Press release on the "WindIO" project of October 29, 2020

Ecologically and economically optimised wind turbine with digital twins

Bremen, Bremerhaven, Berlin, Hannover, Varel, Oldenburg, Bad Doberan, Ostenfeld. Bremen coordination office, ForWind-Centre for Wind Energy Research (Bremen, Hannover, Oldenburg), has initiated a research project to preserve equipment, maintenance support, minimise expenses, and maximise wind yield at the University of Bremen. The aims of the project are the ecologically and economically optimum operation of the wind turbines with the help of a digital twin. ForWind members, the Institute for Integrated Product Development (BIK), and the Institute for Electrical Drives, Power Electronics and Components (IALB) are working with eight partners to develop a research wind turbine within three years into a cyber-physical system.

The title of the research project is "Concept and design of a cyber-physical system for the holistic development of wind turbines" (WindIO). Its total volume is 3.1 million euros, where 2.1 million euros are being funded by the German Federal Ministry for Economic Affairs and Energy under the 7th Energy Research Programme of the Federal Government "Innovations for the Energy Transition". The project is supported by the project management Jülich.

Besides BIK and IALB as research partners, another five companies are involved as development and application partners: CONTACT Software GmbH (Bremen), Pumacy Technologies AG (Berlin), fibretech composites GmbH (Bremen), Deutsche WindGuard GmbH (Varel) and SWMS Consulting GmbH (Oldenburg) as well as associated partners Windrad Engineering GmbH (Bad Doberan), energy & meteo systems GmbH (Oldenburg) and Deutsche Windtechnik Service GmbH & Co. KG (Ostenfeld).

Benefits of "digital twin"

If the potentials offered by digitisation were exploited more efficiently, then the wind turbines could be operated in a more environmentally friendly and economical way. Their research and development activities focus on the concept of the "digital twin". This is the virtual equivalent of a real existing, i.e. physical system such as a wind turbine. In the WindIO project, the digital twin represents the dynamic model of the research wind turbine of type "Krogmann 15-50" of the IALB. Furthermore, the second research wind turbine of the University of Bremen will serve for WindIO research, a 3.4-megawatt turbine operated by the project partner Deutsche WindGuard.

Prediction of field performance and operating lifetime

The operating data must be permanently recorded and fed into the Twin in order to digitally map the real conditions in real time. This requires a large amount of sensor data. The system is transformed into a cyber-physical system (CPS) by connecting the mechanical and electrical components via a communication network to an information processing system. In fact, the digital twin is a specific application of a CPS. Predictive analysis functions and holistic condition monitoring are its key features which providing support during the entire lifecycle of a wind turbine - from the production, installation, operation, maintenance and the final recycling. For instance, linking weather and load conditions allow to get the prediction of the operating performance and service life of the turbines.

Test with Bremen 3.4-megawatt research wind turbine

The software architecture developed on the basis of the Krogmann 15-50 is to be applied in parallel for a digital twin of the second research wind turbine. This will help to investigate whether and how this methodology can also be applied on larger turbines, thus, evaluating the effectiveness of the concept.

”Heretofore, digital twins technology has not been utilised extensively in the wind energy systems. Mostly restrictive information management, in the wind industry, delays the development of higher-level operation and optimisation strategies. Consequently, the potential of the digitisation cannot be fully exploited,” declares Dr.-Ing. Christian Zorn, head of the ForWind coordination office, University of Bremen. One of the project goals is therefore particularly close to his heart: ”With the WindIO twin, we want to establish a database that enables the exchange of plant-specific information for the different stakeholders.”

Universal, freely accessible platform

WindIO is intended to create a free accessible transparent data basis that useful for the development and integration of new ideas and optimisation approaches. This opens up completely new possibilities for comprehensive research activities with real field data, serving as a basis for technical as well as economic simulations for business model development.

The WindIO system is to contribute significant improvement of the maintenance forecasts and the load-minimising control of the wind turbines. It should be possible to guarantee optimum operation management by consideration of the individual boundary conditions. This contributes to a considerable reduction in the costs of energy generation and the best possible conservation of resources.

(Sabine Nollmann)

Further information:

www.brementestturbine.science (project homepage)
www.bik.uni-bremen.de
www.ialb.uni-bremen.de
www.ForWind.de

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Note to editors:

Photos can be downloaded here:
www.brementestturbine.science/files/content/2020-10_WindIO_Fotos_zu_Pressemitteilung.zip