High Wind Speed Cut-out Event Description, Modelling and Analysis

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Motivation

High Wind Speed (HWS) cut-out events can result in a sizeable, unforeseen, step-change loss in generation. This presents the System Operator with a balancing challenge, particularly if no rapid start-up reserves are dispatchable to meet the resulting generation deficit.

Problem Statement

Wind Energy Facility (WEF) siting generally takes place with maximum cumulative energy yield in mind. The impact of HWS cut-out events has not been investigated in the South African context, especially for future scenarios of high penetration. Empirical analyses have been performed on a limited basis elsewhere to monitor the effects of HWS shutdown, but no formal modelling has been undertaken to characterise individual sites in terms of their cut-out potential.

Methodology

A modelling methodology is proposed to describe the nature of HWS cut-out events. This event model embodies the accurate modelling, clustering and statistical interpretation of events derived from measured wind data (WASA).

The modelling of cut-out events requires the translation of measured wind speed to power at a suitable height. A metric is defined to quantify the percentage loss of plant (ie. plant availability) in the WEF to describe the severity of the extracted events.

The clustering of these events is necessary as they are turbulent in nature and is done for later comparison of site cut-out potential. A time-based event clustering method is described and a suitable measure is used to assess the clustering accuracy.

A statistical analysis is done to describe the events in terms of their predictability and potential impact on the network with a risk assessment approach.

Results

It is shown that the HWS cut-out potential varies across sites. The impact of these events is described in statistical terms and points to a significant effect on the network in terms of event duration, frequency and ramp rates.

Conclusions

The consideration of HWS cut-out events in the siting of WEFs is of importance. Clustering sites in one region can have severe consequences for network reliability. The application of this methodology allows for a probabilistic interpretation of a sites' cut-out potential.