

# YOKOGAWA WIND POWER SOLUTIONS

Wind power is a clean, renewable and cost-effective method of generating power. As system production costs decrease and the world turns to renewable energy, larger wind power farms are being built and are starting to encounter challenges in safety and operation efficiency.

## The Solution

Yokogawa Wind Power Solutions can improve your plant assets by monitoring, controlling and optimizing the operation from field to community level with comprehensive communication interfaces that can be connected to third-party equipment in your plant.

Of course, as with any Yokogawa system, the highest level of reliability is attained to ensure that your plant assets operate at their maximum potential.

## **Enterprise Automation Solution**

Safety and compliance are becoming increasingly important in industrial plants. In order to help improve management, Yokogawa offers an enterprise system that can integrate, monitor and control the customer's entire plant from a single remote location with redundancy provided.



## Wind Turbine Control System (STARDOM FCN)

Yokogawa's highly-reliable hybrid PLC is used in large numbers in many countries and diverse industries. The high-speed CPU supports a wide range of interfaces such as CANopen, DNP3, Modbus, dedicated pulse module for rotation speed measurement, and SOE function, making it suitable for wind turbine control.



### Data collection and local control

Yokogawa's edge controller "e-RT3" is made to run 24/7 and is ideal for long-term stable operation.

This PLC, with built-in LINUX CPU, can collect data, monitor and control the plant, and issue alarms. Integrated data on wind power such as generated power, battery status, lightning events, weather information and substation abnormalities can be monitored and, in case of abnormality, the switchgear or circuit breaker can be guickly operated and alarms issued.





## **Energy Management System**

The objective of the Renewable Energy Management System is to minimize disruption to renewable generation. To increase the inclusion of renewable energy in electrical power grids, its supply must be



### **Battery Energy Storage System**

To ensure a stable supply of power to the grid, a renewable energy farm may use batteries. Yokogawa's network-based control systems play an important role in smoothing out the supply of this power to the grid. A power monitoring & control system and a battery control system are both configured in the dual-redundant controllers.



- Centralized and standardized cybersecurity management
- Distribution of OS security patches and anti-virus signature files

### **IIOT Solutions** (IIoT: Industrial Internet of Things)

- Remote CCTV plant monitoring
- Operations management
- Weather data collection (wind direction, wind speed, storm activity, etc.)
  - Wireless sensors
- Production Dashboard System (such as KPI management)





1 Yokogawa Renewable Solutions WIND POWER Yokogawa Renewable Solutions WIND POWER 2

## YOKOGAWA WIND POWER SOLUTIONS

## Wind turbine monitoring and control

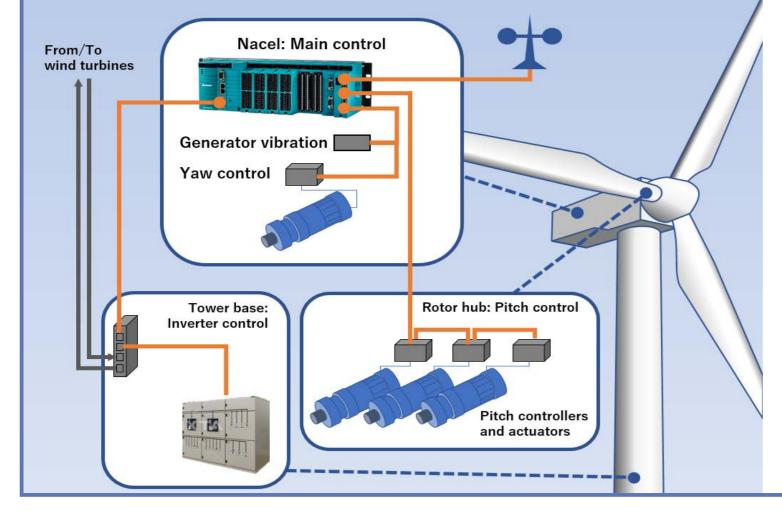
## WIND TURBINE CONTROL

Yokogawa's network based controller "STARDOM" has a huge installed base throughout industry and across global markets. The dedicated and redundant CPU for wind turbine control complies with ANSI/ISA S71.04 corrosion resistance and thus ensures extremely reliable operation even in harsh environments.

