



Wind turbine icing loss forecasting software

A software for forecasting wind turbine performance reduction caused by ice formation.

Applications

- Wind turbines in cold regions

Key Benefits & Differentiators

- **Forecast reduction in power generation:** using forecast meteorological icing data
- **Forecast one to two-week in advance** to prepare turbine control parameters; also enables better power grid planning
- **Daily and hourly forecast** enables control updates to minimize power loss due to icing

Overview

In cold climate regions, ice formation on turbine blades (accretion) poses significant challenges for wind turbine systems. Ice accretion on turbine blades and irregular shedding during wind turbine operation lead to load imbalance and excessive, unpredictable turbine vibration. Accretion of ice also affects the aerodynamic properties of the turbine, which significantly impacts its efficiency. Consequently, such icing events result in severe energy losses.

Researchers at the University of Minnesota have developed a software that enables forecasts for energy losses of wind turbines caused by icing. The underlying model uses temperature, relative humidity, wind speed, precipitation, or other weather forecast parameters as initial inputs to predict the forthcoming meteorological icing event. Based on the relationship between the meteorological icing event and typical icing duration (i.e., icing duration derived from historical data), the software can estimate the duration of the wind turbine icing event, and further forecast the turbine energy loss during the event with turbine power curve as input. The underlying model is self-adjusted, relying on evaluating each passed icing event for more general application to wind farms in various geographical environments. The software allows for forecasting one/two-week ahead with hourly/daily resolution, which could provide insights to better grid scheduling. The software also facilitates short-term forecasts to guide the wind turbine control for safer and more efficient operation in cold climate regions.

Phase of Development

TRL: 6

Researchers have validated the wind turbine icing forecast model for large-scale wind farms.

Desired Partnerships

This technology is now available for:

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- Co-development

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