NERC PURE Associates

SCIENCE OF THE ENVIRONMENT



Extending wind power forecast horizons

WEEK 3 PROBABILISTIC WIND POWER FORECASTING Centrica plc / University of Reading

The need

From week to week, there can be large swings in UK wind power. Wind farm asset owners, such as the energy company Centrica, are therefore exposed to variability in wind power volumes. These swings can change the wholesale market power price and create difficulties for National Grid balancing the system.

Typically, it is assumed that wind power forecasts beyond 10-12 days have no skill, and to date no commercial forecasts exist beyond 14 days. Being able to forecast an extra week ahead would result in a reduction of wind power output volume risk and lead to an improvement in the optimisation of the wind farm assets and the scheduling of maintenance.

What we have achieved

In partnership with Centrica, an operational wind power forecast system has been developed that produces forecasts up to 3 weeks ahead. This was made possible after research from the associate's PhD concluded that UK wind speeds can be forecast beyond 10-12 days, the limit that was previously thought possible, by averaging to a weekly wind speed.

Standard industry practise is to revert to climatology (i.e. average wind power expected at that time of year based on previous observations) when forecasting 3 weeks or beyond. Providing Centrica with a week 3 forecast in addition to climatology, has helped reduce the risks associated with wind speed variability on an operational basis, leading to a reduction in costs.

Based on feedback from interviews, the forecasts were found to be simple to interpret, were included in some decision making processes and continue to be used operationally. A quantitative evaluation of the forecast system over the winter of 2013/14, between the forecasted value and the UK wind power generation found that when accounting for probabilistic information by only "acting" on forecasts with higher confidence, a smaller error of 1120 MW was found relative to 1440 MW when using climatology. This difference in error, 320 MW, is equivalent to £2.7 m of traded electricity over a week[†].

"The forecasts are clear and easy to interpret. The probabilistic information is useful as it gives an indication of the confidence in the forecast. Even though the forecasts don't have the accuracy of our day ahead forecast - they still enable us to stay ahead of the weather." Matt Dodwell, Centrica

¹£2.7 m is the total value of a week's worth of power generation at 320 MW (assuming a wholesale market power price of £50 MWhr-1) and does not represent the saving from using the week 3 wind power forecast instead of climatology.

PA13-003 / May 2014

How we did it

Software was developed to run automatically on the servers at Centrica. Upon receiving a new wind speed forecast from the European Centre for Medium-Range Weather Forecasting, a statistical model begins by calibrating the wind speeds (based on past performance), then converts to wind power, and finally produces a week 3 probabilistic wind power forecast. Training of end users has ensured the forecasts are interpreted correctly. For instance, the forecast (figure on the right) showed there was a higher chance of above normal wind power generation with high confidence (due to a shift and narrowing of the forecast pdf relative to the climatology pdf). The actual average wind power generation for that week was higher than usual at 3.9 GW. To ensure continued reliability of the forecasts production in future, the Information Systems department now supports the running of the model and the head meteorologist disseminates the forecasts within Centrica.



Figure: Forecast issued for the week beginning 10th-Feb-2014 expressed as a probability distribution (pdf).



"This project gave me the chance to implement my PhD research in an operational setting, enhance my skill set and provide benefits for Centrica. PhD theses can sit on a shelf and never be used, so it is nice to know that Centrica stakeholders are already using the forecasts developed from my research."

Kieran Lynch, University of Reading

This project is part of the Probability Uncertainty and Risk in the Environment (PURE) Associate programme, funded by the Natural Environment Research Council (NERC) and managed by the Smith Institute for Industrial Mathematics and System Engineering.

NERC is the UK's main agency for funding and managing research, training and knowledge exchange in the environmental sciences. Its research contributes to a strong UK economy and improves people's lives.

PURE is a Knowledge Exchange Network and Research Programme funded by NERC to increase the impact of Natural Hazard research and to take a national leadership role in changing the way in which uncertainty and risk are assessed and managed across the Natural Hazard community.



Project Details

Partners University of Reading Centrica plc

Project dates

December 2013 - Apr 2014

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