The Quest for the Perfect Turbine

Condition Monitoring Software Takes Systematic Approach to Wind Farm Maintenance

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Condition monitoring systems can identify wind turbine issues before they worsen. All photos courtesy of ONYX InSight.

There is no perfect turbine. Each one offers a set of component limitations, site challenges for offshore, availability onshore, as well keeping the turbines turning with limited to no downtime. Extending the life of the turbines and maximizing energy production and performance is, in fact, the very nature of engineering: the continual drive to make things better.

That's the case for any system of electrical generation, where energy will leak out somewhere along the way; it's a hard-coded truth.

Wind farm owners and operators are rising to the challenge of net-zero emissions admirably but have found their ambitious digitalization strategies hampered by software solutions that are built for a smaller, less dynamic sector. As wind scales, so does the ambition of industry stakeholders. Operators require access to their data, simplified to give them the insight they need to boost asset profitability but often adopt short-term thinking rather than long-term solutions.

In the wind industry, though, we're a far cry from thermodynamics being the only barrier to maximizing output. And we can look at the most common lost energy issues that wind farm operators contend with daily including anything from temperature issues, pitch misalignment/calibration, rotor imbalance to leading-edge blade erosion.

Condition monitoring systems can identify issues before they worsen and cause failure later—allowing servicing teams to manage multiple minor faults, and not just a few catastrophes, at a time. CMS systems have become proven technology, with the return on investment (ROI) shown as 20-1 but the systems themselves need to be treated as part of the turbine for holistic and optimized use.

An issue compromising the capacity of an individual turbine could span a whole fleet; a challenge which could, in theory, be dealt with on a turbine-by-turbine basis.

The problem is knowing where to start. Which issues are most urgent? How can engineers and operational supervisors coordinate to solve them in the most efficient way possible?

When wind operators are alerted to multiple faults happening simultaneously, they need to formulate and carry out plans based on the answers to those questions. But with so much of the necessary information trapped in data silos—indecipherable spreadsheets, clogged-up inboxes, or disparate software systems—it's hard to do act with certainty.

The costs of scattergun maintenance work are age-old and

no different from those you'd expect from any other kind of inefficient business: time and money. To save on both and boost efficiency and profit, wind operators need to see and prioritize which leaks in their energy pipelines to plug, with machine-like precision.

With wind farm efficiencies averaging between 30–45 percent, untold gigawatts will continue to be left on the table as long as inefficient approaches to lost energy problems persist. 62 percent of wind industry stakeholders believe that access to data is their biggest barrier to advancement.

Having a single, predictive analytics software to manage your fleet-wide intelligence is key in integrating multiple data feeds to streamline and enhance operations and maintenance (O&M) decision-making.

Wind operators are therefore able to efficiently manage their fleets and asset owners to manage their growing portfolios more profitably, reducing their cost of energy by up to 12 percent.

Last-generation software platforms are increasingly unable to keep pace with sophisticated, scalable approaches to O&M. Since they can only handle one data source at a time, they might require site engineers to use dozens of separate software platforms in isolation.

Too often, wind O&M engineers spend valuable time trawling through email chains to bring up historical cases or reprioritize ongoing issues.

Data is often held offline in spreadsheets, increasing data silos are neglected and inefficiencies often occur when managing large, geographically diverse fleets and data from inspection, service, and maintenance with much of them still being paper based. Having one platform that centralizes critical data streams such as vibration, oil sensor, and pitch bearing monitoring, allows operators to benefit from engineering-enhanced machine learning.

Operators are looking to upgrade their approaches to O&M from turbine-by-turbine analysis to fleet-level strategic control.

With a single platform connecting engineering and site teams, automating labor-intensive, data standardization and case management functions to free up resources allowing them to see the history of their turbines to empower smarter decisions.

Components are replaced earlier, with known data proof sources and we can reuse as many of them as possible, looking at remaining useful life. Once condition monitoring becomes part of the process, with a long-term view operators and owners can move from calendar-based maintenance to condition-based maintenance, enabling simpler scale-up and O&M decisions. With condition monitoring plus all data integrated, alongside an experienced engineering view, the gap closes slightly more on our quest to keep turbines turning for longer. Owner/operators gain confidence in being able to look at the bigger picture. **PTE**

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