Digital automated independent solutions: a necessity for asset managers and an opportunity for O&Ms

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Wind industry business models are shifting their focus. They used to be mainly driven by financial aspects of the business plan and the debt used to finance it, while technical operations, often subcontracted, came in second place. The priority of the wind industry was to ensure robust turbines with a high degree of availability, with performance being considered secondary.

This happened mainly for three reasons:

1. High electricity resale prices were guaranteeing comfortable margins.
2. Technical skills were not always available or easy to acquire by the owners and asset managers
3. Digital data was of poor quality, often difficult to use because it was controlled by the turbine manufacturers.

The gradual disappearance of feed-in tariffs and the implementation of reverse auction systems are giving the market a different dynamic, with the main consequence being a significant drop in the resale price of electricity. Average prices have decreased by 50% in the last 8 years, directly impacting the wind farms Return On Investment (ROI).

Nevertheless, this drop in the price of electricity is an excellent opportunity for the industry, as it makes wind energy more competitive within the energy mix. The influx of capital has been unstoppable, and has even led to a sharp increase in the selling price of wind farms already in operation.

Patrick Pouyanné, CEO of Total Group, a major investor in renewables, advocated recently, that producing 1 GW of electricity requires USD 1 Billion investment. Such a heavy investment is partially compensated by the low cost of money, but this dynamic could change if the capital cost rises as all return on investments will need to increase as well.

So even if the wind industry is still boosted by a very cheap capital, the decline in wind farm yields cannot be forever compensated for by the low cost of debt. Focusing on machine performance is a gamechanger for major players and a key power factor to go and look for bigger production margins, more in line with the new business model.

One of the answers provided by manufacturers today is the race towards turbine sizes. Especially in the rapidly expanding offshore market where 10MW turbines was the target a couple of years ago, whereas today we look at 14MW machines, and tomorrow 20MW ones. However, lower buying price per MW at installation does not solve the problem of operational performance. In fact, every additional percent of AEP gain has way more impact today than 4 years ago, 5% more production yielding 10% in annual Cash Flow to Equity.

Another answer lies in Data. Its quest even becoming the new Eldorado. But many challenges await the data diggers.

First, monitoring and improving the performance of wind farms require access to large volumes and quality of data, paired with powerful data computing, in order to establish large-scale processing. Despite

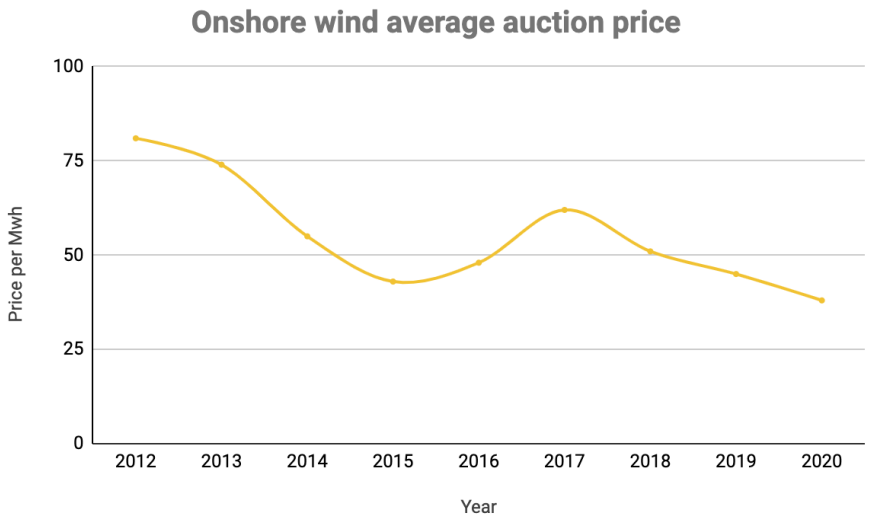
many announcements and marketing messages, the wind energy sector remains relatively less digitized compared to other industries. Making the digital switch isn't easy for big organizations and will be driven by innovative, native digital companies.

Second, many players/owners are seeking to reach a critical mass in order to set up digital systems that centralize their operational data, whether in the form of raw or processed data.

