

SUCCESS STORY



IBERDROLA RENEWABLE ENERGIES PORTLAND OPERATION CENTER



PcVue is the nerve center of a solution for centralized control of wind farms across the United States.

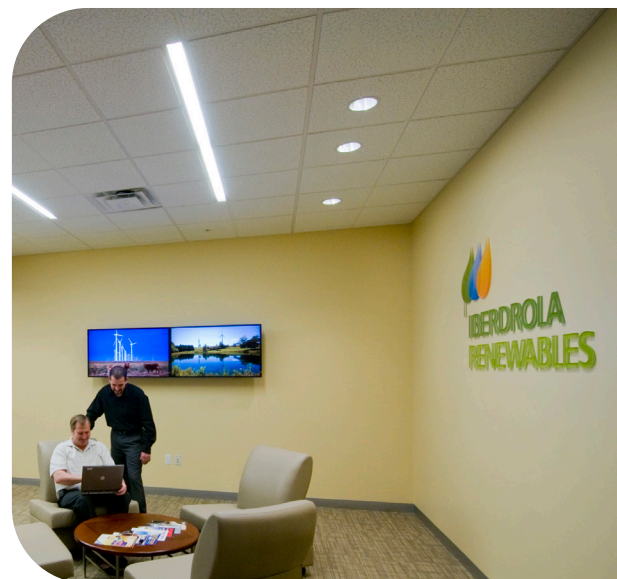
Wind energy is the fastest-growing source of energy in the world and a tremendous source of homegrown power and Iberdrola Renewables has a nerve center in the wind industry at its National Control Center in Portland, Oregon.

Iberdrola Renewables is the largest provider of wind energy in the world and the second-largest provider in North America, helping utilities to 'green up' their energy portfolios. The Center is professionally staffed 24/7/365 to provide energy management, scheduling and generation dispatch. These capabilities help the customers of Iberdrola Renewables to manage risks and uncertainty in the natural gas and power generation industries while fulfilling energy requirements with clean, sustainable power.

The company began operating in Oregon in 2001 with 12 employees. At that time it was called PPM Energy and was part of Scottish Power. As of 2010, more than 850 workers throughout the United States maintain, develop, build and operate over 3,500 megawatts of wind power and other energy facilities in 20 states. With a goal of adding about 1,000 megawatts of new renewables each year, this exceeds the capacity of any other renewable energy supplier in the U.S. The latest operation at Iberdrola Renewables is the National Control Center. Located in a room that looks a little like NASA's Mission Control, systems analysts oversee every turbine at every wind farm throughout the country, 24-seven. They monitor the performance and efficiency of every turbine. They keep an eye on approaching storms to warn technicians in the field to get to safety before harsh weather hits.

They even help scientists conduct groundbreaking wildlife research at wind farms. And they help the nation's various transmission system operators ensure grid reliability to keep the lights on under any circumstance! A vital element of this operation is the SCADA system. Each wind turbine has a control box at the top containing a PLC, power converter, control boards and I/O device. Sensors for wind speed, wind direction, shaft rotation speed and numerous other factors collect and transfer data to the PLC. By detecting the direction of the wind, the control system can use a motorized yaw gear to turn the entire turbine in the proper direction for maximum power generation.

All turbines are connected to a Local Area Network (LAN), with each wind tower's control box using Ethernet to link to the base of the tower where there is a fiber-based, redundant ring LAN connection. The LAN is connected to a remote control station running a control system that



BUSINESS OBJECTIVE

- Monitor and control of wind farms installed across the US, from one location
- Manage a big data system
- Scalable at high growth rate

manages and collects data, adjusts turbine settings and provides intelligent alarm, troubleshooting and reporting capabilities via the central facility.

The National Control Center has a powerful SCADA system supplied by PcVue that acts as a 'nerve center' for all of the wind farms. It connects to this central control room the individual turbines, substations, meteorological stations, bird/bat avian radar and other surveillance systems for preserving wildlife. It provides visibility for the operator to supervise the behavior of all the wind turbines in all of the wind farms. By keeping a record of activity on a time-interval basis, the SCADA allows the operator to determine what adjustments and corrective action, if any, need to be taken. It also records energy output, availability and error signals. It offers the capability to implement any compliance requirements and to control (among other matters) the power factor, voltage and reactive power production. This is to manage the wind farms' contributions to network voltage and frequency control. It also enables operators to manage power output based on real-time grid requirements.

The SCADA communicates with the turbines via a communications network that uses optical fiber for almost all its links. Iberdrola Renewables uses turbines of various types and each turbine supplier provides their own control/HMI system. The major advantages of using PcVue as the main SCADA system are that it is neutral to turbine suppliers and is not tied to any one PLC vendor so it can be free to provide data reporting and analysis formats irrespective of turbine type.

PcVue is one of the few SCADA providers on the market that is not owned by a PLC provider and is able to invest wholly in its core competency, which is about robust, high performance SCADA systems. This was of particular importance to Iberdrola who have wind farm operators using many turbine types and a myriad of PLC types. The Iberdrola team also really liked how PcVue is user-friendly and easy to configure. Its ability to iconize animated mimics and use pop-up windows reduced the risk of overlaying crucial information and helped to simplify the SCADA view. Also, the creation of templates for contents and behavior ensures consistency of all animations in mimics. Iberdrola uses multi-level access rights and menus associated with each user to ensure that navigation within the application is tailored to the needs and permissions of

each individual. This ensures a layer of security, traceability and control for users' actions.

