PP40010982

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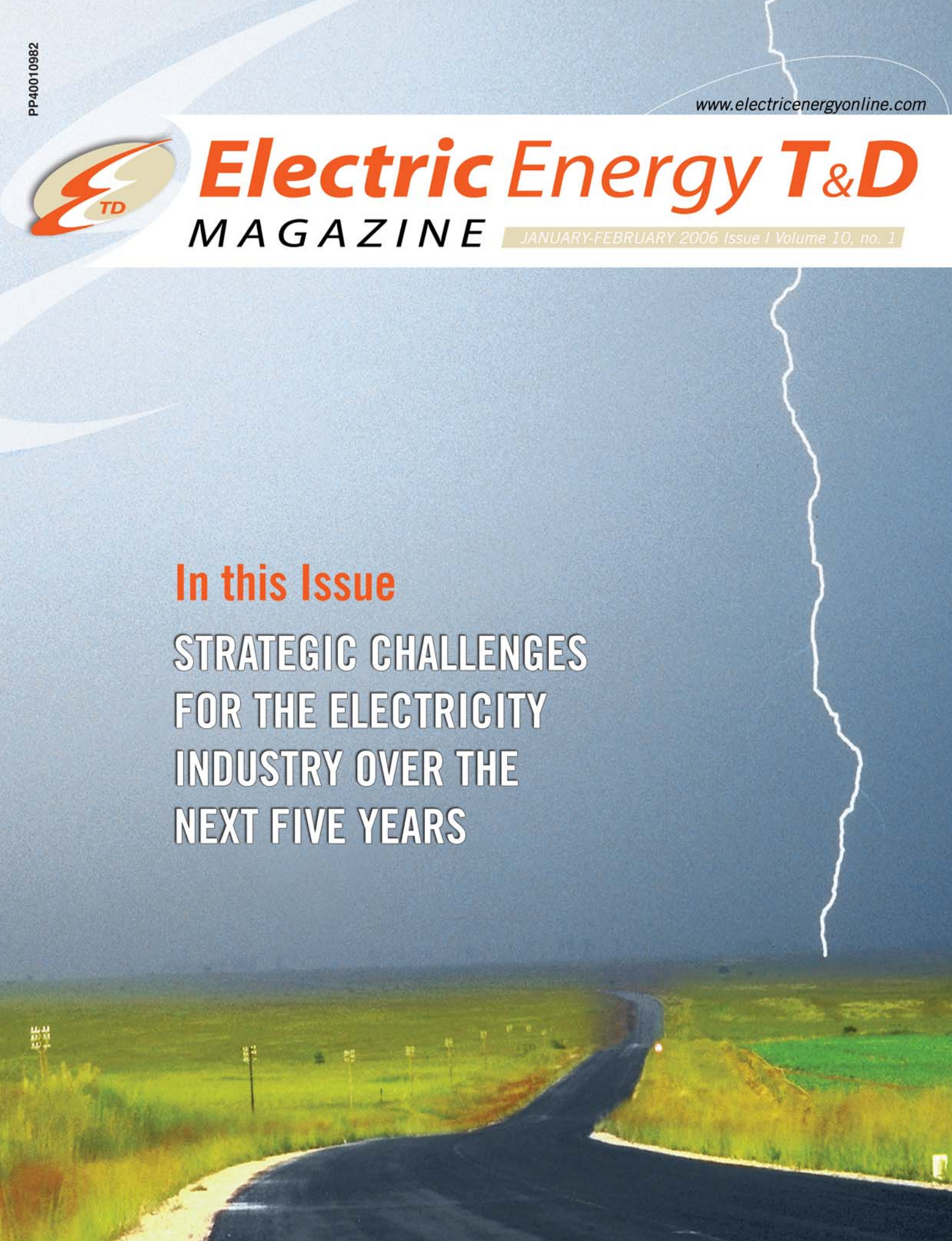
Electric Energy T&D MAGAZINE

