Performance Transparency Project

Harald Hohlen

Harald Hohlen, Senior Wind Measurement Specialist at ROMO Wind, caught up with PES to talk to us about the improvements in the iSpin technology and the Performance Transparency Project, which will provide data to the whole of the wind industry.

PES: Welcome back to PES Wind magazine. Thanks for talking with us. For the benefit of our new readers, would you like to begin by explaining a little about the background of your organisation and how you currently serve the wind industry?

Harald Hohlen: Thank you for this opportunity. ROMO Wind is a service provider with the focus on performance transparency and improvement. Our services are built around the unique iSpin spinner anemometer technology, which measures wind quantities of key importance where the wind flow is predictable and can be reliably corrected – at the spinner.

Our initial services were based around the detection and correction of yaw misalignment. Now more and more, the iSpin system is being used as a precise and accurate measurement tool, for evaluating site conditions and turbine performance behaviour.

PES: We have been hearing about your Performance Transparency Project, can you tell us what this is?

HH: The Performance Transparency Project which we call PTP aims to demonstrate the ability of the iSpin spinner anemometer to measure and compare wind turbine performance, everywhere and all the time. In other words; provide transparency on performance.

Technically speaking we want to show the high robustness of the iSpin measurement regardless of terrain and wake effects. This means the nacelle transfer function (NTF), which maps the free wind speed to the wind speed measured with the iSpin system at the spinner is stable.

Given this high robustness we think that the iSpin technology can function as a cost effective, universal tool for verifying and monitoring power curves of the wind turbines. Once iSpin has been calibrated for one turbine type, on flat terrain, there is no need for further site calibration. Then iSpin becomes a tool that can be used for verifying and monitoring power curves, from all turbines in a wind farm and on all terrains, including offshore.

PTP is one of the largest and most systematic demonstration projects for a wind measurement system so far. The plan is to install and evaluate iSpin systems, on a total of around 90 wind turbines, in 9 different wind farms. 3 different turbine types will be evaluated on 3 different terrain types, such as flat, semi-complex, complex or offshore.

At each of the wind farms one met mast, or lidar system, will be used for at least 12 months. In doing this it will be possible to evaluate the NTF stability and the power performance measurement capabilities over a period of time. In total about 90 wind turbines will have their power curves measured, according to IEC standard 61400-12-2 , using iSpin anemometry.

What is unique about PTP is that the results will be validated by renowned independent technical consultants and the anonymised data, reports and data analysis will be made freely available. The data will be available for downloading from ROMO Wind's website, by anyone in the wind industry. We hope this will inspire more research into wind turbine performance.

PES: Last time you told us about the iSpin spinner anemometer technology, can you explain the technological advances and the benefits to the end user of the iSpin Guardian?

HH: Sure, the iSpin spinner anemometer

does measure the wind speed and wind direction, the yaw misalignment and the vertical inflow directly at the spinner. Additionally air temperature and air pressure are collected. Furthermore, turbulence intensity, which affects the center of the rotor, can be derived from the iSpin measurements.

Following several field tests we are able to see that the iSpin measurements are only, to a very small extent, disturbed by changing inflow conditions, such as wake effects. Therefore we are convinced that the iSpin system can perform robust measurements of the wind quantities affecting the wind turbine – not only under free flow conditions but also under 360 degree inflow.

iSpin Guardian can therefore be used to identify underperforming turbines, monitor changes in performance and quantify the effect of upgrades to the turbines. For the first time it will be possible to directly benchmark turbines to each other.

PES: When is this project due to start and are the iSpin systems suitable for all terrains – on and offshore?

HH: The PTP actually started already October 2016. Currently we are in the initial phase where the main challenge is to identify and select suitable wind farms on different terrains, with identical turbine types and - as a key requirement - with met-masts which can be made or are already compliant to the power curve verification standard IEC 61400-12-1.

Other important points are the preparation of the iSpin installations, as well as data handling and of course, the selection of 3rd party consultants to perform the independent data analysis and reporting.