When it functions as a main controller, STARDOM can be integrated with other systems such as pitch controllers, tower base controllers and inverter controllers thanks to its wide range of interface protocols. This flexible option allows the control system to be fully integrated and optimized.

#### **Key Features**

- Extremely reliable operation
- · High areliability dual redundant CPU as an option
- Anti-corrosion coating compliant with ANSI/ISA S71.04 G3 standard
- Excellent local support throughout the world
- Quick delivery





Example display of wind turbine monitoring

## REMOTE MONITORING OF WIND TURBINES

Yokogawa's SCADA "FAST/TOOLS" based monitoring system provides consolidated data of multiple turbines as well as relevant information such as environmental conditions and grid status. The system can function as a secondary SCADA and acquire integrated data from local control systems to provide their consolidated information in the remote monitoring room.

#### Available data includes:

- Power generation/operating status and record
- · Ambient temperature, wind speed, wind direction
- Nacelle condition, including rotor speed, rotor vibration, tower vibration
- Detection, alarm issuance, and recording for lightning and fire
- Natural conditions e.g. wind speed, direction, number/time of lighting strikes

Some components are designed for use in offshore wind farms and their installation is rapidly growing.

3 Yokogawa Renewable Solutions WIND POWER

## YOKOGAWA WIND POWER SOLUTIONS

#### Offshore wind turbine solutions

Offshore wind turbines face a higher risk of accident compared to onshore ones. Yokogawa is able to offer early-detection solutions so that countermeasure can be taken before the accident escalates to a serious level.

#### Wave level sensing

Abnormally high ocean waves can cause significant damage to wind turbine operations. Yokogawa's wind turbine control system comes with a fully integrated wave level sensor and ensures suitable operations to avoid serious damage to the turbines.

#### External monitoring by anti-corrosion CCTV

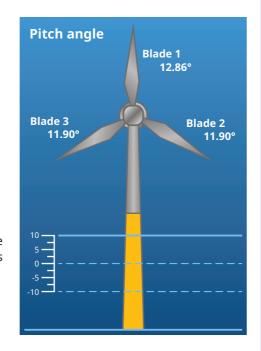
Wind turbines are often located near or in the sea, making it difficult for field cameras to survive in such harsh conditions. Yokogawa's CCTV FIELDEYE II is corrosion-resistant and offers 360° viewing. External monitoring enables detection of abnormalities.

## Wide-area fire detection by Distributed Temperature Sensor (DTS)

Yokogawa's DTS, a fiber optic cable type of temperature sensor, can cover the whole area where there is a risk of fire such as Power Cable. It provides 24/7/365 monitoring along the entire length of the cable.

#### Robust Features

Dual Redundant CPU
Anti-corrosion coating compliant with ANSI/ISA S71.04 G3 standard



60 wind farms, 3.0 gigawatts applied for, and more than 2,000 wind turbines in China

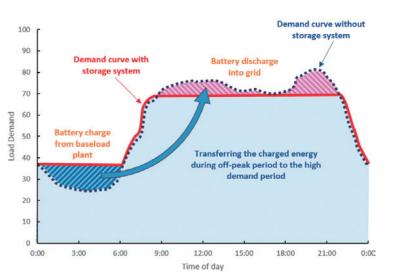
25 Wind farms, 380 megawatts, and more than 176 wind turbines in Japan

### **Energy Management System**

The Energy Management System (EMS) provides integrated operation and revenue maximization for renewable energy generation facility operators, by providing energy balancing and scheduling between various forms of renewable energy (wind, solar), conventional generation (thermal, hydro), energy storage systems (batteries, pumped hydro, flywheels), and dispatch instructions from the market operator.

By integrating various data such as weather forecasts, power storage and electricity tariffs, the EMS provides automated predictions of power demand and calculates the optimum power generation and supply schedule, including the optimized use of battery energy storage.

While the EMS is intended to manage energy, it can also be integrated with Yokogawa's Computerized Maintenance Management System to avoid system failure caused by malfunction or deterioration of mechanical devices.



### **Battery Energy Storage System**

To ensure the stable supply of power to the grid even when there is a dip in power generation, many renewable energy farms use a battery energy storage system (BESS) as a backup power supply.