JANUARY-FEBRUARY 2006 Issue I Volume 10, no. 1

In this Issue

STRATEGIC CHALLENGES FOR THE ELECTRICITY INDUSTRY OVER THE NEXT FIVE YEARS



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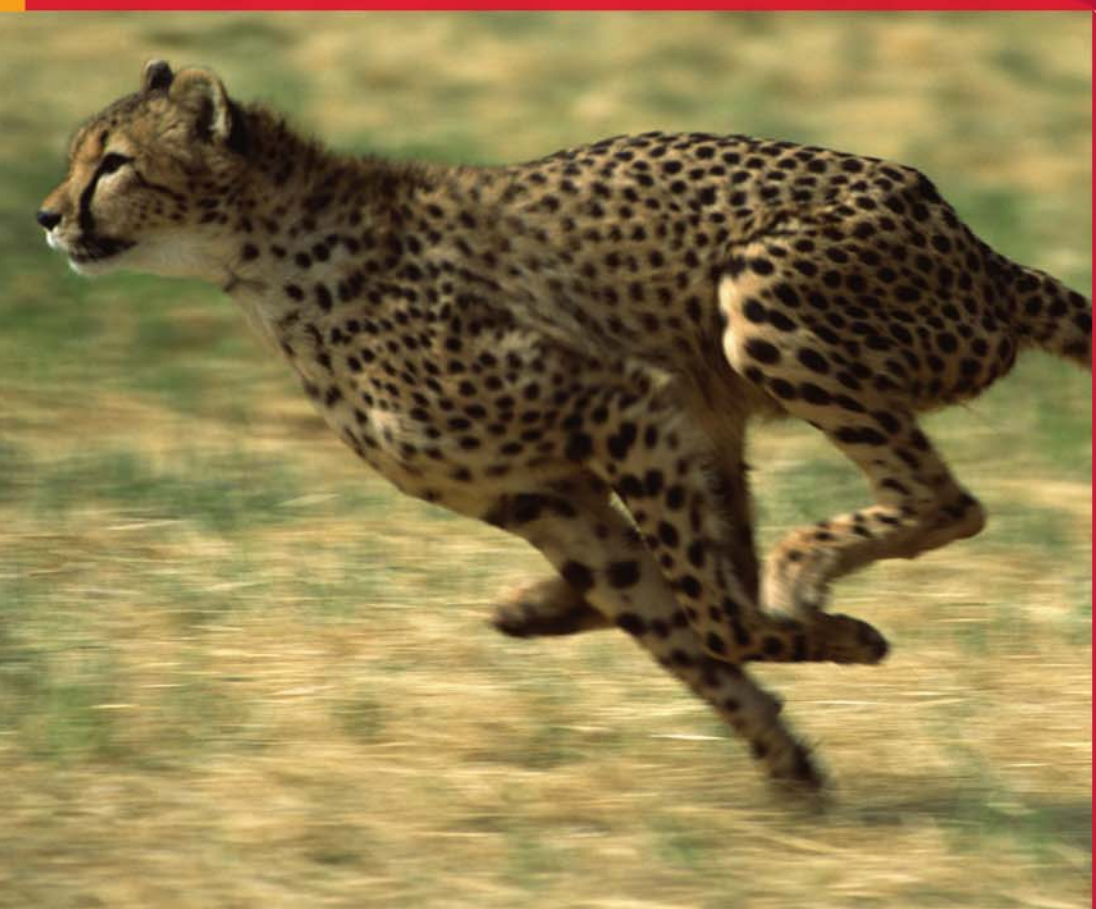

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Electric Energy Magazine is published 6 times a year by: Jaguar Media Inc.

1160 Levis, Suite 100, Lachenaie, QC Canada J6W 5S6
Tel.: (888) 332-3749 • Fax: (888) 243-4562
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Post Publication agreement number 40010982

Please return undeliverable mail to:
Jaguar Media
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COVER PAGE PHOTO: **www.photos.com**

Electric Energy T&D MAGAZINE

IN THIS ISSUE

The CEA Environmental Commitment and Responsibility Program: Trust, Performance, Accountability

By: Francis Bradley, Vice-President, Canadian Electricity Association, bradley@canelect.ca

Improving environmental management and performance across the industry and nurturing a healthy environment are the main ideas behind the Environmental Commitment and Responsibility (ECR) Program, established in 1997 by the members of the Canadian Electricity Association, and a condition of CEA membership. Through a Public Advisory Panel, an independent verification process and annual reporting, the Program aims to enhance environmental consciousness and responsibility into the daily activities of each member company.

ECR Program Principles

1) To be more efficient in our use of resources and to promote energy efficiency to our customers.

2) To manage the adverse environmental impact of our business.

3) To be accountable to our constituents and transparent in our operations.

4) To ensure that our employees understand the environmental implications of their actions and have the knowledge and skills to make the right decisions.

