Empowering asset managers through independent data analysis

With the wind being an unpredictable beast, optimising the performance of turbines and reacting quickly to changes in conditions involves a huge amount of data gathering and analysis. Sereema takes a look at how digital technology is being used to enable quick decision making with everyone in sync.

As the wind industry market grows in size and complexity, digital innovation is needed to maintain accuracy across the sector and for businesses to remain competitive on a global level. Turbine and wind farm optimisation are the cornerstones to the future of the wind industry, impacting all the businesses of the value chain.

For example, in the near future smart turbines will be capable of learning from local conditions, determining their best patterns of behaviour without human action. Instead of having to analyse tons of data, asset managers and operators will be able to simply interact with their intelligent turbines, monitor their optimised behaviour and track the extra energy yield obtained.

Present in 15 countries and with 2.5GW of

supervised wind experience, Sereema's constant progress in machine learning and digital tools bodes well for the future of this intelligent wind turbine, taking the company from an innovative tech business to a global leader in digital services for wind.

As part of this journey, Sereema is releasing a best-in-class analytics toolbox to help performance and asset management teams by enabling decisions to be made to their technical skills whatever the level.

AEP Calculator

Changes in performance due to various events, like a yaw misalignment or rotor imbalance, a parameter change on the controller, or a turbine upgrade to both hardware and software occur very frequently. Despite this, the industry doesn't

have the right tools to quantify the performance improvements that can be attained by these corrections.

The AEP calculator from Sereema is a tool within its Windfit technology that combines complex information from multiple datasets to precisely estimate the change in performance on a turbine.

With the calculator, all measurements are air density corrected using Windfit atmospheric sensors. In addition, machine learning based PC filtering removes all external events, such as turbine stops, grid curtailments or sound management. Nacelle direction is obtained using a compass and independent wind speed measurements are used to verify changes in the wind turbine SCADA wind speed. With this new technology it is also
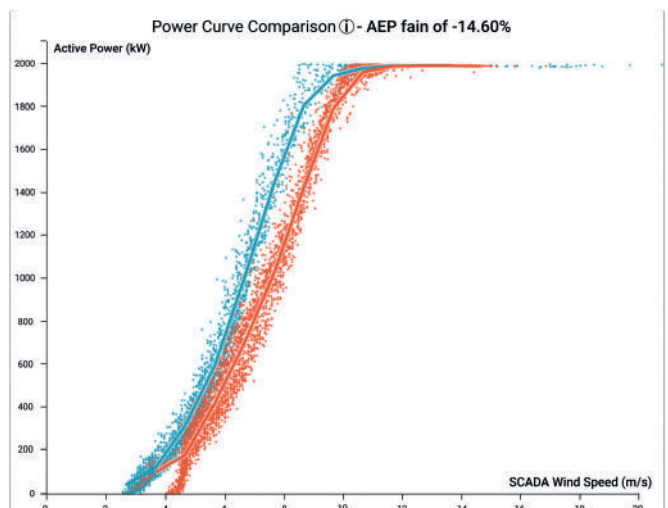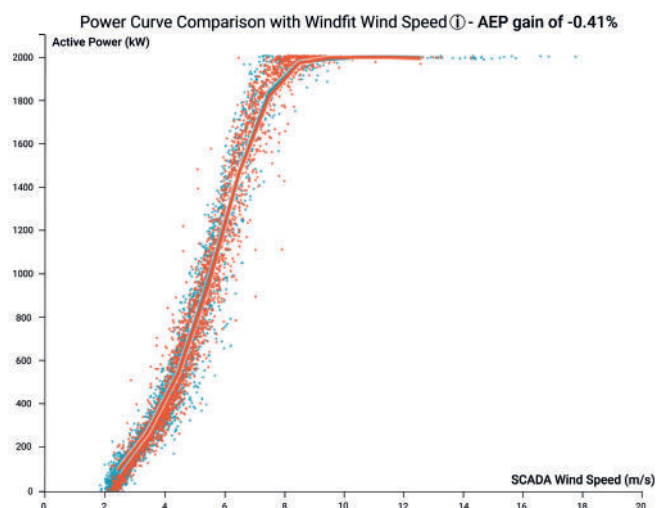
possible to make power to power comparisons between neighbouring turbines with high precision, thanks to the correct North direction and filtering of common free flow sectors.

Teams can quantify the change of performance after the installation of blade aerodynamic improvements like vortex generators, or changes on the wind turbine nacelle transfer function, that lead to a visual improvement to the turbine PC without a real gain in performance. All these, on a very flexible and easy to use tool, allowing the user to select different periods of time or sectors of interest.

This new tool means that Windfit is not only seeing the changes to the turbine operational parameters (pitch strategy, yaw reactivity, change on turbine anemometer transfer function) through its diagnosis features, but it can also support asset owners and operators in precisely estimating the impact of such changes on the turbine performance.

