

Centralized automated control saves US\$1.5M for New Zealand's largest energy provider

After automating and centralizing control of its power plants, Meridian Energy has saved 23.5% in maintenance and staffing costs, while improving plant efficiency, reliability, and market responsiveness.

Background

Meeting approximately 30% of New Zealand's energy demand, Meridian Energy is New Zealand's largest electricity generator. It generates most of its energy from hydro power, managing nine hydroelectric plants in New Zealand's South Island: eight on the Waitaki River system and the country's largest station at Manapouri. Meridian Energy has a capacity of 2,458 megawatts and mean annual production of 12,500 Gigawatt hours.

The eight power stations in Meridian Energy's Waitaki hydro scheme are arranged in a chain, so the water can be used up to eight times to produce electricity. Water can be stored in lakes behind dams until it is needed. It is then passed from the storage lakes through canals to five power stations on the upper-Waitaki and three power stations on the mid-Waitaki. Thirty-two generators are located at these eight sites.

Challenge

Meridian Energy's key objectives were to improve efficiency and plant performance, while providing centralized control and dispatch of generation. Generating electricity from hydro power is an extremely efficient process. However, it demands a huge outlay of capital, so even small improvements in efficiency can offer significant returns. One obvious way to improve efficiency is through automated control.



Several of the power stations in Meridian Energy's hydro scheme were manned and required local manual control. Meridian Energy wanted to control and monitor each of its plants simultaneously from a remote, central location. However, remote control from a centralized control room while leaving the nine power stations unmanned is inherently risky. Any control system that is implemented had to be completely reliable.

In addition, Meridian Energy is one of a number of electricity generators vying for sales on the New Zealand Electricity Market (NZEM), also known as the "spot market." If there is a shortage of electricity anywhere in the country, suppliers such as Meridian can bid to supply the shortfall until a power station closer to the area can increase its capacity to fill the void. Suppliers that are

able to respond quickly have a competitive edge in this market and are able to benefit from each opportunity.

When there is a demand on the spot market, Meridian can ramp up very quickly to supply the additional energy required — within 10 seconds, compared with 15-20 minutes ten years ago. Upgrading and automating their 39 generators would improve their ability to capitalize on spot market opportunities even further.

Solution

Recently, Meridian Energy commenced the Automatic Remote Control (ARC) project. The purpose of the project was to automate the generators so they could be controlled reliably from a remote, central location and to overhaul each generator's governor. Project goals



were to improve efficiency by at least 1%, while reducing labor cost by eliminating the need to have each individual power station manned.

With its expertise in turbines and governor control equipment, Voith Siemens Hydro was contracted to overhaul and upgrade the governors and generator controls, some of which were 20 to 30 years old. Voith also developed the software for the generator and generator governor controls. Partnering with Voith was another company, Telegyr, (now Siemens EMIS), which provided a SCADA and application package.

Voith selected Rockwell Automation to supply the PLC system and develop the software for the water control system PLCs and local services PLCs. Meridian Energy had been using Rockwell Automation PLCs since 1989 to control generators and water gates, and expressed confidence in their reliability for an application that would involve remote control. They also believed Rockwell Automation was unsurpassed in terms of local support and service of PLC technology.

ControlNet was chosen as the communication network on each generator PLC and its associated inputs

and outputs, while Ethernet with fiber-optic cables connects the PLCs to the SCADA application. The PLCs are designed to stand alone, so if an Ethernet cable to the control room were to be cut, the PLC will continue to operate safely in its most recent state while continuing to produce electricity. All PLCs are accessible from Meridian Energy's network, which covers hundreds of kilometers of the South Island of New Zealand.

Results

The new control system has resulted in improved efficiency, superior plant performance, greater reliability, and improved market responsiveness.

Today all nine stations are controlled remotely from a central location by one person. This enables the generating plants to run unattended, eliminating the need to have shift and operating staff at each location. Maintenance and service at the stations is outsourced to provide cost efficiencies and to leverage key industry expertise.

In the past, loading a generator was done manually by operators at each location. Today, automated, remote control of each generator is provided by

an Allen Bradley PLC-5. Each PLC receives its output command from the main control room several kilometers away.