A New Business Environment

The Canadian electricity industry today looks very different than it did when the ECR Program was established nine years ago. Deregulation has introduced competition in some regions of the country. Segregation of operations has led to the establishment of new companies and a complex matrix of electricity generation, distribution, transmission and service entities. Aging infrastructure coupled with increasing demand for electricity will lead to a crisis of supply in some areas of the country. Regulatory uncertainties cloud the picture further by creating uncertainty and making it difficult to attract the investment necessary to meet this rising demand. Although the context has changed, the industry's main goal remains the same: to ensure Canada enjoys an affordable reliable, source of energy with minimal environmental impacts.

The electricity industry is largely achieving this goal. The Canadian electricity supply is reliable, and industry is working with governments and regulators to ensure it remains this way. Canadians enjoy some of the best electricity prices in the world, along with tools to manage their own energy consumption, and fuel choice options. To ensure rigorous pursuit of its environmental objectives, CEA is the only industry organization in Canada to require all its members to implement an ISO 14001 compliant Environmental Management System.

In this context, environmental stewardship is a greater priority than ever before. Environmental priorities do not conflict with our business priorities, but rather they line up together to provide common solutions to meeting the industry's challenges.

A Balanced Generation Mix

An efficient, reliable electricity supply is dependent on a variety of fuel sources. Traditional sources such as coal, natural gas and hydro, as well as newer alternative sources such as biodiesel and wind are all key ingredients in balancing the generation mix. The use of alternative energy sources continues to grow thanks to investments made by Canadian utilities. CEA's members are the largest and most active developers of alternative generation technologies, such as wind, small hydro, ocean energy, biomass and landfill gas.

Although alternative generation sources account for a small percentage of overall generation, the amount of alternative energy has been increasing steadily and dramatically since 1997. In 2004, an additional 287 GWh came online, representing a 30% increase over 2003.

The impacts associated with traditional generation are also being reduced though the use of new technologies and partnerships such as the Clean Coal Coalition. Both industry and governments continue to evaluate the technical potential of electricity production from coal, oil, gas, hydro, nuclear and emerging sources, such as wind to determine the role each will play in Canada's electricity future.

Reducing Emissions

Reducing harmful air emissions from electricity generation remains one of the industry's top environmental priorities. We continue strive to reduce greenhouse by pursuing technology solutions and diversifying the generation mix, while continuing to work with governments and stakeholders to outline practical strategies for meeting greenhouse gas reduction targets.

All companies are working to effectively manage emissions of air contaminants such as nitrogen oxides (NOx), sulphur dioxides (SO2) and particulate matter – common pollutants that lead to air quality issues such as acid rain and urban smog.

The sector has also been working to more effectively manage emissions of hazardous air pollutants such as mercury. The federal government is planning to develop a Canada Wide Standard for mercury in the next year, and in preparation utilities have been working to establish valid mechanisms for mercury measurement through the CEA Mercury Program: www.ceamercuryprogram.ca.

ECR Annual Report Highlights

- Investments in alternative energy continue to grow.
- Gross CO2 emissions down in 2004.
- Gross NOX and SO2 emissions down in 2004.
- Utility companies pledge $1 billion investment in energy efficiency programs.
- CEA and NRCan explore energy efficiency target for the sector.
- Utility companies emphasize the importance of stakeholder engagement in addressing environmental issues.
- Industry is making progress towards PCB elimination.
- Environmental Management Systems continue play an important role in operationalzing environmental priorities

The strategy for improving overall air quality is complex, as the reduction of each individual contaminant has implications for the broader emissions framework. For example, several mercury capture technologies already in development actually increase CO2 emissions. However, utilities are striving to find a balance and develop an integrated approach to emissions reductions. A measure of success is being achieved as in 2004 gross emissions of NOx and SO2 have both been reduced.

Managing Energy Use

Energy efficiency is a two way street in the electricity sector, as companies are both consumers and producers of electricity. The sector strives to set an example by using resources efficiently, while also providing customers with the tools necessary to manage their own electricity use.

Canadian utilities offer a wide range of programs to consumers to help them manage their own electricity use more effectively. CEA members have allocated over $1 billion dollars for the development and implementation of Demand Side Management (DSM) programs over the next several years. CEA has been working with Natural Resources Canada (NRCan) to determine the how to increase this figure and remove market barriers to DSM where they exist.

The industry is also working to improve its own energy efficiency and make the most of its own resource use. The ECR Program is currently examining the development of an energy efficiency target for the industry, in conjunction with NRCan's Canadian Industry Program for Energy Conservation.

New technology development, such as Smart Meters, help manage energy use and in the long run reduce costs for both companies and consumers. Strengthening relationships with stakeholders improves understanding of issues on both sides, and improves policy development and project planning. The development of training programs entrenches environmental policies into business practices and results in fewer accidents, improved employee health, and reduced costs.

