How to harness the power of the wind

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There might be a better way to use wind power, according to a recent paper in *IEEE/CAA Journal of Automatica Sinica (JAS)*, a joint publication of the Institute of Electrical and Electronic Engineers (IEEE) and the Chinese Association of Automation.

Scientists from the University of Rhode Island, Florida Atlantic University, USA, and Wuhan University, China, teamed up to find a way to optimize wind power for use, even on windless days. "The power grid is a real-time system requiring power plants to produce the right amount of electricity at the right time to consistently and reliably meet the load demand," writes Professor Haibo He in the paper.

To tackle this problem of reliability and consistency in wind power, the researchers proposed a day-ahead economic dispatch model for wind-integrated power systems. It's an algorithm designed to consider both the next day's planned energy use along with real-time energy use.

"It decides the optimal output of a number of electricity generation facilities over a 24 hour period to meet the system load at the lowest possible cost, subject to transmission and operational constraints, to fully accommodate the wind power generation without curtailment," says He.

The goal is for the wind power to be available for use consistently. "Because of the high randomness, uncertainty, and volatility of wind power, the system... needs more redundancy to fully accommodate [the power output requirements]," says He.

Behavior patterns in the wind's data are analyzed. It's like a school of fish—the group can appear random, but there's logic underlying each swell and fall, as each move benefits the most individuals in the group. Constraints are placed on the data movements, removing outliers and promising that the bulk of the data is performing as expected. Lastly, researchers verify the performance expectations by testing the data in real-world simulations.

The framework can successfully predict the optimal model for real-time energy use and day-ahead energy commitment, according to the scientists. However, they note that their method may be subjective as it relies on past experiences to inform future predictions.

He and his team plan to further develop advanced optimization and control methods needed to integrate renewable energy sources into a smart grid. While He focuses mainly on modeling and simulation of smart grid research, his group will collaborate with the power industry to test their simulated models and algorithms against the standard benchmark systems.

More information: Yufei Tang et al, A chance constrained optimal reserve scheduling approach for economic dispatch considering wind penetration, *IEEE/CAA Journal of Automatica Sinica* (2017). DOI: 10.1109/JAS.2017.7510499

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