The Wind Energy Institute of the Technical University of Denmark (DTU Wind Energy,) as our project partner in the project, is directly involved in the selection of the wind farms and is also responsible for any upgrade work needed for the existing met masts. Furthermore they will be responsible for installing the reference wind speed measurement at one offshore site.

Up to now we have already selected two turbine types in wind farms, covering three different terrain classes. If everything goes well we expect to start with the first iSpin measurements at beginning of the 3rd quarter this year.

Amongst these wind farms there is also an offshore wind farm. The iSpin system is in principle, suitable for all terrains. We are convinced – especially for large offshore applications – that the cost-effective and meaningful wind speed measurement with the iSpin will bring many benefits and insights to the customers.

PES: This seems to be a costly investment, how do you intend to fund the project?

HH: Yes it is, but it is a worthwhile investment – we think not only for us, but also for the complete wind turbine community. ROMO Wind will bear the main part of the costs and of course we expect to get rapidly growing acceptance and application of our iSpin systems during and after the project.

Additionally we are supported by the Danish EUDP grant scheme, which is a Danish innovation fund for technology and innovation. Last year we applied for a joint grant with DTU Wind Energy. We are proud to say that this application was accepted and seen as important for the wind industry by the evaluation experts.

PES: How will ROMO measure the success of this project?

HH: There will be at least two success indicators. One is of course the scientifically sound proof of the iSpin NTF robustness by the 3rd party consultants. A high NTF robustness will change the game, in power curve evaluation and verification significantly.

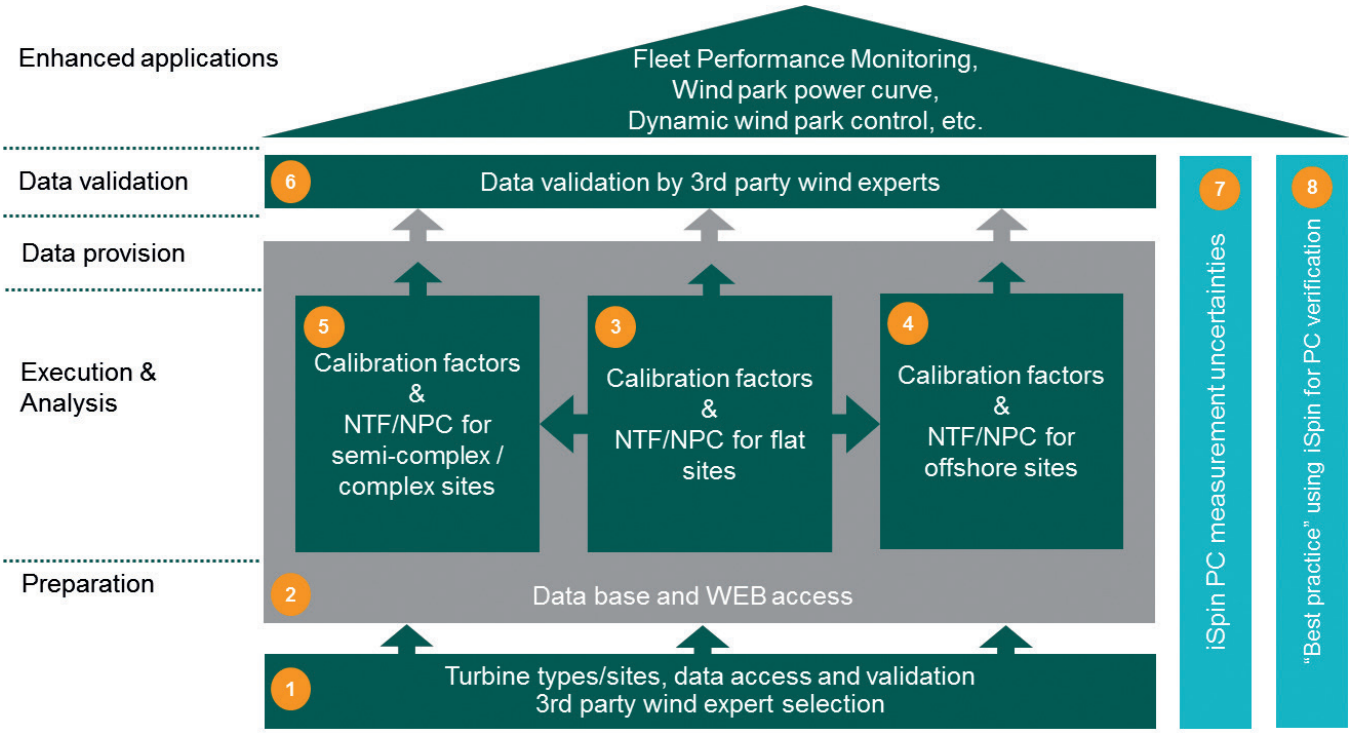
We are convinced that the project will create the basis for a simple, affordable and practical way of measuring performance on all wind turbines, all the time. Our ambition is that OEMs and operators will use iSpin Guardian for performance warranties.