For them, data isn't and should not be limited to the SCADA delivered by manufacturers. The real performance lever also integrates information from third party sources.

The reasons why:

- independent data is more precise, especially when acquired at very high frequency with fully automated process
- they provide deeper levels of information
- their analysis is oriented both towards improving performance to increasing AEP, and preserving the lifetime of the machines, limiting maintenance costs, and improving the profitability of the investment in the long term.



Source: IEA

A system like Sereema's Windfit generates up to 35,000 times more data than a classical SCADA system, acting like a magnifier revealing details, aka underperformance sources, that asset managers were not able to see before.

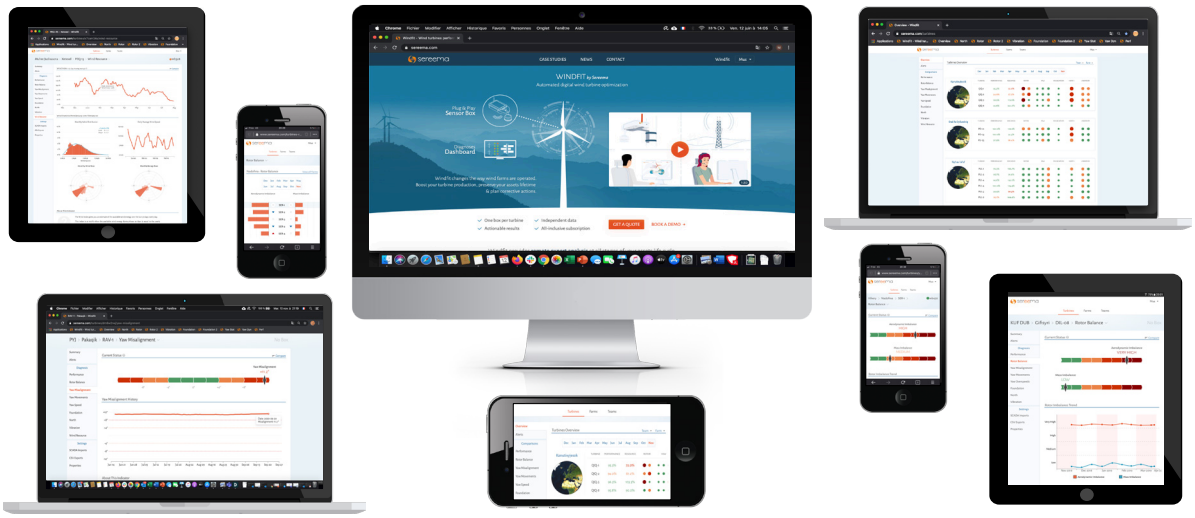
Solutions today need to answer the need of wind farm owners and operators to be closer to their assets.

200% performance

Assets are not considered just as a spur of the moment producing machine anymore, but more as a long-term investment generating higher and longer revenue. Wind farms are also reaching an age when maintenance contracts come to an end with turbine manufacturers, looming in on retrofit or repowering issues. Investors are thus now all the more focused on the lifetime cycle of the farm, from mid to long terms issues as well as short ones.

Maintenance vs. Performance

O&Ms have so far focused on optimizing maintenance costs while their clients, wind farm owners and operators, also need optimized performance and boosted



production. In order for both maintenance costs and performance strategy to be reconciled, a third-party referee is the only option to display a neutral, independent vision, detached from what's happening on both sides of the equation, but focused on the machine performance vs maintenance ratio.

Win-win situation

The emergence and development of innovative digital solutions in the wind energy industry is a strong and inevitable trend. Although, O&M's first reflex was to see the risk of increasing their maintenance costs, or having the quality of their maintenance questioned. We are proving, with systems like Windfit, that it's more fruitful to consider this new deal as an opportunity of development for all parties.

Far from blaming the O&M for underperformance, or to act as a preacher's son, digital newcomers like Sereema bring independent facts, and only facts, to the table helping all parties optimize assets' performance without harming O&M's costs.

A challenge for the clients coming down to an opportunity for the O&Ms to improve their customer relationship by developing their quality of service and integrating the performance corrective actions in their maintenance procedures.

