Assessment of storm forecast - DTU Orbit (26/03/2019)

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When wind speed exceeds a certain value, wind turbines shut-down in order to protect their structure. This leads to sudden wind plants shut down and to new challenges concerning the secure operation of the pan-European electric system with future large scale offshore wind power.

This task aims at analysing the ability of existing forecast tools to predict storms at the Horns Rev 2 wind farm. The focus will be on predicting the time where the wind turbine will need to shut down to protect itself, e.g. the time where wind speed exceeds 25 m/s. At the same time, the planned shut-down should cost as little lost wind energy as possible. Therefore, the planned shut down time should be as close as possible to the time where the wind turbine itself would shut down, but still reliable. The forecast systems available to ENERGINET.dk will be applied.

The forecast tools ability of accurately predicting storms was analysed based on historical meteorological data available at Risø DTU and dynamically down-scaled to the Horns Rev 2 wind farm level. This solution was chosen due to the lack of measurements. Moreover, since the project started, there were four events during which Horns Rev 2 wind farm stopped, completely or partially, producing due to extreme wind speeds. Wind speed and power measurements from those events are presented and compared to the forecast available at Energinet.dk. The analysis looked at wind speed and wind power forecast.

The main conclusion of the analysis is that the wind speed forecasts are not very reliable in predicting when Horns Rev 2 wind farm will stop producing due to a storm. One of the reasons for that is the fact that there is no clear and precise definition of Extreme Wind Period (EWP) at wind farm level (how many wind turbines should stop producing in order to consider it an EWP) and that the available wind speed forecasts are given as a mean wind speed over a rather large area. At wind power level, the analysis shows that prediction of accurate production levels from a wind farm experiencing EWP is rather poor. This is partially because the power curve typically used to transform wind speed into power has not been optimised for high wind speeds. This means that today, the wind power forecast error that the TSO’s control room is facing when dealing with EWPs is around 1 p.u.

General information
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