The other indicator is the growing demand by the customer, to use iSpin as a standard device for measuring and assessing the turbine performance and the site conditions, to have an even better turbine fleet. We could have started the PTP on a much smaller scale for one or two turbines per wind farm, but the real benefit will be visible when we have the comparable results from many turbines on a wind farm.

PES: Why is the wind measurement of such great importance to the turbine owners?

HH: Wind turbines are energy producing devices, meaning it is important for the customer and the OEM to know how efficient a turbine converts energy from the given wind conditions.

View of iSpin mounted at the rotor of a wind turbine



General setup of Performance Transparency Project (PTP)

The difficult thing is to get an objective grip on the performance of wind turbines. Questions like: "Does a turbine change its performance characteristics over time?", "How do the turbines perform relative to each other?" or "Is an upgrade having the expected effect?" are difficult to answer.

For customers as well as for manufacturers it is important to be able to identify a performance outside the "normal" range and to be able to differentiate between the drivers. In other words: Is there an underperformance and what is causing the underperformance? Are the environmental conditions different than expected or forecasted during the site evaluation process and is this causing less annual energy production? Or is the turbine underperforming, due to e.g. degradation, issues with components and problems with the turbine control or misleading measurements?

PES: How does iSpin compare to other technologies when carrying out 360 degree wind measurement?

HH: Our evaluations and comparisons with other technologies showed that iSpin is only, to a very small degree, affected by terrain and wake effects. When evaluating power curves based on iSpin measurement it becomes visible that the scatter in the power curve is reduced by approximately 30%, compared to other technologies.

Furthermore you can see that the measurement characteristic does not really change when leaving the free inflow conditions. This becomes especially obvious when iSpin based power curves, get compared with power curves, based on conventional nacelle anemometry. For the latter sensors the measurement characteristic can change significantly, meaning that such measurements only deliver meaningful results when the turbine is operating under free flow conditions.

PES: How does the iSpin based evaluation differ from more traditional SCADA methods of evaluation?

HH: The key difference to traditional SCADA methods is that iSpin wind quantity measurements are used which are undisturbed by the nacelle and predictably affected by the rotor. This opens the possibility of using data from all wind directions, meaning performance comparison during the conditions the turbine is actually experiencing.

Further iSpin quantities like turbulence intensity, yaw misalignment, flow inclination or air density, can be used to correct and normalise the collected data, to improve the quality of the evaluation and reduce the uncertainty level.

PES: Looking to the future what are your biggest challenges in the market place?

HH: The wind industry is for good reasons, a conservative industry and there is a natural inertia to embrace new technologies. This combined with a low level of trust between industry participants means no one trusts anything other than their own data. We hope PTP can set the stage, for a quicker way to get market acceptance of new technologies and therefore help the wind industry innovate faster.

PES: There have been significant changes in the political landscape, with BREXIT and Donald Trump in the Whitehouse, how do you think these will affect the current trade agreements?

HH: The political uncertainty is clearly not helpful for the industry but it is too early to say what the effects will be. So far it has been mostly rhetoric, with few concrete actions.

The wind industry has become a global industry and the growth in new installations is shifting from region to region. Few countries can offer a big enough market to warrant a full supply chain. We are therefore dependent on being able to trade between countries and to trust that the trade agreements put in place will be honored. I can just hope the politicians understand this.

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