O&M strategies evolve today depending on the brand, and even within the same brand, depending on the region. The switch has been turned on and it's very promising to see virtuous 3-party collaboration starting to settle in, step by step. It bodes well for the digital development of the whole wind power industry.

Windfit by Sereema, brings more than independent expertise, and introduces independent data. More than just yet another source of expertise, independent solutions producing automated results answer fully the arising need for data control, understanding, analysis and actionability.

All these operations are biased if not drawn from independent data.

Independent data solutions

These present 2 major advantages over the standard available data sources:

One, they are designed for performance: from the sensors selection and high frequency data acquisition to the full automated data processing, these systems can identify issues that are causing the wind turbine to underperform and even define how both the wind turbine and the wind farm should operate in order to optimize their performance.

Two, they provide an external and independent view of the turbine. This allows identifying issues that are not visible from the turbine's SCADA data. These systems are able to identify and quantify the most frequent causes of underperformance on operating wind turbines such as pitch offsets on the blades, yaw static and dynamic misalignments, power curve degradation, wrong implementation of curtailments, etc. Correcting these otherwise non detectable issues mechanically improve assets AEP.

Based on 1.4 GW monitored, Windfit has shown that:

Almost 30% of turbines present a rotor aerodynamic imbalance worth correcting (between 1 to 6% AEP gain)

1/3 of the machines revealed north deviation of at least 10°, particularly important when dealing with wind sector management issues or performance analysis per wind sector;

Up to 20% reveal a yaw misalignment generating a minimum of 1 to 6% AEP loss.

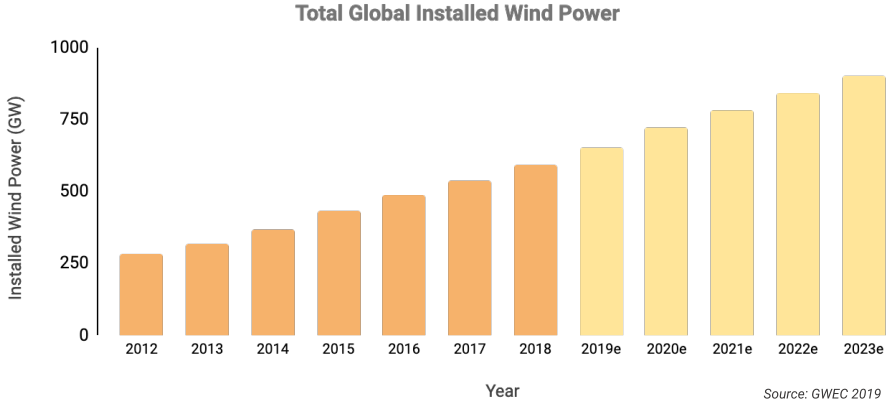
Those 3 features are only part of the global scope independently and autonomously monitored by Sereema's product.