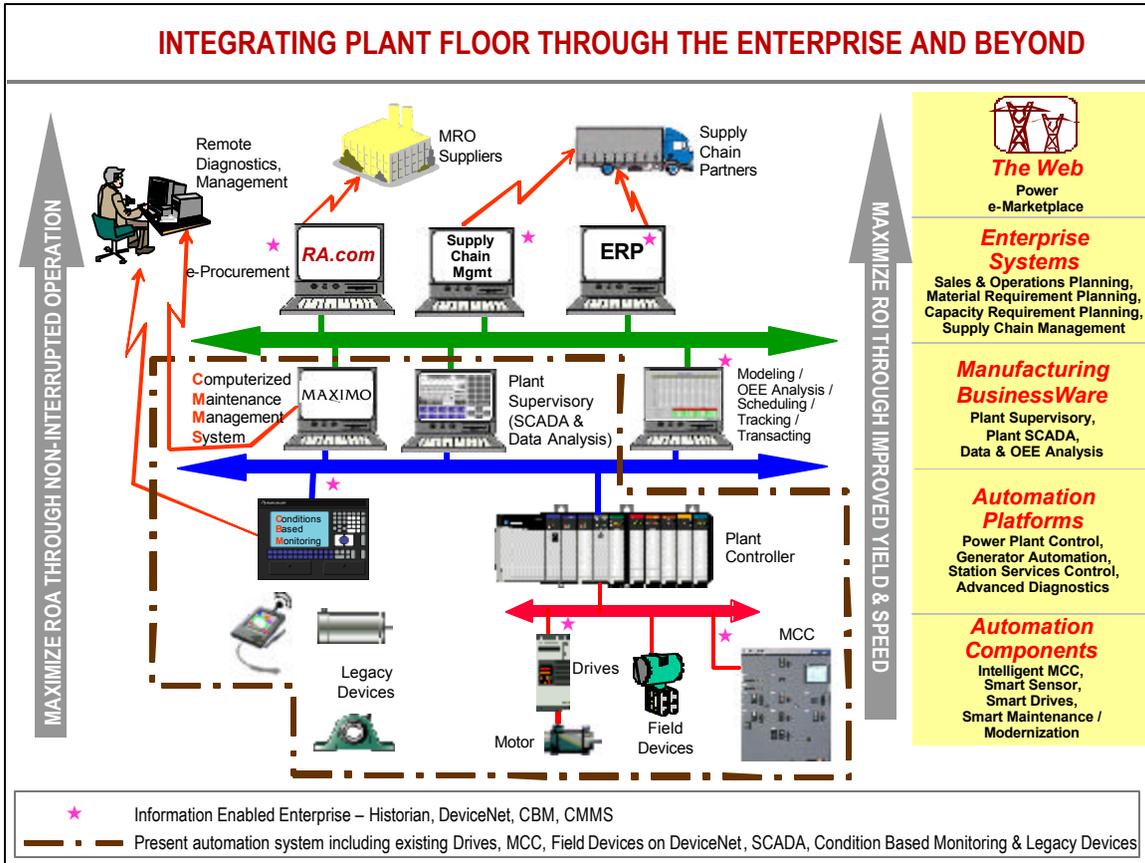
Automated control provides Meridian Energy with added flexibility in meeting spot market demands. The system automatically controls the 39 remote generators and water control stations within the entire Waitaki and Manapouri hydro schemes.

As demand levels change, the system automatically turns generators off or on while increasing or decreasing load levels as necessary. It continually makes adjustments to the entire power scheme, for example, by opening or closing gates to ensure the optimal flow of water from the storage lakes to the power stations. This ensures energy is generated as efficiently and as safely as possible while speeding response time. Operators can observe the entire process from the centralized control room.

Results of the project have exceeded Meridian Energy's expectations. By automating and centralizing control of Meridian's Waitaki hydro scheme, Meridian Energy has saved 23.5% in maintenance and staffing costs, surpassing the US\$1.5M per annum goal for the project.

The architecture on the following page depicts Rockwell Automation's concept of an Information Enabled Enterprise. The area outlined with a brown dash line represents the present automation level under discussion in this document. The remaining portion illustrates a host of solutions that Rockwell Automation can provide today to integrate the plant floor to the enterprise and beyond.

INTEGRATING PLANT FLOOR THROUGH THE ENTERPRISE AND BEYOND



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