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Communicating warnings for extreme events: use-case of a high-speed shutdown warning system for a system operator with high wind power penetration

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In the world meteorological organization's (WMO) guidelines on ensemble prediction, the WMO warns about ignoring uncertainty in forecasts, even if an end-user receives a deterministic forecasts. The WMO argues that "...if a forecaster issues a deterministic forecast the underlying uncertainty is still there, and the forecaster has to make a best guess at the likely outcome. Unless the forecaster fully understands the decision that the user is going to make based on the forecast, and the impact of different outcomes, the forecaster's best guess may not be well tuned to the real needs of the user".

It is this gap in the basic understanding of uncertainty inherent in forecasts that lead to wrong assumptions among end-users with little or no experience in basic meteorology or atmospheric science. Mistrust in forecasts and forecasting methods including uncertainty methodologies often stem from a wrong expectation on the quality of forecasts for a specific problem. If uncertainty forecasts should find their way into the power industry's weather related decision making, a deeper understanding of weather uncertainty, the way weather services produce uncertainty of weather forecasts, and how such forecasts are to be translated into end-user applications is required.

In order to shed some light into the gaps and pitfalls of uncertainty forecasts in the energy sector we want to present a use-case and highlight some of the many advantages of applying uncertainty forecasts in power system applications.

The use case is a probabilistic warning system for a system operator in an area with high penetration of wind power, where regular high wind speeds (> 20m/s) lead to shutdown of wind turbines over large areas of the transmission grid, causing large costs due to reserve requirements, if such events are not predicted a number of days in advance.

The high-speed shutdown warning system will be explained and practical experience from the evaluation of high-speed shutdown events will be discussed. The alert system provided to a transmission system operator showed that it is absolutely crucial for the end-user to understand the alerts, receive the information in different ways (text and graphics) in order to be capable of relating the warnings to the impact it may have on their grid planning. The impact of a false alarm needs to be evaluated carefully, decided upon and documented in the design phase, so that the end-users have a clear reference system to relate an alert to. Technically, the frequency of the alert generation is easy to adjust, but difficult to design efficiently from a human perspective. It is crucial to not overload end-users with warnings.

The many technical and behavioural communication aspects that need consideration in such a design and our experience with a real application will be described and discussed.