

CASE STUDY

Dairyland Power Cooperative—La Crosse, Wisconsin

Multitasking Metering System Enhances Dairyland Power's Widespread Generation and Transmission Operations

Advanced, multifunction meters and wide-area IP (Internet Protocol) communications improve metering and power quality data collection at a Wisconsin power generation and transmission cooperative.

Advancements in products that leverage converging technologies have created significant opportunities throughout the power systems industry. With communications-related advancements, the right choice of solutions can extend return on investment (ROI) via expanded power system benefits. Such has been the case at Dairyland Power Cooperative (DPC), headquartered in La Crosse, Wisconsin.

In 2004 DPC, a 1,000 MW generation and transmission cooperative, was experiencing diminished service within its analog cellular-based data communications system, with the possibility of no further service beyond February 2008.

DPC provides power for 25 member cooperatives and 20 municipalities who serve over 500,000 customers. A Touchstone Energy affiliate, DPC's service area encompasses 62 counties in 4 states (Wisconsin, Minnesota, Iowa, and Illinois). The cooperative owns and operates over 3,100 miles of transmission lines and 348 substations. The cooperative produces electric power from a variety of sources, including hydro and coal-fired plants plus renewable resources, such as landfill methane recovery and animal waste-to-energy.



Figure 1—DPC produces in excess of 1,000 MW of electric power from hydro and coal-fired plants and from waste-to-energy plants using renewable resources, such as animal waste-to-energy conversion shown above and landfill methane recovery (shown below). The customer area covers 62 counties in 4 states (Wisconsin, Minnesota, Iowa, and Illinois).



Figure 2—DPC owns over 3,100 miles of transmission lines and 348 substations like the one shown in the above photograph. DPC provides electric power for 25 member cooperatives and 20 municipalities who serve over 500,000 customers. The cooperative experienced diminished service

within its analog cellular-based data communications system and upgraded to an IP communications system.

“With the imminent need to replace the old cell phone system, there was an opportunity to install a new automated telecommunications system that would provide secure collection of meter readings from all of our substations,” explains Ed West, Director of Telecommunications and Control at DPC. “At the same time, we wanted the same system to provide real-time meter data, local alarms, and a secure communications path for our AMR (automatic meter reading) members.”

The DPC staff identified a list of required capabilities for a secure communications path including:

- Substation automation information from the substation to the DPC office
- Real-time meter data for display on a Security System Operations (SSO) website
- Substation kWh meter readings every 15 minutes for billing purposes
- Automatic Meter Reading (AMR) data from the substation to the distribution cooperative office
- One system that could support the needs of both the member utilities and DPC for secure, robust, wide-area communications

In order to simplify new equipment installation in each distribution substation and minimize the amount of training required, DPC staff made decisions early in the design process including:

- Each distribution substation would have a “standard” set of equipment
- The communications cabinet would have a custom-designed enclosure
- The communications cabinet components would be assembled in the DPC facility

- The spread-spectrum radio, router, communications, protocol interface device, and high-end multifunction meter would be tested and verified by the DPC meter lab
- Remote facility monitoring would be provided with physical and cybersecurity
- A 48 Vdc battery-backed power supply must be included for all equipment
- The cabinet design must allow for modular expansion to meet the requirements of each substation
- Each completed cabinet would be taken to the substation to be installed and field verified

In December 2004, a comprehensive plan was approved for the installation of an upgraded distribution automation/telecommunications system to accomplish these goals. The project included (1) expansion of the existing digital microwave network, (2) installation of point-to-point, IP-capable spread-spectrum radios, and (3) installation of a custom-designed metering and communications cabinet to provide secure serial and IP connections for real-time billing metering data, historical data, distribution SCADA, load management, and AMR traffic.



Figure 3—Shown above is a metering and communications cabinet providing secure serial and IP connections for real-time billing metering data, distribution SCADA, load management, and AMR traffic.

Because metering was a primary goal of the project, Dairyland Power decided to evaluate a multifunctional digital meter from

Schweitzer Engineering Laboratories, Inc. (SEL). “We had used a number of SEL relays and other protection products over the years and felt very confident about their quality,” West says. “Plus, we wanted to integrate the metering equipment into a highly customized communications system, so the product features and level of SEL technical support were also important to us.”



Figure 4—The back of the SEL-734 Revenue Metering System is shown with current, voltage, serial communications, Ethernet communications, output contact, and optoisolated input connections. A total of five communications ports are available on the SEL-734 with simultaneous operation on four communications ports (not included in the model shown above).