Iberdrola Renewables has been in the global energy business since 2000. In the past with a small number of wind turbines transmitting energy into the grid, the process of entry to the industry was fairly easy. Currently, congestion has become a large issue with wind energy suppliers balancing energy production with available inputs for transmission. Requirements are quite strict, thus Iberdrola has designed an integrated system using curtailment via set-points to manage the generation profile on a real-time basis. They are working towards a more scalable system to suit the next generation of renewable energy markets.

According to the Managing Director, Head of Operations Services – Wind Operations for Iberdrola Renewables in Portland, Oregon, *"we are installing wind turbines to operate in harmony with other sources such as nuclear power, solar, hydro and other energy in a netting arrangement to optimize performance. We are on the cutting edge."* To manage their growing business, Iberdrola Renewables has developed fiber optic networks on their wind farms in the U.S. along with the National Control Center that is a state of the art facility located in Portland, Oregon.

PcVue's centralized configuration provides the capabilities for management and traceability of the various application versions and changes. It also supports automatic updating of the stations that make up the supervisory system. At each start-up of a station on the network, PcVue automatically runs consistency checks of the application versions in use. Without geographical limitations, the Operation Center has a global potential to supply energy management services to any owner of such facilities. The facilities in the U.S. are currently producing 3,600 megawatts of wind power across 50 independent power plants. Iberdrola maintains 2,479 wind turbines. Each wind turbine supplies about 300 to 350 data points, which equates to approximately 700,000 to 850,000 I/O data points on more than 22 servers. To cope with the diverse demands of maintaining Iberdrola's wind farms, the PcVue application's alarms are highly configurable. Alarm messages may be printed, viewed in alarm lists and archived. Operators configure the behavior of alarms by using groups, filters, sorting, acknowledgement and masking. They also create alarm counters and associate specific actions with



MAIN TECHNICAL FEATURES

- 1,000,000 I/Os
- 2479 WTGs
- 50 wind farms
- 3600 Megawatts
- 22 redundant PcVue servers

KEYS TO SUCCESS

- Robust and reliable architecture which is easy to extend to new wind farms
- Scalable to hundreds of thousands of tags accessible from multiple clients 3500 Megawatts
- Open system allowing easy integration with other automation technology

any alarm. Alarms can be acknowledged by operators directly from mimics and those actions can be broadcast automatically to all nodes on the network.

Iberdrola Renewables is using OPC as the communications protocol, along with other protocols, to pull data from the various PLCs. Wind farm applications often use OPC™ and the KEPServerEX™ driver to communicate seamlessly with diverse systems. Iberdrola uses PcVue's OPC Data Access Client and the OPC DA XML Client for exchange of real-time data with communication servers, plus the OPC DA Server to facilitate data exchange with third party applications.

All of the data acquisition that occurs is routed back to the National Control Center. The development team at the National Control Center in Oregon found the PcVue Solution to be reliable, scalable and easy to configure. CORE had been kept up and running very successfully. PcVue provides a single user view that allows an easy visual display and overall management of the myriad systems in place from the PLC, HMI and control system equipped on the turbines. According to the Managing Director of the Control Center. *"As we monitor avian migration and weather in addition to controlling and managing our turbines, we needed a system that would provide a simple, easy to read GUI so that we can react at a moment's notice."*

The new PcVue SCADA software integrates and connects with the wind turbines via the PcVue-GUI interface acting as a light client to the PcVue application and managing up to 2.5 million data elements. This configuration provides the operator with all required information about the turbine signals. Iberdrola Renewables is utilizing this distributed client-server architecture with a redundancy mechanism to ensure that the design is fault tolerant. Using PcVue's built-in redundancy features, Iberdrola Renewables is able

to ensure continuity of data collection in the event of failure of a system component. PcVue also supports dual networks both for communication with field equipment and among PcVue stations.

Each component and each station in the configuration has a validity status to enable the operators to view the condition of the system in real time. These client stations are communicating via OPC with the redundant communication front ends connected to the 1,000 Mbps TCP/IP Ethernet network. Each front-end is able to receive up to 100,000 I/Os. Using the PcVue architecture, operators can see in depth details of the data from the remote wind farms in a real-time status display. The supervision is arranged on two levels to handle the large volume of information (around 350 signals per turbine) and to facilitate operation and maintenance of the facilities.

A first supervisory level provides an overview of the most relevant alarms, values and counters, which is enough to supervise the turbines in a normal situation and to detect failures that need to be corrected. A second, more detailed level of supervision is triggered on request to display selected data from the turbine so that the operators can immediately and precisely diagnose any failures that have occurred and determine remedial operations. The data received can be processed as set points, historical records, alarm management, trending and so forth. The control system in each installation collects the main operational information from the generators and their associated substation. The control system is connected to the National Control Center through a remote communication channel, which eases maintenance. The Center receives this information and processes it into an organized and simplified structure that enables easy identification and diagnosis of failures. This triggers the appropriate actions for its solution: remote reset or activation of local maintenance teams. As a result, average downtime decreases and availability is increased.

RESULTS

Solution with PcVue is remotely controlling US wind farms from the National Control Center in Portland, Oregon

PcVue has decreased average downtime and increased availability

PcVue is a complete wind farm model enabling an out-of-the-box expansion for new sites 



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