Working Towards Effective Legislation

Agreements, such as the Memorandum of Understanding with the Department of Fisheries and Oceans, are paving the way for smart, effective legislation that both reduces investment uncertainty and protects the environment. Proactive environmental policies, programs and targets in areas such as greenhouse gas emissions reductions also provide a measure of confidence in the industry's environmental commitment, while reducing our impacts. Energy efficiency programs reduce greenhouse gas emissions while also managing electricity demand and mitigating the need for new generation capacity.

A Continued Commitment

This is why CEA members remain committed to the ECR Program. By providing a forum for discussion, the ECR Program allows utilities to share solutions across the industry, and increase transparency for our stakeholders by reporting on these activities. ■

For more information on the ECR Program or to receive a copy of the most recent report, please contact Valerie Snow at snow@canelect.ca.

IEC 61850 – A Brand New World in Substation Protection and Automation

The new international standard for substation communications, IEC 61850, allows for the development of a new generation of substation automation systems resulting in the significant reduction of overall system costs, while at the same time improving the functionality of different distributed applications.

IEC 61850 based systems provide significant advantages over conventional centralized systems used to perform the same functions in the substations, such as:

- Reduced wiring, installation, maintenance and commissioning costs
- Easy adaptation to changing substation configuration

The existing solutions in substation protection, control, measurements and recording systems are based on hardwired interfaces between the primary substation equipment – transformers, breakers, instrument transformers, etc. and the secondary protection, monitoring, control and recording devices. The interface requirements of the relays are quite different from the metering devices. As a result, they need their own instrument transformers to allow accurate metering of energy or other system parameters

IEC 61850 allows a new approach to the measurement of currents, voltages and other system parameters in substation automation systems eliminating the need for hard wiring between many primary and secondary devices in the substation. Non-conventional instrument transformers with digital interfaces based on IEC 61850-9-2 process bus eliminate some of the issues related to the conflicting requirements of protection and metering Intelligent Electronic Devices (IED)s. Analog interface units (or Merging Units) located in the substation yard interface with conventional or non-conventional instrument transformers and send the sampled current and voltage values over fiber; thus significantly reducing (actually eliminating) the copper wires between the substation primary equipment and the protection, control and measuring devices.

The Substation Configuration Language defined in the standard represents a leap in the engineering process related to any type of substation automation application. High speed peer-to-peer communications between the different devices in the substation can be used for protection, interlocking and other applications that requiring high performance, and eliminate hard-wiring as well. ●

For more information, visit:
www.areva-td.com
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Cutting Edge Technology Make SPCC Compliance Easy

Immediate Response Spill Technologies, LLC (IRST) has developed environmentally friendly products that are helping Electrical Utilities across the country reduce the cost Secondary Containment and Diversion to meet the Sill Prevention, Control and Countermeasure (SPCC) requirement mandated by Federal Regulation, 40CFR112.1. CI Agent is listed on the EPA's National Contingency Plan Product Schedule as an "Oil Solidifier" and can be used in loose powder form to solidify any type hydrocarbon spill on land or water. CI Agent turns any hydrocarbon into a cohesive rubber-like mass upon contact.

With the proposed deadline of October, 2007 fast approaching for implementation of the SPCC Plans, CI Agent Barrier Booms and Mats (estimated for over 200 yrs.) can be placed above ground in a dike arrangement or in the ground (at the depth of the subsurface), around any facility quickly and easily. The CI Agent polymers and materials allows water to pass through but becomes an impervious barrier against any migrating emergency oil or other hydrocarbon release, thus protecting the facility and the environment. CI Agent Barrier Booms and Mats are maintenance free but can easily be removed for any other type facility maintenance and then replaced. CI Agent product costs are pennies on the dollar as compared to alternative methods of retrofitting older substations with concrete walls, oil/water separators, holding ponds, etc.

This same technology can be used to design to specifications, CI Agent Hydrocarbon Flow Filters (HFF) to fit any existing gravity drains or containment walls, where water is being held or process, so as to totally eliminate the O&M costs associated with inspecting and releasing contained water.

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SUEZ ENERGY RECOGNIZED FOR COMMITMENT TO EMPOLOYEES

SUEZ Energy Resources NA of Houston recently earned recognition from international management consulting firm PI Worldwide for its commitment to employees? professional growth and ongoing success. The company is the fifth largest and fastest growing retail and electricity provider to commercial and industrial customers. The firm was honored as the 5,000th client of PI Worldwide, which uses the workplace personality survey, the Predictive Index, to help companies become more successful by focusing on their most important asset, their people. The award ceremony, which took place at SUEZ Energy?s Houston headquarters, was part of PI Worldwide?s 50th anniversary celebration. ●

At left: Rich Sweeney, president of PI Worldwide's member firm, R.H. Sweeney Associates, Muenster, congratulates Craig Sutter, vice president of sales, Suez Energy NA, Houston.

