

TEN SMART APPLICATIONS YOU CAN EMPLOY TODAY WITH YOUR EXISTING METERS

By Eddie Schweitzer, research and development manager, metering department, Schweitzer Engineering Laboratories

THE U.S. and other governments are promoting smart grid development with funds to update power system monitoring and control equipment. This is a good time to consider upgrading residential and light-commercial meters to take advantage of this support. However, most utilities have already invested in smart monitoring and control devices for generation, transmission, and distribution systems.

So, what can you do today to make your grid smarter with the advanced meters that you already own? Below are ten methods that you can easily employ to improve the efficiency, reliability, communications, and control of your electrical system with little to no additional investment.

1. Connect the meter to a communications processor or remote terminal unit (RTU). Most power generation stations, as well as distribution and transmission substations, include communications processors and RTUs connected to their SCADA system. Advanced meters in these installations may be solely connected to a telephone or serial line for weekly or monthly billing reports. In addition to reporting billing data, an advanced meter is an excellent, high-accuracy transducer that can report data, including voltage, current, four-quadrant VAR flow, average demand, power factor, and harmonics. When connected to a communications processor or RTU, the SCADA system can readily poll the meter for these values using Modbus®, DNP3, or a proprietary protocol. Many times, connecting a simple serial cable between the two devices enables SCADA reporting. For example, a substation with an SEL-2032 Communications Processor can report high-accuracy billing data from an SEL-734 Advanced Metering System by adding just one serial cable. The communications processor will automatically recognise the new device, and new data points are instantaneously available. These data can give the SCADA system a more detailed and accurate picture of the power system's state, enabling more advanced control and automation.

2. Enable event reporting. Advanced meters report and time-stamp power system disturbances, such as voltage sags, three-



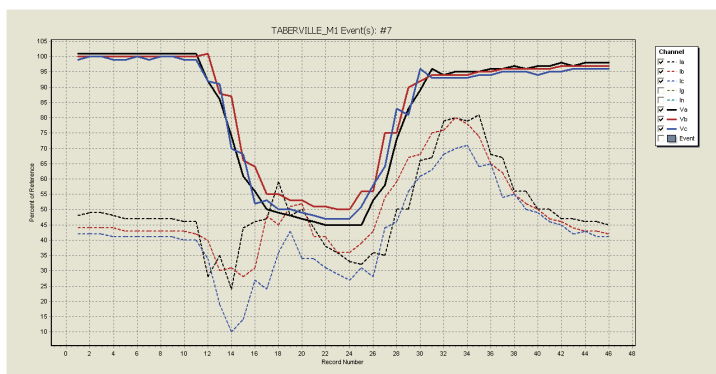
SEL-734 Advanced Metering Systems and the SEL-2032 Communications Processor.

phase unbalance, and system faults. These reports provide a simple, chronological summary of when a disturbance occurred and how long it lasted. Event reporting can even record when an enclosure door is opened, settings are changed, or the demand register is reset. Many end users require notification of these types of disturbances or security breaches. A text report is the simplest way to communicate this information to your customers.

3. Accurately time-stamp data. Some advanced meters include an IRIG-B input for precision time stamps. These time stamps allow post-event time alignment to the millisecond across an entire electrical system. Did the fault at the end of the feeder actually cause a 30-second outage at a plant 20 kilometers away? Precision time stamps help answer this question. They also help consumers decrease peak demand charges by incorporating demand shifting or peak shaving at precisely the right time.

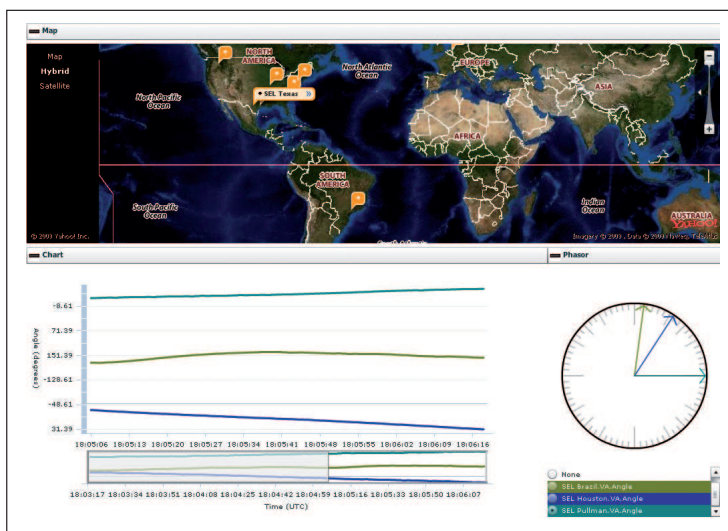
4. Retrieve and analyse waveform event data. Advanced meters capture high-resolution waveform data for post-event analysis of system disturbances. They constantly sample voltage and current magnitudes and phase angles at rates of thousands of cycles per second. During an event, a meter can store these data to nonvolatile memory and automatically report to a data collection system. If a disturbance occurs, the data collection system notifies the engineer, who can quickly analyse the high-resolution waveform data to determine exactly what happened. Tools that accelerate analyses include event playback, phase rotation analysis, harmonic analysis, and undervoltage reporting. Engineers can also use these reports to improve future system reliability.

