Digitalization of wind farm services

Predicting turbine operations and energy output with higher certainty 12-48 hours ahead of time will enable greater penetration of wind into the grid as a reliable energy source, writes *Duncan Koerbel*, Chief Technology Officer, Suzlon Group

With over 34 GW installations, the Indian wind sector is highly mature and is geared to unlock the 300 GW potential. With an ambitious target of 60 GW by 2022 set by the government, the wind energy sector is scaling up to achieve nearly 10 – 12 GW per annum installation. To meet this demand, the wind energy industry must focus on employing cutting-edge technologies for bigger and increasingly reliable turbines, improving supply chain, enabling grid integration and leveraging digital technologies. Suzlon was employing the 'Internet of Things' concept long before it became a buzz word. Predictive analytics plays a key role, as it allows to, better predict or forecast the power generation. Predicting turbine operations and energy output with higher certainty 12-48 hours ahead of time will enable greater penetration of wind into the grid as a reliable energy source. Better analytics simultaneously assists in identifying areas for enhancing the wind turbine generation and optimizing the operation and maintenance costs by proactively identifying failures and taking action before the failures occur. In future the introduction of Augmented and Virtual Reality based solutions will be effectively utilized for training engineers, in various health & safety scenarios, thereby reducing the chance of human and material losses.

Recently, the reduction in levelised tariff of wind power to a record low of Rs. 2.43 (3.8¢ US) per kWh (without any direct or indirect subsidies) during auctions for wind projects, has severely impacted the top and bottom line for players throughout the wind industry. In order to mitigate the effects of reduction in margins, the employment of Predictive/ Prognostics Analytics based Maintenance, Condition Monitoring System and Inventory optimization will pay a significant role.

●● DIGITALIZATION INITIATIVES UNDERTAKEN

Suzlon has developed a best-in-class Supervisory Control and Data Acquisition (SCADA) system. More than 300 sensors in each turbine continuously transmit

data 24x7 on secure network to Suzlon's Monitoring Centre (SMC) in Pune, India. At the SMC, round-the-clock monitoring and advanced analytics is carried out to convert this raw data into valuable insights. This enables us to expedite troubleshooting, identify recurring events, predict likely failure of events and prevent unscheduled downtime.

SC-TRINITY, an in-house developed, application based on SCADA system enables real time monitoring, reporting and analysis for the customer. Rich and intuitive interfaces of this application, makes it a real world class product.

●● WIND FARM VIEW WITH REAL TIME WIND TURBINE STATUS

Real time monitoring of Wind Turbine Parameters Graphical display of Wind Turbine Parameters

Across the board, Operations and Maintenance Services (OMS) processes at site and head office levels have been automated using the SAP based ERP system, which enable end-to-end digital transactions. It was not long ago that every turbine took many sheets of paper in the form of checklists, work instructions, technical documents necessary to maintain the turbines. This transition to automation and digitalization of systems and processes, now form the DNA of Suzlon's OMS operations.

There has been increased thrust on providing mobility solutions to the site teams, in order to enhance the effectiveness of Preventive Maintenance (PM). The mobile app enables technicians to capture all the PM checklist data, while performing tasks in order to have real time input and feedback. It also provides comprehensive overview dashboards to monitor and analyze the progress of Preventive Maintenance (PM) activities of the wind farm. This has greatly improved the quality and timeliness of the PM activities.

●● PM MOBILE APP

Predictive analytics based maintenance solutions detect failure patterns to

determine wind turbines assemblies that are at the greatest risk of failure. This early identification of issues helps to deploy valuable maintenance resources ahead of time to mitigate potential failures before they happen. This lessens the down time for the turbine and eliminates possible collateral damage due to a failed component. This reduces the demand on the quality and supply chain teams. The predictive models have been developed using machine learning algorithms and big data technologies in order to provide a high degree of accuracy and actionable insights.

Deployment of Condition Monitoring System (CMS) enables integration of vibration sensor data with temperature data and oil sample reports to further enhance accuracy of predicting failures. Advanced data fusion/mining strategies are employed for monitoring and prognosis of major assemblies like; gear box, generators and main bearing, with an aim of reducing turbine downtime and replacement cost. These initiatives directly impacts in enhancing the life of the wind turbine asset.

In order to enable better penetration into the grid, wind power forecast data is shared a day ahead with the state utilities. To improve the forecast accuracy, the revisions are being sent every 1.5 hours, as per CERC guidelines. The forecast models integrate numerical weather prediction data, wind turbine SCADA data & terrain data to accurately predict the wind power.

Suzlon wind turbines are also equipped with sophisticated Low Voltage Ride Through (LVRT)/High Voltage Ride Through (HVRT) systems. These systems enable individual wind turbines to remain connected to the grid during grid voltage fluctuations. Further, Suzlon turbines have the provision of a 'park controller' that enables automated control and regulation of wind power at complete wind farm level. This enhances the power supplied to the grid and eases the operations for the utilities at the state level.

●● BENEFITS OF DIGITALIZATION

 Digitalization initiative aims to maximize turbine efficiency and availability by leveraging the big data technologies. Big data represents the Information assets characterized by such a High Volume, Velocity and Variety. This not only enables increase in energy production at lower lifecycle cost, but also results in greater transparency of performance parameters at all levels. It is a win-win situation for customers and wind farm operators due to enhanced revenue at reduced operations and maintenance cost. Further, with improved accuracy in scheduling, forecasting and integration in the grid, enabled by the technological advancements, we are continuously reducing the Levelised Cost of Energy (LCoE). **en**

(Views expressed are personal)