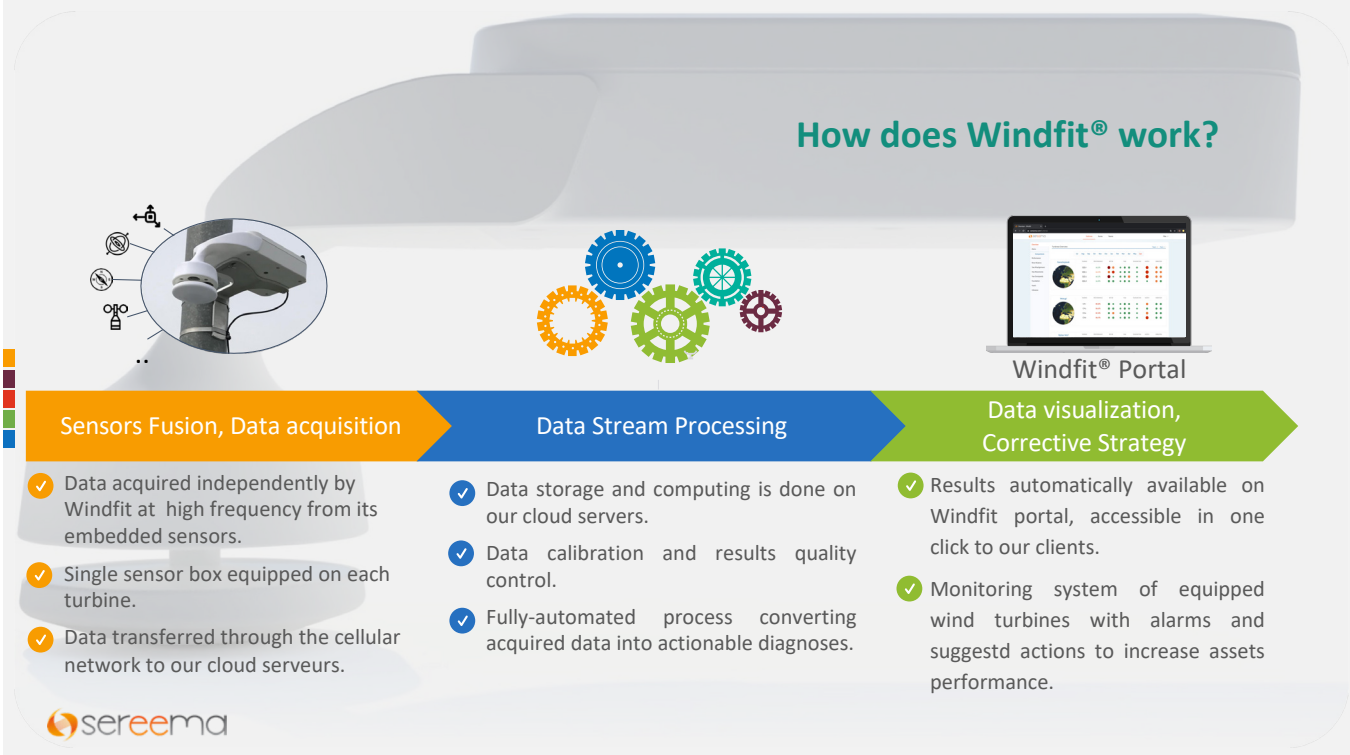
Our clients today are building their user strategy according to their needs:

Permanent and long-term performance monitoring:

- being able, at each given time, to make sure the turbine is producing to its best possible in-situ ability, not just availability. In this strategy, the system becomes part of the turbine.

- under-performance diagnosis: perform campaigns in order to identify all issues that are creating non-optimal conditions for





operation. In this strategy, the system is usually used at:

Commissioning and/or end of warranty:

- where owners want to make sure their turbines operate at their best since the beginning

Due diligence

- on the seller side to show the value of the assets; and on the buyer side to verify the overall status of the asset

Problematic wind farms

- every owner has a set of wind farms that have been being problematic for a while, either lower production than expected or frequent maintenance issues.

In conclusion, independent automated digital solutions allow for a real change on the operation of wind farms making the approach focused on performance and changing the balance of power between owners and manufacturers.

Today the market is bursting with expert alternative solutions but they're all maintenance or O&M oriented. There are no solutions for example to challenge and prove the value of software upgrades pushed through by the O&M teams. It's not an easy task when the only data available to compare and analyze is provided by the same manufacturer who sells the upgrades as well...

Sereema's strategy does not dwell on reigniting the fire between O&Ms vs Operators, but on acting as an independent 3rd-party expert reinforcing each actor's skills and competence to have boosted performance and life maintenance strategies fit together in a realistic but optimized economic and environmental plan.

www.sereema.com

About Sereema

Sereema is the future of Wind farm optimization through SAAS paired with IoT & Big Data processing. Our solution, Windfit® helps asset managers and wind farms operators define corrective actions to improve power production and preserve wind turbines lifetime.

The solution acts as an autonomous automated expert, processing big data generated by our sensor box, to deliver accurate and actionable diagnostics to the end users. It is based on latest IoT technology, MEMS sensors embedded in a single box and big data cloud computing.

Available as an automatically renewed subscription, the service is sold as an all-inclusive package and can be purchased all across the world, no matter the type and model of turbine, both on onshore and offshore windfarms.