The SEL-734 Revenue Metering System, which DPC considered for the project, offers complete instantaneous metering functionalities, including voltages, currents, power, energy, and power factor. Other capabilities, such as predictive demand, time-of-use metering, automatic voltage sag/swell monitoring, harmonics metering, and synchrophasor measurement, make this meter an exceptionally versatile system component.

“From a metering perspective, Dairyland Power wanted to do daily load profile and interval-by-interval metering of their delivery points for billing purposes,” explains Dick Martin, Product Manager of SEL’s Meter Systems Division. “They also

wanted to provide real-time monitoring of energy—the amount of power being delivered—for both generation and transmission purposes and to make that information available on a distribution SCADA system to their members. As a multifunction device, the SEL-734 Revenue Meter is very well suited to all of those needs.”



Figure 5—The SEL-734 provides programmable logic to combine meter quantities, contact inputs, remote command inputs, and timers to control meter calculations, internal logic, and contact outputs. The meter is compliant with the following standards: ISO 9001:2000, CAN/CSA Certification C22.2, IEC Safety Standard 61010-04-1:2001-1:2004 2nd edition, and CE:Mark-EMC Directive, Low-Voltage Directive.

Billing data are collected from the meters by a master station system running Itron’s latest MV-90xi meter-reading software, which has the ability to query devices over a wide area network (WAN). At the same time, via the meter’s DNP3 protocol capability, Dairyland is using its distribution SCADA system to poll the meters for real-time operational data.

Otherwise, this remote function would typically be done by installing RTUs costing \$3,000–\$5,000 (for models suitable for this application). “Historically, the sensors on RTUs required dc input,” says Martin. “That usually meant incorporating ac-to-dc transducers that require annual calibration, which can be a maintenance nightmare. However, because the SEL-734 Revenue Meter communicates via DNP3 protocol, it is compatible with SCADA just as if it were an RTU—without the maintenance costs and headaches.”

“Another factor that drove the scheme was that the meters Dairyland Power was using

before had room for improvement,” says Ken Graves, the utility’s Manager of Telecommunications Services. “Based on Schweitzer’s reputation, we felt confident that the SEL-734 Revenue Meter would provide us with a good, workable solution. Also, because we were fabricating our own panels, we wanted a panel-mounted meter for our transmission environment. The SEL-734 met our requirements nicely, rather than the standard round, socket-based meter. So, there was interest in the SEL-734 from the transmission side of our business. Plus, using a high-end, panel-mounted meter allowed us to use the same meter to meet our distribution metering needs.”

The SEL-734 Revenue Meter’s power quality monitoring capability is another feature that is significant to DPC. The utility wants to make certain that the power it delivers to customers is within its high-quality parameters, and if there are any issues, they have the information they need to quickly solve the problem.

“This metering device is very feature-rich for an affordable price,” Martin says, “when you consider that capabilities like power quality monitoring and instantaneous synchrophasor measurements are usually collected with expensive single-purpose devices that can cost from \$25,000 to \$50,000.”

“Dairyland Power selected the SEL-734 because it provides very high-accuracy energy metering, load profile data collection, instantaneous power measurements, power quality monitoring, and

communicates simultaneously over a modem, serial ports, and wide area networks (WAN),” Martin explains. “The meter is backed with a ten-year, no-questions-asked warranty and SEL’s network of factory and field support engineers.”

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About Dairyland Power Cooperative

Headquartered in La Crosse, WI, Dairyland Power Cooperative provides wholesale power for 25 member cooperatives and 20 municipalities who serve over 500,000 customers in 62 counties in the 4 states of Wisconsin, Minnesota, Iowa, and Illinois. Dairyland owns and operates over 1,000 MW of generation, over 3,100 miles of transmission lines, and 348 substations. For more information, contact Dairyland Power Cooperative, P.O. Box 817, La Crosse, WI 54602; phone: (608) 788-4000; fax: (608) 787-1475; email: info@dairynet.com; or visit the website: www.dairynet.com/.

About SEL

Schweitzer Engineering Laboratories, Inc. (SEL) has been making electric power safer, more reliable, and more economical since 1984. This ISO 9001:2000-certified company serves the electric power industry worldwide through the design, manufacture, supply, and support of products and services for power system protection, control, and monitoring. For more information, contact SEL, 2350 NE Hopkins Court, Pullman, WA 99163-5603; phone: (509) 332-1890; fax: (509) 332-7990; email: info@selinc.com; website: www.selinc.com.

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SCHWEITZER ENGINEERING LABORATORIES, INC.

2350 NE Hopkins Court • Pullman, WA 99163-5603 USA

Tel: +1.509.332.1890 • Fax: +1.509.332.7990

www.selinc.com • www.selindustrial.com

Email: marketing@selindustrial.com