Yokogawa's network-based control system play a key role in smoothing out the supply of this power to the grid.

The following key functions of BESS monitoring and control help you to achieve stable and profit-maximized operation.

#### **Operation planning and monitoring:**

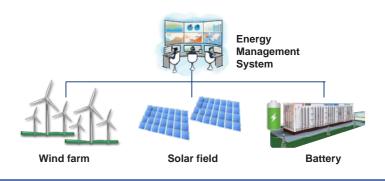
Using the power generation scheduling system, operators can access the weekly operation plan data they need to draw up an operation plan for the next day. At their stations, operators can view graphic displays showing the power sales target, power generation plan and battery charge-discharge plan.

## Associated power monitoring:

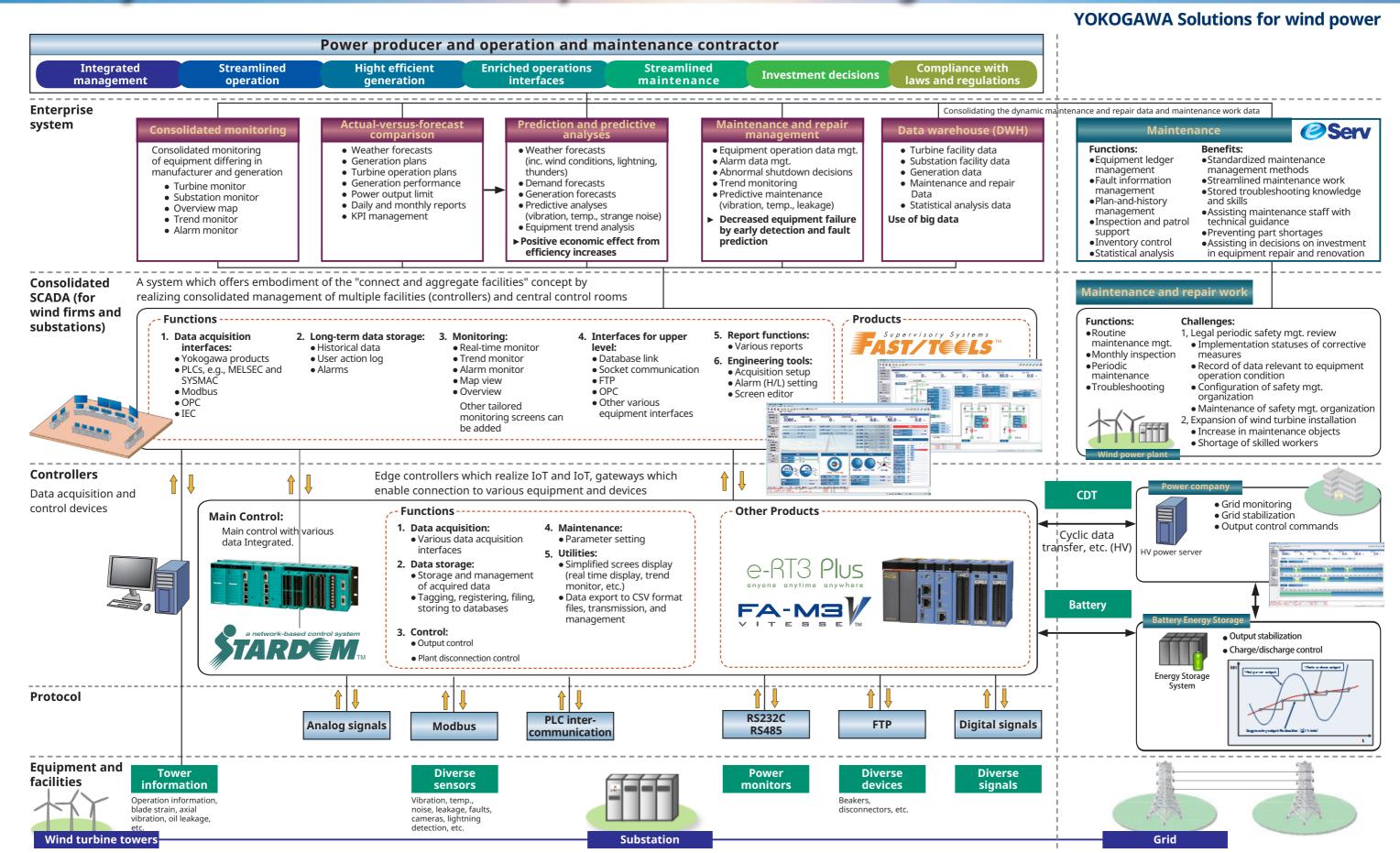
Operators can view data on total power output for the entire facility, battery charge status, and transformer operation status.

