

Assessment of wind turbine power performance at the Alpine Test Site Güttsch

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The performance of the variable pitch and variable speed wind turbine at the Alpine Test Site Güttsch, Andermatt, Switzerland, is analysed. The analysis is based on the 10-min averaged data acquired over a year. The terrain is complex and the turbine is subjected to ice formation. In this work, the measured power curve is found to deviate significantly from the manufacturer's curve, due to wind variations smaller than 10 minutes (Fig. 1). The yearly energy production is calculated using the standard IEC bins method, which involves the multiplication of the experimentally determined power curve with the measured wind frequency distribution. It is found to match the actual energy production well (2.3% lower) and the capacity factor is very low (0.15). This predicted energy can be up to 20% less if the standard power curve is used instead of the measured curve. Subsequently, the power production and wind velocity are averaged according to temperature bins. The energy production is found to be particularly high (up to double the mean annual power) between -1 and -9 °C; a 50% reduction is estimated if the wind conditions would remain at the 10 °C levels for the entire year. Finally, icing events are recorded from a camera mounted on the nacelle of the turbine and matched with the measured velocity and power data. Icing is found to cause a 12.1 MWh (1.6%) reduction in yearly energy production, 8.4 MWh of which is directly caused by ice on the blades. It is concluded that despite the detrimental effects of icing, turbulence and gusts, further development of projects in such environments could be highly beneficial. It would be especially relevant to study further the effects of icing on wind turbine performance.

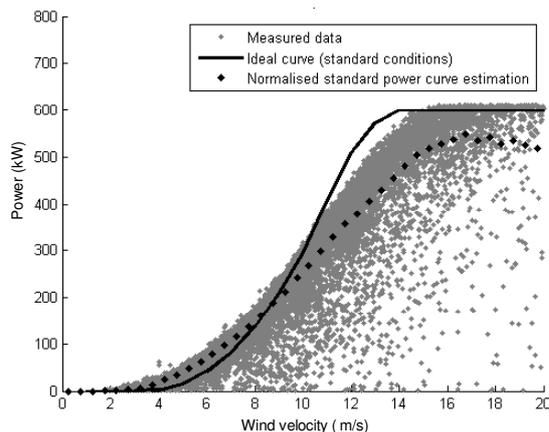


Figure 1. The measured points (grey) and bin-averaged points (black) compared to the manufacturer's power curve, corrected for density.

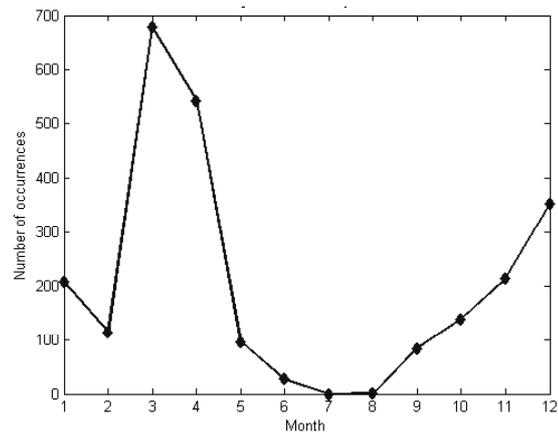


Figure 2. Number of icing occurrences per month.