OWI-Lab presents keynote speech and poster at IPF

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Pieter Jan Jordaens

Not only chocolates and beers, but also our expertise and experience in offshore wind energy has now become a Belgian export product of worldwide fame. This will be demonstrated once again at the International Offshore Wind Partnering Forum (IPF), North America's leading conference on offshore wind energy, which will take place from 26 to 28 April. Sirris, as coordinator of OWI-Lab, is proud to be giving a keynote speech at this industry meeting.

The IPF is organised by the Business Network for Offshore Wind in Atlantic City, New Jersey, USA, and intends to connect global supply chain leaders and companies by providing unique networking opportunities and offering the latest and most relevant industry updates, from technology and policy to safety and siting. The conference will be attended by about 1,500 visitors from all over the world, 154 speakers and a trade fair with 137 international exhibitors.

Presence of OWI-Lab

Because wind energy is expanding so quickly, these events are also becoming more relevant. The Belgian presence is therefore significant. On 27 April (13:15-14:15 local time) Sirris, as coordinator of OWI-Lab, will give a keynote presentation on the experience of 12 years of R&D campaigns and innovation projects in offshore wind, together with Belgian companies 24SEA, Marlinks and Jan De Nul, and in cooperation with the Blue Cluster. The presentation will be on ‘Cost Reduction and Lifetime Extension for Foundations and Cables’, covering topics such as the importance of a thorough understanding of geotechnical parameters and digitalisation (through monitoring) to reduce CAPEX and OPEX costs associated with foundations and cables. We also share lessons learned from more than a decade of research in structural health monitoring (SHM) of different offshore structures, the connection types and ongoing studies set up through the Blue Cluster such

on test infrastructure

nts on wind turbine

Harsh environment validation testing using a large climate chamber, cold-start-up test bench and large size ice spray array

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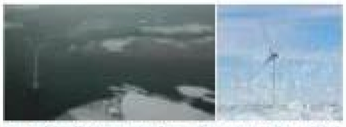
Abstract and importance of harsh environment testing

Wind turbines are more frequently installed in remote areas, where often profitable wind conditions makes such sites attractive to implement wind farms. On the other hand, such locations sometimes must deal with extreme harsh climatic weather conditions: extreme cold (-45° C onshore, and -20° C offshore) or hot temperatures (+50° C), strong winds and gusts, high humidity, snow atmospheric or splash icing conditions, hail or salty conditions depending on the site.



In cold climate markets for example, wind turbines need to be capable of operating below -30° C and need to be capable of surviving -40° C which is challenging for the machine and its components but also for inspection and maintenance works. Some repair actions even need to be postponed due to safety during harsh weather conditions and thereby affect the turbine availability and business case.

OEM's and component suppliers develop specific cold, hot and offshore climate packages to increase the performance, reliability and robustness of the turbine. Dedicated cold-start procedures, the use other materials, lubrication or dielectric fluids and all kind of monitoring and mitigation solutions when dealing with icing are developed nowadays. In order to learn and validate how these harsh environment packages operate and perform in real-life conditions a large climate chamber test facility was set-up in Belgium (Antwerp).

The facility and its associated test and R&D-projects have specific attention to cold climate testing and offshore high humidity and temperature cycling testing. Additional test benches for cold start testing of gearboxes, the testing of transformers and a large-scale icing array were added as additional features to the large climate chamber to fulfil specific industry needs.

Objectives

Climate chamber tests at full system level, specifically cold start and cooling tests are considered by product design and validation engineers to ensure the required performance and reliability levels of their designs during operational and survival conditions. Also for certification purpose (IEC 60068-2-1 for example) specific prototype system validation tests are mandatory or recommended to ensure reliable and save operations during extreme climatic events.

Specific attention goes to **low temperature cold start-up behaviour** of drive-trains and pitch & yaw solutions and it's lubrication performance, the same driver can be found in the testing of liquid filled transformers and the performance validation of (new) di-electric tank fluids. Challenges with respect to rotor icing, nacelle cooler icing and ice blockage of emergency escape doors are also of importance for certain sites.

Most test procedures or functional validation tests can only be executed when the climate chamber is combined with mechanical and/or electrical test equipment to reproduce a representative testing environment such as a black start event (cold-start). As alternative to expensive wind tunnel testing a large scale icing array can be used for some pre-tests related to atmospheric and splash icing topics.

Methods

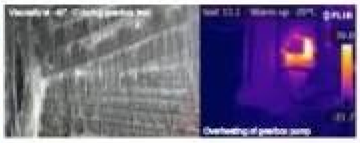
In 2010 a **large climate chamber** was built-up in Belgium by Sirris to support the design validation testing of large and heavy wind turbine components up to 150 ton. The climate chamber was foreseen with the ability to recreate -60° C to +60° C climatic environments in a 10,6 x 7x 8 meters (LxWxH) test room. In order to perform real scale system testing of drivetrains to evaluate grid failure events and cold start-up performance (measuring the break-away torques, warm-up times and the functioning of lubrication units) a no-load test rig for cold start tests was also developed to functionally test gearboxes (and drivetrain assemblies) during extreme cold climate events.

In order to test **liquid filled transformers** for cold start functioning, a multi-MW electrical test concept was built in the same climate chamber.

Recently a new feature, a **large scale icing test array**, was added that will be used to evaluate (new) anti-ice coatings, ice detection and de-icing strategies as alternative to expensive climatic wind tunnels testing. Certain development and validation tests can be performed at first with such set-up before advanced climatic wind tunnel testing are considered.

Results

Lessons learned from more then 100 validation test campaigns in (extreme) harsh conditions in the climatic test facility of Sirris has learned us that the failure of small parts or components such as lubrication pumps, valves, heaters or even sensors which are tested as individual parts can still cause unforeseen failures when used in a full system testing approach and cause downtime of the full turbine.



Most component suppliers and OEM's know the added value of full system testing and they put effort in developing dedicated climate packages to overcome the challenges during harsh weather conditions. With more wind energy farms planned in remote sites and harsh weather conditions, and the increasing frequency of extreme weather events (during winter and summer), there is a need from industry to test machines at real scale in those challenging environments to prove the performance and reliability of the equipment, either for certification purpose and for risk mitigation.

References

https://www.owi-lab.be/large-climate-test-chamber-services

NEN-EN-IEC 60068-2-1 (cold)

DNVGL-RP-0363 - Extreme temperature conditions for wind turbines

Authors

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