
By Paul Mertes, CircuitMeter

Tens of billions of dollars in electrical energy expenditures are wasted every year in the commercial and industrial sectors of North America. The larger and the more complex the facility or building, the more likely energy will be wasted. Fortunately, advances have recently been made in the world of electricity metering and energy management information systems to help industrial and commercial energy users analyze their consumption and reduce their costs.

In the past, the world of electrical metering was not able to provide technology to measure and communicate detailed operating data to those responsible for energy management in an economic manner. Traditional metering provides monthly energy consumption and peak demand information so that utilities can accurately bill clients at the building or facility level. This approach is about total consumption and billing, not about providing data to facility managers to monitor, analyze and minimize energy consumption and cost. Real time metering and energy management technology have not been introduced until recently because this type of state-of-the-art technology was far too expensive. Metering at this level of detail in an economic fashion is a new concept as is the opportunity to analyze more detailed and granular data.

In the last two years, sophisticated metering technology has been introduced into the market that dramatically improves the economics of gathering detailed electricity consumption data and increases the analytical power of facility/portfolio energy management systems. This new combination of technologies is based on patent pending submeter design and cloud based, enterprise software with a cost structure that is a fraction of that of previous meters. The software is designed to provide very high speed analytics that allow users to analyze tens of millions of data points in less than one second and forms the basis of energy monitoring systems for building complexes and industrial facilities.

This new metering and communications technology can address complex issues faced by commercial and industrial energy users and can identify energy waste in a number of categories. One category relates to basic errors in control system programming and errors in maintenance and servicing procedures. Examples include:

- Heaters operating when not required (e.g. ambient outdoor with indoor air conditioning system operating): energy metering and management software detects this condition and alerts management through emails sent to personnel.
- Underground parking lot ramp snowmelt systems found to be operating in the summer months: energy software identifies the incorrect control system settings and sends emails to relevant personnel if the system becomes operational during the summer months.
- Exhaust fans operate 24 hours a day while related equipment was powered off from midnight to 6 AM when the facility was non-operational: software highlights inconsistent control settings as a flag to facility maintenance users responsible for energy management.
- Rooftop air handling units intended for air conditioning operation in a commercial retail facility found operating in the winter months: software detects this condition and management is made aware of the need to correct and shut down for remainder of the season.
Another area where energy efficiency can be improved is through continuous measurement and systematic feedback to facility users. Employee engagement and conservation behaviour programs have great potential if energy measurement and regular feedback is available by reducing powering down of systems in off hours and times of dis-use. The same information can be used to identify candidates for automated shutdown. Examples include:

- Employees are given weekly feedback of total energy use per floor, or sub floor operating areas, in graphic form: with team meetings and employee engagement programs, targets can be set for energy reduction and action plans can be identified e.g. turning off computers, lights, etc.
- Employees in industrial environments are given weekly feedback on the use of machine specific energy usage and engaged in the identification of areas of opportunity to reduce unnecessary power consumption: shutting down machines properly at end of shift and at the end of the work week can be a potentially significant area of energy savings in some operating environments.
- The power factor of specific equipment can be easily monitored: areas of significant cost savings can be identified.

Real time metering can also save money through improved demand management. The ability to quantify the make-up of each component of a facility’s peak demand at the individual system level can lead to the insight that will identify the most cost effective and least disruptive opportunities to reduce demand during periods identified as times of peak generation. Targeted reductions by end users can lead to cost savings and contribute to provincial and regional demand reduction objectives. Granular historical analyses can generate detailed information about CO2 production figures and provide insight into the effectiveness of CO2 abatement strategies. This aspect is significant because cap and trade policies are being implemented in Ontario Canada.

These changes in metering technology are occurring at a time when Ontario’s government is pursuing a “conservation first” strategy in the electricity sector that includes a demand response component. This strategy emphasizes the role of the province’s local distribution companies (LDCs). Ontario has more than 70 LDCs, ranging from Hydro One with more than one million customers, to local companies like Hydro 2000, serving just over 1,000. Through an enhanced focus on teamwork, LDCs can better tailor conservation planning to the needs of their local communities and the larger region. Under the “conservation first” strategy, Ontario’s LDCs are collectively responsible for planning cost effective ways to reduce seven terawatt-hours (TWh) of electricity consumption by December 31, 2020, with individual targets assigned to each distributor. In addition, the Ontario government, through the Independent Electricity System Operator (IESO), provides financial assistance to encourage private sector companies to invest in innovative process changes and equipment retrofits to reduce electricity consumption and to become more competitive by positively impacting their bottom line.

The ability to measure and analyze at the circuit level in real time is being described by one firm under a new term known as “Forensic Energy Management™”, which carries with it the implication that line by line detailed information can lead to an entirely new scope of energy conservation opportunity than was previously unavailable.

Measuring the energy consumption at the circuit level is a necessary first step in identifying specific targets for conservation. Sophisticated metering technology can enable energy users to drive down their energy costs by identifying energy waste, operational anomalies and off-spec behaviour of equipment through software available to users over the internet. This system is usually provided for a monthly fee and
available to an unlimited number of approved users on an enterprise basis, with no extra charges for system upgrades.

This proprietary, ultra-low cost energy analytics software solution is delivered through a cloud-based service that provides remote monitoring capabilities with historical and real-time data for all electrical equipment within any type of building or facility. A single meter is able to capture 36 metering points, in real time, with data sent to the user every 2 seconds. The affordability enables facility managers to capture the energy usage data from every circuit in an electrical panel or motor control centre.

One path forward for adopters of this new energy conservation technology is the use of pilot projects prior to full scale implementation across a full portfolio. The overriding objective of the pilot project evaluation is to become comfortable with the use of the system, the system economics, and the scope for value creation. Pilot projects can provide answers to the following key questions:

- Does the program have the potential to deliver meaningful and cost-effective energy and demand savings across other regions and end uses?
- Does the technology meet the needs of participants and will the technology likely be effective for other members of the targeted participant group?
- Has the program been effective in identifying unique energy efficiency opportunities within participating organizations that would have otherwise likely remained as lost opportunities?
- Are there improvements that can be made to the program, technology, delivery strategy, educational materials or other components that would further the degrees of success?
- What barriers to program participation has the pilot overcome and which additional barriers remain that must be must be addressed prior to full scale roll-out?

With this new metering and energy management technology, the opportunity now exists to reduce huge amounts of wasted electrical energy, improve equipment maintenance and introduce a new era in energy conservation and demand management that will benefit not only commercial and industrial energy users but also governments and consumers through cost reduction.

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