enabling exploitation of areas which are not economically suitable for current bottom fixed solutions.

Based on the analysis of the state of the art, semi-submersible floating technology was selected as most suitable for the specific conditions and extreme environment present at the proposed case-study test site. This is a location on the western Irish Coast, near Belmullet, Co. Mayo which was selected for assessing floating concepts in the LEANWIND project.

In addition, this deliverable presents an Anchoring System general overview and its suitability depending on the design constraints (soil type, load bearing, etc.) and applicability to floating offshore wind technologies.

For this type of innovative technology under development, a risk analysis is critical. This report provides a detailed risk ranking analysis for deep water floating wind turbine substructures including the different phases of the project and their associated risks. Some measures to de-risk the process have been detailed in this document, including, the necessity of using more advanced numerical tools, development of further demonstration projects, increased collaboration with Original Equipment Manufacturers (OEM), and a stable legislative framework.

A description of the process to define and design the semi-submersible platform is provided. This includes the evaluation of possible alternatives for the platform’s general arrangement. This description includes the design process from the creation of a specific Design Basis, with selected site characteristics and wind turbine characteristics (NREL 5MW in this case), until the achievement of a complete basic platform design. Additional

tasks were included in order to complement the concept design and its evaluation and analysis:

- UCC→ Design of the Mooring System
- GDG→Design of the Anchoring System
- Iberdrola→ Design of the auxiliary systems of the semi submersible platform
- Fraunhofer→ Development of an innovative tailored WT controller
- EDF→Partial evaluation of the semi-submersible platform design:
 - Benchmark of simulation results in coupled numerical software (EDF's Calypso and NREL's FAST, which model has been developed by IBR during the design stage), and of bench test results, to bring confidence in the design.
 - Evaluation of the design for a Mediterranean site in addition to the Belmullet site.

This document also presents the results of the validation of the semi-submersible platform design performed using physical tank test trials. These tests have been performed using a 1/36 scaled model for the most representative operational and survival conditions, but also in some specific conditions during the transportation and installation stages. The tank tests conditions (Belmullet site) included exposure to waves that would scale to a height of 32m in real life.

Since the main focus of the LEANWIND project is to reduce the cost of offshore wind energy, a preliminary economical assessment of this LEANWIND semi-submersible floating platform in an assumed demonstration project (1 unit of 5MW) has been performed. This cost estimation includes the whole manufacturing of the platform, as well as the installation cost.

Finally, an evaluation of the possible implementation of the semi-submersible platform in a mild scenario (in this case a Mediterranean site is selected near the French Fos-sur-Mer test site) has been performed and the results are described.