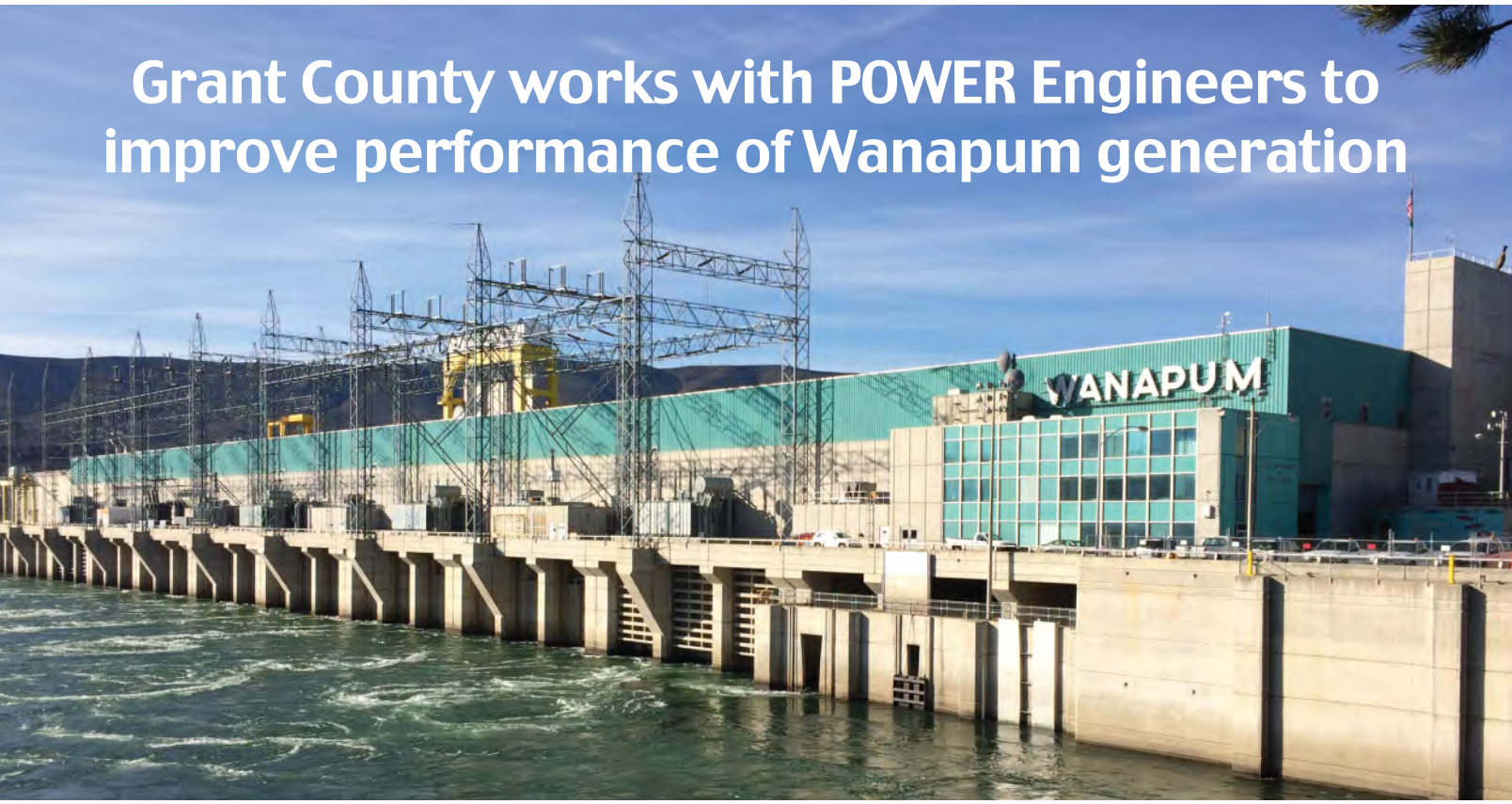
by Mark Nelson and Scott Ross

Grant County works with POWER Engineers to improve performance of Wanapum generation



Wanapum Dam's SCADA systems give operators better control over power generation equipment. Photo provided by Grant County PUD.

