

Cold start validation of full-scale wind turbine prototype for antarctica

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In 2021, Fairwind - a Belgian company that designs and manufactures vertical axis wind turbines - performed climatic environmental tests on a 50 kW-Polar-Version-Wind Turbine prototype inside the Large Climatic Test Chamber at OWI-Lab, Sirris. Those tests were conducted to verify, at very low temperatures, the proper behaviour of its full-scale Polar-Version central shaft.

During the tests campaign, the chamber reached a minimum temperature of -40 °C, which aimed to verify the machine's safe and reliable operations in temperature conditions similar to the ones in Antarctica, where the central shaft will be installed on an actual wind turbine at the German meteorological Neumayer-Station III.

Adapted to Antarctica

This vertical axis wind turbine installation targets the Paris Agreement objective to reduce the consumption of fossil fuels taking place in Antarctica. Next to the cold-start tests of the wind turbine prototype itself, different anti-icing blade coatings were tested and compared as well.

Low temperatures and Antarctica harsh conditions, such as severe icing and very high windspeed, bring additional challenges to the wind turbine design and manufacturing process. For example, the developers needed to consider additional environmental loads, such as ice accretion on rotor

blades or thermal expansion and contraction with such temperature gradients. Different materials, coatings and lubricants needed to be used, and cold start-up procedures had to be adapted as well. Moreover, the emergency braking system integrated into the blades needed to be verified and its operation validated for such extreme events in cold climate sites. Finally, maintenance actions were foreseen according to Antarctica access restriction and remote location.

Part of the tests campaign, next to the functional tests on the prototype, aimed to test different anti-icing coatings on blade samples using an icing array that can generate different types of ice.



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This low temperature test campaign was conducted by Fairwind S.A. in collaboration with Sirris using its large climatic chamber. Thanks to the large size of the climatic chamber, the full-scale 50 kW-Polar-Version wind turbine central shaft could be installed and operated next to the icing set-up in extremely low temperatures, down to -40 °C.


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