Ovation™ Wind Turbine Control

Features

- Complete individual wind turbine control and monitoring system
- Accessible and open control platform with flexible tuning and troubleshooting capabilities
- Scalable hardware designed for harsh environmental conditions
- Integrated condition monitoring system for major rotating components
- Optimized integrated plant management
- Comprehensive lifecycle support programs enable cost savings through long-term services provided by a single vendor
- Cybersecurity options available for reduced risk

Introduction

As power generation from wind continues to grow in energy portfolios worldwide, customers are actively seeking to maximize the annual energy production (AEP) of their wind turbine farms. The two most accepted ways to grow AEP are:

- Increase the turbine size
- Improve the turbine controls

Initially, wind turbine control systems were designed to last the entire lifespan of the turbine hardware. However, the consolidation of smaller OEMs purchased by major OEMs has created the challenge of maintaining the legacy control systems of older turbines as they become obsolete and unsupported.

Upgrading older control systems with newer advanced technology can help customers extend the lifespan of their wind turbines while improving turbine performance and reducing maintenance costs.

Ovation Wind Turbine Control

Emerson’s proven Ovation™ automation technology reliably controls and monitors a variety of power generation assets worldwide and has been a widely-recognized automation market leader in the power industry for nearly five decades.

Unlike PLC-based options, Ovation systems are designed and built specifically for mission-critical power-related applications.

Recent enhancements now cost-effectively extend the Ovation platform to small-scale and widely distributed assets.

The Ovation wind turbine solution provides a single platform for control of the pitch system, yaw system and vibration monitoring of individual turbines.
This powerful solution allows customers to maximize AEP and avoid obsolescence through the following features:

- **Open and flexible software platform** allows operators to gain turbine operation insights that reduce maintenance costs and increase production.
- **Hardened hardware platform** allows for optimal control of individual turbines in constantly fluctuating conditions and remote locations.
- **Vibration monitoring** provides predictive maintenance to prevent major component failures.
- **Integrated plant management** coordinates individual turbine operation to minimize turbine generator downtime and optimize overall wind farm operations.
- **Seamless connection to other plant assets** including third-party systems and networks as well as with solar, battery storage or other distributed generation on a single software platform.

**Applications**

**Yaw Control**

Yaw control determines the nacelle’s position as it rotates around its vertical axis. Ovation measures wind direction based on signals received from wind measurement devices and uses this information to position the nacelle accordingly. Under generating conditions, Ovation will orient the nacelle to directly face the incoming wind for optimized power generation. Under curtailment conditions, the wind turbine will be set 90° from incoming wind.

**Pitch Control**

The pitch system is a critical part of controlling wind turbine power generation. Ovation’s wind turbine logic directly controls the pitch position, pitch velocity and turbine speed. The result of Ovation’s control actions angles the wind turbine blades to a position that maximizes wind capture at below rated wind speed, maintains rated output power above rated wind speed, and feathers (increasing the pitch angle) the turbine blades at wind speeds above the cut-out speed.

The pitch system communicates with the power converter to control generation. When wind speed is below the rated wind speed needed for maximum power, the Ovation solution, via the pitch control strategy, maximizes energy capture by adjusting to changing conditions.

**Integrated Condition Monitoring**

As wind farms age, managing the operations and maintenance (O&M) costs become increasingly important, and major rotating component failures can be costly. Ovation’s native Machinery Health™ monitor module uses predictive maintenance to ensure the protection of major components by measuring the vibration of:

- Main shaft bearings
- Gearbox
- Generator bearings

The module’s PeakVue application provides actionable insights for roller bearings and gearboxes, identifying equipment wear before failure and allowing customers to plan and prepare for equipment maintenance.

PeakVue provides a call to action sooner than traditional vibration monitoring systems, while vibration measurements are still within acceptable limits, which helps to reduce overall O&M costs.

**Architecture**

**Open System Design**

Ovation’s open architecture allows users to make control adjustments and detailed control tuning to ensure that maximum energy harvest is being achieved. Wind turbine logic is displayed in SAMA diagrams that are accessible to engineers so they can confidently make the changes needed.

Ovation’s signal diagrams improve troubleshooting by tracking signal status and output values to quickly identify the root cause of a fault.

Additionally, Ovation uses a first-out algorithm that immediately captures the cause of any fault and avoids an overwhelming flood of alarms.
Scalable Hardware Platform

Ovation’s wind turbine solution, including the Ovation OCC100 controller, enables superior performance through its reliable, secure and low-power architecture. The Ovation controller is designed to withstand hardened environmental conditions which make it suitable for the harsh temperatures that can occur at wind farms.

Furthermore, Ovation’s reduced hardware footprint utilizes flexible bases that can accommodate high density I/O modules, which allow for twice as many I/O points in the same space as traditional I/O modules. The reduced footprint is advantageous for the wind industry where space is often limited for turbine control hardware.

Wind Farm Management

Beyond managing individual turbine control, Emerson also recognizes the importance of integrated wind farm management. Supervisory control of a wind farm can increase the AEP by maximizing power output and turbine availability enabled by a centralized system. An Ovation-based SCADA solution, which communicates natively with individual Ovation wind turbine systems, can be used to manage and monitor wind farm assets as well as provide protective supervisory shutdown, programmed supervisory stop, supervisory control of switchgear, wind turbine generator maintenance management and wind turbine diagnostics and alarms.

Connectivity

The Ovation system has the capability to integrate individual plant control systems, applications, third-party devices and corporate networks into a single unified platform to provide accurate process data when and where it is needed the most.

Ovation’s connectivity options include controller and I/O modules such as the Ethernet link controller, workstations such as the Ovation SCADA communication server, OPC connectivity, visualization and data analysis tools such as EDS, and wireless solutions.

Cybersecurity

Aware of the risk of current cybersecurity issues, Emerson offers security services and business processes to enhance a plant’s security posture. Addressing these issues holistically provides an up-to-date system management practice that can result in more reliable operations, fewer unplanned outages, quicker incident resolution and rapid recovery.

Each Ovation system is equipped with basic security functions such as account management, password management, workstation hardening and controller certification. Emerson’s Power and Water Cybersecurity suite is optionally available to manage cybersecurity risks and provide enhanced control system protection for secure, reliable, safe and efficient plant operation.

Lifecycle Support

Emerson understands the importance of lifecycle support and offers a range of lifecycle programs and services that are designed to increase system reliability and provide the long-term support users need. Backed by decades of power control experience, Emerson ensures reliable and knowledgeable support through the following services:

- **Field services** to perform routine or emergency visits to optimize management of plant operations and keep systems up to date.
- **Educational services** that include comprehensive and customized training delivered on-site or in house.
- **System support** which includes 24/7 phone support, remote diagnostics and software patch management.
- **Evergreen program** to prevent obsolescence through continuous support long after project commissioning
- **Ovation Advantage** to integrate small projects to PLCs and other skid type equipment into the Ovation DCS.
- **Security solutions** to assist with compliance and cybersecurity best practices to reduce risk and improve reliability

Emerson can assist with creating a lifecycle support plan to ensure that Ovation system investments stay current with changing technologies.