## **Battery monitoring:**

The charge-discharge rate, charge status and operation status of each battery are displayed.



## From field maintenance to enterprise decision-making



7 Yokogawa Renewable Solutions WIND POWER 8

## INDUSTRIAL AUTOMATION and CONTROL

## YOKOGAWA RENEWABLE SOLUTIONS CATALOGUE

#### Production control and safety instrumented systems

Reliable control systems that respond quickly to changes in management and operations and establish the foundation needed for high efficiency, quality, safety, and stability in plant operations

- > Control and safety system
- > Control improvement software
- > Control devices
- > Quality control system





STARDOM





Range-free multi-controller

FA-M3V

FAST/TOOLS

#### Field instruments, analytical instruments, and recorders

Field instruments and systems that enable highly precise measurement, data acquisition, and analysis

- > Data acquisition
- > Field instruments
- > Analyzers
- **≻** Components



#### **Transformation**

Comprehensive solutions that take the broad view in driving operational excellence throughout an enterprise's business activities, from production through to supply chain optimization, and risk and business management

- > Enterprise business optimization
- > Supply chain optimization
- > Asset operations and optimization
- > Asset management and integrity
- > Operational risk management
- > Profit-driven operation
- > Connected Intelligence

#### **Execution**

Flexible, agile project implementation services, built on a strong global track record

- > Agile project execution services
- > MAC and MAIC services

- > Modernization services
- > Value delivery services

#### Lifecycle

Maintenance and development services designed to deliver optimized operations over the entire plant lifecycle while working side by side with customers

- > Lifecycle performance care services
- > Safety and security
- > Asset performance monitoring
- ➤ Upgrade and migration
- > Operation and maintenance improvement
- > Training



**COMING** 

Renewable Solutions for Solar PV Bulletin 53T01A02-01EN



Renewable Solutions for Wind Power

Bulletin 53T01A02-02EN

Renewable Solutions for Geothermal Bulletin 53T01A02-0XEN



Renewable Solutions for WtE/Biomass Bulletin 53T01A02-0XEN



COMING

Renewable Solutions for Energy Management Systems EMS Bulletin 53T01A02-0XEN



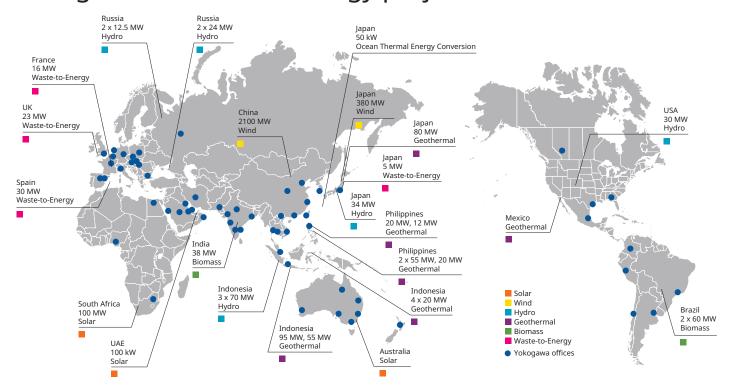
Renewable Solutions for Solar CSP Bulletin 53T01A02-0XEN

Renewable Solutions for Hydro

Bulletin 53T01A02-03EN

Yokogawa Renewable Solutions WIND POWER 10 9 Yokogawa Renewable Solutions WIND POWER

## Yokogawa's renewable energy projects





Synaptic Business Automation underlies a process of co-innovation and collaboration with customers that leverages Yokogawa's domain knowledge and digital automation technologies to create sustainable value.

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