

STate of art Rotor Extended To Create Higher performance

Publieke samenvatting / Public summary

Aanleiding

Upscaling wind turbines is an effective way to reduce cost of offshore wind energy. The energy production (AEP) increases with the square of the rotor size, while the costs for offshore wind farms are largely related to foundation, cabling, installation and O&M. These costs have a weak dependency on rotor size. This drive to upscaling leads to such gigantic machines (in the present project diameters of 220+ meters are considered) that they can only become an economic reality if innovative low weight designs are introduced for not only the blades, but also for the pitch bearings and hub. To achieve a rotor with a 220+ m diameter in a cost-effective manner, a set of critical design challenges needs to be addressed. This requires improved modelling and testing of hub, pitch bearings, blade-hub interface and blade design. This requires significant test method developments, as currently there are no facilities available for testing rotor components of 10+ MW Offshore Wind Turbines (OWT).

Doelstelling

The design and testing of large rotors requires development in testing methodologies as well as development in design capability. The goal of this project is to create the design suite as well as the testing capabilities for extremely large rotors. This goal is achieved by the following subgoals: • To stretch an existing rotor design from a diameter of 206 meter towards 220 meters and eventually to 112-115% of the original length whilst not inducing

Projectinformatie / Project information

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Algemene informatie / General information

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an excessive weight penalty to the overall rotor, turbine or substructure. This way the production (AEP) increases more than the costs of the turbine;

- A reduction of 30-40% in test time from a conventional bearing reliability test;
- Making available a world class rotor test facility for multi MW offshore wind turbines.

Korte omschrijving

The project will take advantage of beyond-state-of-the-art developments which currently take place in the consortium: a 12 MW wind turbine prototype is now under development by GE, with a 220 m diameter rotor. This exceeds all current OWT industrial products or prototypes today. The project design basis is the AVATAR blade design that has been made publicly available. This 10 MW RWT, with a rotor diameter of 206 m has been generated with the most advanced aerodynamic and aero-elastic knowledge. As such it forms the optimal starting point to stretch the blade length even further, first towards a rotor with rated power of 12 MW and a diameter of 220 m and eventually towards a 12-15% larger rotor which will also have an increased power rating of above 12 MW. Integrated design loops between simulations and testing, digital twins, will allow the project to accommodate the changes to the design while improving simulation tools and experimental processes for future innovations. The structural performance of hub, hub-interface, pitch bearing and blade root will be validated by advanced full-scale rotor testing. Test results will also be used to improve modelling of the rotor components.

Resultaat

The main results of the project are:

- An innovative large-scale rotor design for the next generation OWT with improved performance and reduced costs which has the potential to contribute significantly to the renewable targets of the Netherlands;
- New innovative design methodology for large scale rotors;
- A Dutch world class centre for rotor testing through expansion of LM's WMC Laboratories facility into a state-of-the-art rotor test facility so that rotors used in the next generation OWT can be tested;
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New testing methodologies for wind turbine rotor-hub assemblies aimed at next generation OWT and reduction of test-time; • A leading position of the Dutch Wind Energy sector in this ever-growing market with more jobs on the field of rotor testing resulting in additional job creation in North-Holland at ECN part of TNO and LM Wind Power;

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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