5. Enable and monitor voltage sag/swell/interruption (VSSI) data. Voltage sag is one of the most common power quality disturbances. If the supply voltage sags low or long enough, critical loads will shut down. Report these data using the CBEMA/ITIC format for a very simple summary of voltage disturbances, their frequency, and their likelihood of causing equipment damage or outages. These data are also useful for settling customer disputes. Did a voltage sag this morning shut off a critical refining process? Did a voltage swell last Thursday damage a variable-frequency drive? Plotting the load current and voltage in an SEL-734 VSSI report can quickly tell you whether the load or the source induced the disturbance. A current swell followed by a drop in voltage indicates that the load caused a sag, whereas a voltage swell followed by a current sag indicates that the problem originated from the source.



VSSI report—the simplest power quality report.

6. Report consumption data to your customers. By publishing a webpage of the data sent through a SCADA system, you can show power draw, demand trends, energy usage, and power quality disturbances. In turn, your customers can use these data to curb peak demands through peak shaving or to start and stop machines. They can even reduce energy usage by pinpointing the largest consumers and optimising their energy consumption. A factory owner may learn that the largest load is an HVAC system with a stuck baffle, or that a conveyor belt can be turned off at night. A simple webpage can give large customers a view into their power system that they have never seen, or thought of, before.



Synchronized phasor measurement provides a system-wide picture.

7. Monitor voltage and current phase angles across your entire power system. Synchronized phasor measurements, standard in SEL meters, provide a much more comprehensive level of system state awareness for today's utilities. Combined with a precision time source, SEL meters report voltage and current phase angles, time-tagged to the microsecond. With synchrophasor reporting, a onetime poll across the network can confirm that each SEL meter is wired correctly. The list of applications just keeps growing as you consider system-wide power flow and stability analysis, maximum power distribution, synchronisation of rotating machinery across a power system, emergency load shedding, event prediction, post-disturbance analysis, and more.



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ABOUT THE COMPANY:

SEL serves the electric power industry worldwide through the design, manufacture, supply, and support of products and services for power system protection, monitoring, control, automation, and metering. SEL offers unmatched local technical support, a worldwide, ten-year product warranty, and a commitment to making electric power safer, more reliable, and more economical. More information is available at www.selinc.com

8. Educate homeowners and businesses about energy usage. A portable meter preprogrammed to display the yearly cost of energy usage is an excellent education tool. With a portable meter, a utility representative can visit business owners and demonstrate the advantages of employing power-saving devices as well as check for power quality issues, such as low power factor, high harmonic loading, flicker, load unbalance, voltage interruptions, and transformer heating. An annual visit reduces the need for business owners to monitor their own power systems and gives the electric power provider an opportunity to audit a customer's site. Place one of these meters in the utility's corporate lobby so homeowners can plug in their household devices to understand how much they really cost to operate. A preprogrammed, portable meter can help a homeowner figure out if it makes more sense to buy new \$10 LED light bulbs or \$3 compact fluorescent bulbs.

9. Use the meter as a controller. Meters like the SEL-734 can react in less than 100 milliseconds to any system disturbance. Built-in programmable logic enables you to configure an advanced meter for simple protection, VAR-based capacitor bank control, feeder automation, and switchgear control. Do you want to trip off a motor when voltage unbalance and current draw are too great? How about switching in a capacitor bank based on VAR loading, but only when harmonic levels are low to prevent inciting a resonant frequency on the power system? With an

SEL-734, you can standardise on one device for metering, control, automation, and simple protection.

10. Increase accountability for system losses. Many advanced meters can compensate for transformer and transmission line losses. In some cases, losses of up to 10 percent would not be recorded without this feature. If placing a meter at a power substation is impractical, the meter can add or subtract transformer and line loss values from the revenue data. For example, when installing a revenue meter at a steel mill service entrance is restricted because of limited physical access to the property, a utility can place the meter on a distribution pole close to the mill. The billing data will still reflect transformer and line losses.

Implementing just a few of these smart applications can significantly increase situational awareness of your power system and improve customer satisfaction. Most of these suggestions require little or no additional equipment and minimal

time to employ. Incentives for smart grid initiatives may vary, but long-term improvements only require simple, cost-effective solutions with existing advanced metering technology. If your power system does not already include advanced metering, you can add just a few metering points to significantly increase the real-time picture of your system without spending hundreds of thousands of dollars. ■

Smart Metering for Today's Generation

When wind turbines and solar panels stop generating power because of weather changes, backup coal- or gas-based generation may not start in time to prevent a system-wide brownout.

Advanced metering solutions from Schweitzer Engineering Laboratories send real-time generation data, predict high peak demand, calculate synchrophasor measurements, and control station equipment. Combined with real-time weather reporting, SEL meters help ensure backup generation is ready. Visit www.selinc.com/3mi to learn more.



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