New control, protection, and communication systems at Wanapum Dam are giving operators better visibility of the performance of the power generation system, improving safety, dependability, and efficiency.

The Grant County Public Utility District has been working with POWER Engineers Incorporated to replace 50-year-old electromechanical relays with modern microprocessor relays, as well as installing supervisory control and data acquisition (SCADA) systems.

The new relay and SCADA systems at Wanapum Dam support the utility district's upgrading of the power generation equipment. The district is upgrading its 10 109-MVA hydroelectric generators to129 MVA, and replacing other equipment that had neared the end of its useful life. Work on the final generator is expected to be completed in 2018. The district has installed 10 new turbines to replace those that had been in operation since the dam went online in 1963.

POWER developed a master plan for the PUD that called for the relay settings to be installed as a system, and also for the SCADA to be installed as a system on each of the 10 units. With the master plan in place, the implementation and testing could take place in stages. Grant County PUD could turn on each project as it went, dramatically reducing the time and cost of commissioning.

One key to the success of the project was to create a template of the equipment data points from where the relay devices would pull information; the utility's staff could then review the templates to make sure they were getting the information they wanted.

By consolidating the templates into a list that included sequential events recorder (SER) data, the system gives the dam's operators the unique ability to see the timing of events. The master plan proved essential to organizing this high level of data. Careful planning and designing of the entire relay and SCADA systems to the PUD's standards helped make the upgrades more cost effective as well as easier to maintain.

Protective relays help safeguard the dam's electrical systems and equipment from serious damage, if a fault occurs. They also provide event reporting, including waveform capture and data on the sequence of events. Microprocessor relays help do this by providing operators much more information than the old electromechanical relays did. The new relays monitor more than 100 unique data points, where the old devices tracked about four. For example, the new relays provide resistance temperature data from 24 different alarm points on the three-story generators.

Using such data from stators, rotors, and other individual equipment, operators can run the generators much more effectively. They gain additional confidence in the accuracy of their knowledge of how the system is operating.

Redundancy in the new relays, which the old system didn't have, helps increase the reliability of the power system.

SCADA systems collect real-time data from the relays and other devices about the status of the power generation system. This makes it easier for the PUD's operators to see what is happening and in what order.

The dam's SCADA systems do more than just gather data — they give operators better control over power generation equipment. Many of the SCADA fault responses occur automatically and rapidly; however, SCADA systems allow the dam's operators to quickly review any event and adjust the system to avoid or reduce potential harmful effects of a fault. In the past, the dam's operators would have needed to manually combine readings pulled from a number of devices at individual points; SCADA systems consolidate all of the operating data in a master station that engineers like to call the human-machine interface, or HMI.

Think of the HMI as the instrument panel in your car. Instead of having to get under the hood to check for speed, engine condition, temperature, or battery status, you can just scan the display panel. The HMI performs the same function for the dam's operations. It improves operators' ability to view alarms and status information from the entire system and not just one device at a time. Additionally, the HMI remotely collects all of the relay event and SER data, making it easy to analyze and view the system in one easy-to-access location.

Because these new systems archive information, the dam's operators are able to forecast how the dam will perform under certain conditions. For example, by comparing operations during low-water years, the operators can more accurately predict generation during a similar water year.

Thorough planning meant that the Wanapum Dam operations could make the best use of all the features found in today's protection and control devices. Studying fault conditions and then thoughtfully applying and coordinating protective relays and their elements helps isolate faults and eliminate unnecessary trips.

Automation, data collection, and communication systems provide seamless protection, making the Wanapum Dam generation operations safer while also providing a highly reliable power system. NWPPA

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