WIND turbine COntrol strategies to reduce wind turbine blade Rain droplet Erosion

Publieke samenvatting / Public summary

Leading edge erosion (LEE) is a detrimental phenomenon to aerodynamic performance of wind turbine blades. Given that wind turbine blades' LEE mostly occurs due to strong precipitations, the idea behind this project is to alleviate rain LEE by reducing the rotor speed when it is raining heavily. Wind turbine and wind farm operators can reduce the tip speed ratio of their turbines during heavy precipitations to reduce the impact forces occurring between blade surface and rain particles, eventually limiting blade LEE.

Objective

It is expected that the optimized rain control strategies developed in this project will yield to a two-fold benefit for wind turbine and wind farm owners. On the one hand, O&M costs related to blade repair and inspection will be considerably reduced due to less number of repairs. On the other hand, during the span of the turbine lifetime, the net AEP will increase due to 1) less energy loss from healthier blades and 2) larger wind turbine availability related to less repair interventions.

Short description

The project is divided into four technical work packages (WPs). The first WP will aim to develop statistics of relevant rain characteristics (e.g., rain

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intensity, droplet size and velocity) from historical data, specifically at offshore conditions. The second WP will then focus on establishing correlations between rain characteristics, rotor speed and LEE. To this aim, the project consortium will investigate erosion models already developed in recent large European projects and will improve and validate these erosion models with laboratory tests, based on more realistic offshore conditions. Laboratory tests will focus on understanding of the fundamental process behind erosion occurring on realistic offshore wind conditions. The goal of the third and fourth work packages is to develop and assess optimized control strategies for wind turbine rotors. In this phase we will look for an optimal trade-off between the energy loss due to the reduced rotor speed and the benefits coming from 1) the lower repair costs, 2) the lower energy loss due to less eroded blades and 3) larger energy production due to lower downtime.

Result

The aimed result of this project is to deliver control strategies which recommend wind turbine manufacturers and wind farm operators on how to operate wind turbine rotors to make them live longer and healthier. The project will develop optimized rotor control strategies, based on reducing the rotor speed during (heavy) precipitations, to extend the lifetime of wind turbine blades. The project will develop a comprehensive technical procedure based on advanced research on LEE, that can be applied to establish the optimal rotor speed to operate the rotor during given local precipitation conditions.

Website

More information on the WINDCORE project can found on the GROW website.

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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