Wind Sector Analysis

Of course, making electricity out of thin air is no easy feat. The wind is a largely changing source of energy; sometimes it blows, sometimes it doesn't and its uncertainty is not new. This means too, that wind farms are complex systems, as they actually interact and become part of the same wind patterns.

To help determine how turbines are performing against local conditions,

Sereema has developed Windfit Sector Analysis, a tool that dives into what the wind conditions are, and how they affect turbine performance and vibrations. In simpler terms, the analysis answers the question 'are my turbines producing more or less due to the particularities of the wind', and, 'is my turbine's lifetime going to be affected by them?'

It does this firstly by relying on the high precision measurements from the company's Windfit box. In particular, the high frequency compass is used to determine the accurate position of the turbines. Secondly, the external conditions impacting the turbine are measured, in terms of wind speed, direction and turbulence intensity, with the Windfit ultrasonic anemometer, before evaluating their impact of both parameters to the turbine's overall operation and vibration behaviour.

Finally, this powerful information can be combined with the turbine SCADA data to maximise the value of both data sets and provide a complete view of the turbine's performance.

The level of wind resource, turbulence intensity, power curve performance and vibrations are visualised on circular heatmaps, or roses. Additionally, further layers of analysis are integrated to study the different results in more detail.

Some interesting insights Windfit users have found so far include how highly turbulent winds from some sectors are reducing the

turbine power curve performance by more than 5%; how wake effects from neighbouring turbines lead to higher turbulence, and how this connects low performance or high vibrations at specific wind sectors; and how some turbine models present resonance effects as their level of vibrations increases for all sectors at a specific low wind speed level.

In addition, by enabling users to play with time scales, the current turbine behaviour can be compared with historical behaviour to evaluate the impact of improvement measures, or to improve understanding of the long-term degradation on a particular turbine measure.

Data Studio

Complementing this, Sereema has also introduced Windfit Data Studio. This enables users to pull information from all data sources within Windfit to study and compare different data sets, in different visual formats, and all in one single user-friendly dashboard.

The data sources available are: Windfit sensors data, giving the option to choose between high frequency data or 10 minute resolution data; Windfit diagnosis data, namely the results from all the different Windfit diagnoses, again at different resolution options; and the SCADA data coming from the turbines.

This tool answers two important digitalisation trends that Sereema believes
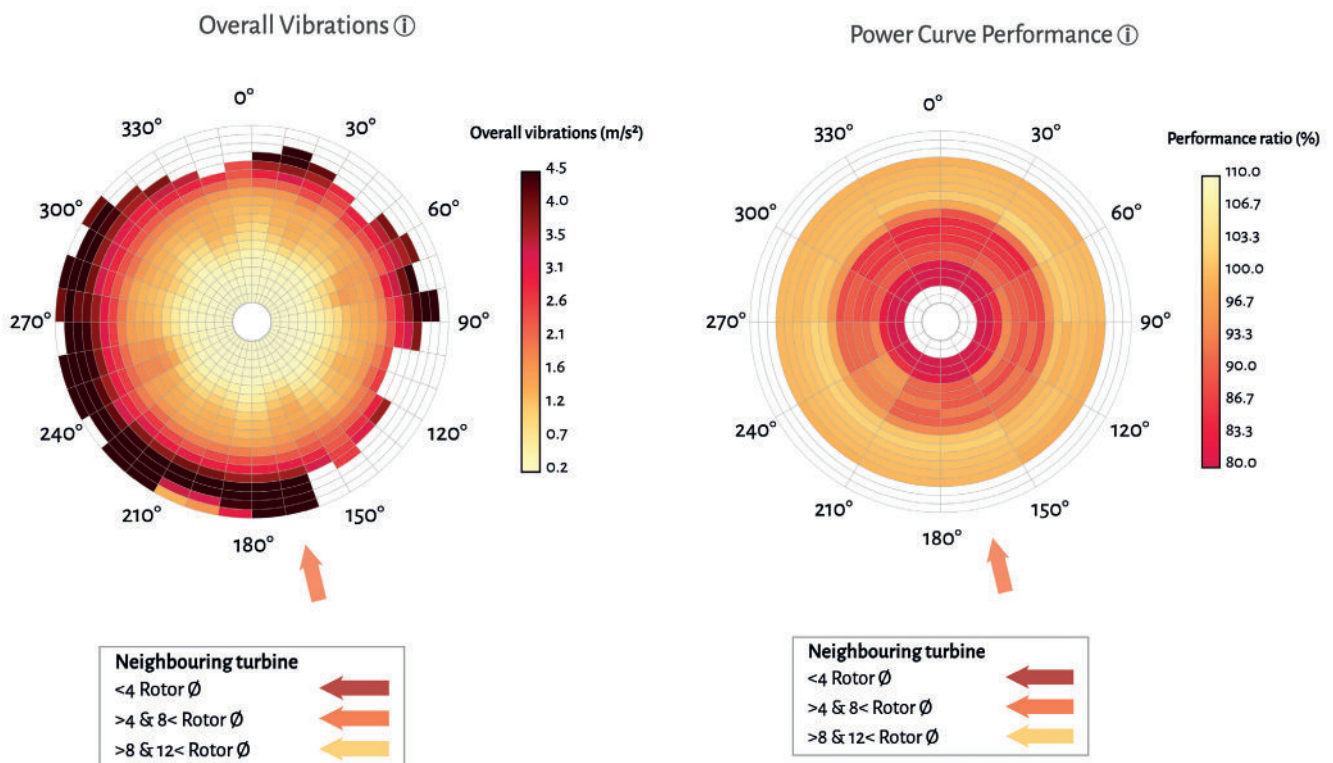
The colour scale allows the user to visualise clearly the severity of a particular measure on a given wind sector and wind speed level

