An Innovative TLP platform for combined reliable and bankable offshore Cup Anemometer - Lidar wind measurements

Abstract

Reliable and Bankable Wind Resource Assessment in offshore wind farms, presents a huge challenge to any wind energy developer. At the moment, IEC/MEASNET compliant measuring devices that can be installed on a TLP FloatMast platform IEC/MEASNET compliant data can be acquired at a much lower cost at any depth and distance from the shore. As a result, a wide range of capabilities for wind resource assessment is available and consequently the level of data credibility and availability are increased and become bankable at a much lower cost. Finally, the structure can be redeployed in another location and provide these capabilities for another wind farm.

Objectives

At offshore wind farms, as they get into deeper waters, further from the shore and bigger in size, the cost of operating and maintaining the infrastructure of the wind farm is increasing rapidly. Therefore, high-quality wind resource assessment is needed to mitigate and drive down the costs per kWh. This leads the financiers to the need of IEC/MEASNET compliant wind resource assessment which requires offshore mast platforms. At present, there are structures available as they are designed in the sea bed and cannot be redeployed in another location if the initial site does not comply with the developer’s expectations. FloatMast overcomes these, being a redeployable mast platform with the ability to be installed in any sea depth at a lower cost. Moreover, it complies with the technical requirements of the developers and the developers’ IEC/MEASNET standards of wind resource assessment.

Methods

The solution to the above issues can be provided by the FloatMast innovative combination of three industries: Onshore Wind, Naval and Oil & Gas. On the deck of a small Tension Leg Platform (TLP), which is a standard and proven technology in the Oil & Gas Industry, a met mast and a Lidar are fixed. The accuracy of the provided wind speed measurements is assured by the use of different state-of-the-art devices (cup anemometers, ultrasonic and a lidar) at the height of 40m mast, which is inside the today’s offshore WT’s rotor. Cup anemometers assure the highest data availability (no matter the weather conditions) and the conformity to the today’s IEC/IEA standards. A 3D-ultrasonic anemometer provides fast measurements for turbulence and other meteorological quantities (Reynolds stresses, etc). Finally, the lidar provides the wind shear by measuring the wind speed at several heights within the WT’s rotor.

The verification of cup-lidar data is performed according to the IEC Recommended Practices RP15 for two heights (40m and a lower one), by an accredited organization for such measurements and member of the MEASNET network. The verification will comprise also turbulence intensity and wind gust speed correlations, two quantities that play an important role in the classification and the design of the wind turbines.

Naval engineering practices secure the floating structure integrity by design and construction approval from classification societies.

Results

Preliminary results show that motion compensation is not required and this is continuously verified by the concurrent fast 3D ultrasonic measurements combined with data from initial motion units (IMUS).

Conclusions

The project demonstrates that TLP platforms are very well suited to wind energy applications and practically no motion compensation is required for the wind speed measuring devices. Lidars are known to have lower data availability than cup anemometers, mainly due to atmospheric conditions, but also because they are sophisticated optoelectronic devices, requiring also power autonomy. With the FloatMast platform, lidar unavoidable data losses are recovered from cup anemometers, with much lower uncertainties than correlating with faraway met masts. The high data availability assured by the high reliability of cup anemometers, lowers the uncertainties of the results, as well as the investment cost of the offshore wind farm, increasing thus the bankability of the project.

References

6. Sponsors

EWEA Offshore 2015 – Copenhagen – 10-12 March 2015

Sponsors