'This tool answers two important digitalisation trends that Sereema believes the wind industry should be working towards: accessibility of data by wind farm owners, and standardization of different data sources in one single platform.'

Result Time Series
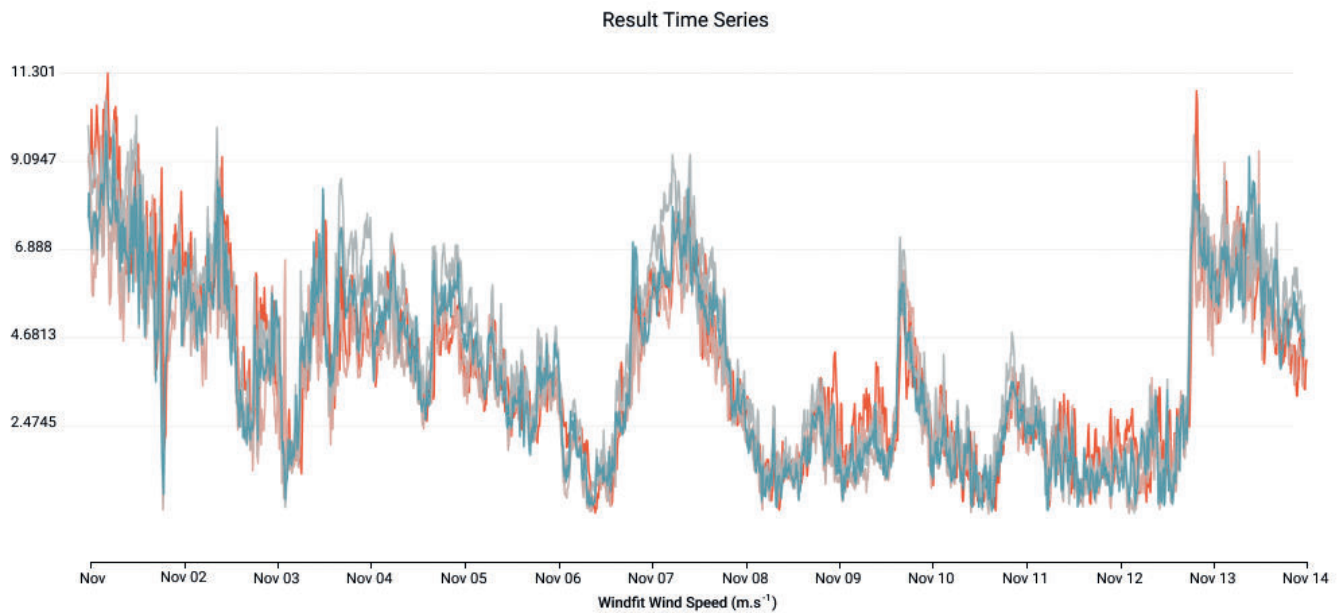
the wind industry should be working towards: accessibility of data by wind farm owners, and standardization of different data sources in one single platform.

In terms of accessibility, the Windfit Data Studio is allowing users to tap into different databases and access to multiple datasets that were not available previously, such as high frequency data, or some of the high resolution diagnoses. This aspect is key to improving the way in which wind farm performance and operation monitoring is done today.

Secondly, being able to consolidate all the different datasets in one single platform has a massive potential when it comes to really understanding the behaviour of wind farms. This means Windfit can be used as a watchdog when SCADA systems fail or are not reliable enough. Both aspects, accessibility and consolidation, are empowering users with the right tool to efficiently manage and operate their wind farms.

So what might the future hold for wind turbine optimisation in a digital world? With the wind industry evolving to take asset performance into consideration, we see asset performance teams being put into place for large wind farm owners and operators. Today, this creation of a new role

means that they have to work on two levels: one to define a company wise performance tools and standards and another to provide the necessary support to the asset managers. This entails performance

managers setting the strategy of the entire fleet, while leaving the operational aspects to the asset managers.

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