For more information, contact:
Contact: Peter Durbin, 716-549-0135
Circle 44 on Reader Service Card

Elster-AMCO Reception Aboard the RMS Queen Mary at AMRA 2005

On Monday, September 19th, guests of sister companies Elster Electricity, **AMCO Automated Systems**, and **AMCO Water Metering Systems** were welcomed aboard the legendary RMS Queen Mary. The Elster-AMCO team hosted a reception to spend time with important customers, prospects and business partners in a beautiful coastal setting. The event coincided with the AMRA International Symposium —a premier industry conference and exhibition held in Long Beach, CA.

A floating city awash in sophistication, the Queen Mary is listed on the National Register of Historic Places and remains one of the most famous ships in history. Guests meandered through the former transatlantic ocean liner, taking in the ambience of an era gone by and made their way to the stern of the ship to the

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Verandah Grill—once the night club for the ship's elite, featuring beautiful hand-painted murals, a sunken dance floor and doors opening onto the Sun Deck.

(left) Rick Minatra (Nashville Electric Service)
(center) Ron Via (Elster Electricity)
(right) Billy Deaderick (Nashville Electric Service)

An Officer of the Ship was on hand to greet guests and answer questions about the ship. A highlight of the night included the Officer lowering and raising a working lifeboat, built to hold 145 people, down the side of the ship while a captive audience looked on.

The evening had an unexpected finale with a finely choreographed lightning show. Guests gathered on the deck overlooking the glistening waters of the Pacific Ocean to gaze up at the brilliant lights dancing across the sky. ●

For more information, contact:
www.elsterelectricity.com; www.amcoas.com; www.amcowater.com
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The IP920, a Wireless Frequency Hopping IP/Serial Gateway, offering wireless communication of 345kbps at 900MHz

Microhard Systems Inc. specializes in the design and manufacture of industrial, long range wireless data equipment. We provide radio products in the 900MHz and 2.4GHz ISM bands, as well as a variety of other frequencies.

Using our robust radio design, which features excellent sensitivity and maximum output power on all of our products, we have earned a trusted name in the wireless industry. Microhard Systems Inc. serves variety of markets on both the OEM and finished product level. Our product offerings include wireless serial, Ethernet, and IO solutions. Our markets include SCADA, Telemetry, Transmission and Distribution, GPS, UAVs, Traffic Control, Robotics, Military and Defense, Fleet Tracking, Homeland Security and more.

Our newest introduction is the IP920, a Wireless Frequency Hopping IP/Serial Gateway, offering wireless communication of 345kbps at 900MHz. This Gateway features a receive sensitivity of -106dBm and 1W output power. As a complete wireless solution for integrating industrial Ethernet and Serial devices into IP/Ethernet networks, the IP920 allows Ethernet devices to share high speed wireless media and provides a wireless gateway for network applications to access serial devices. It supports a full range of Ethernet protocols such as TCP, IP, ARP, DCHP server/client, HTTP, UDP, ICMP.

The IP920 features flexible maintenance utilities and network management facilities and wireless firmware upgrades. Network support and administration is done through remote Web

Browser, FTP, telnet or SNMP (V1, V2, and V3). This makes the IP920 remotely accessible and configurable from any where in the world!

Data is secure to two levels of encryption, the first level is 128WEP encryption and the second level is a baseband-128 bit encryption algorithm and dynamic hopping keys.

The IP920 not just a bridge - It is a Serial and Ethernet gateway. In addition to the Ethernet ports – the IP920 supports two serial ports with RS232/485/422 and user selectable hardware flow control. The serial configuration supports a TCP server, TCP Client, and Virtual COM port. The IP920 provides both simultaneous Serial port and Ethernet wireless communications in Point to Point, Point to Multipoint, Repeater, and Peer-to-Peer modes of operation. The IP920 is also available in an OEM version.●

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FISO TECHNOLOGIES INTRODUCES A COST-EFFECTIVE FIBER OPTIC TEMPERATURE MONITORING SYSTEM ACCESSIBLE TO LOWER RATING TRANSFORMERS

FISO Technologies, a subsidiary of Roctest Ltd (TSX:RTT) and a leading manufacturer of high-quality fiber optic sensors and measurement systems for challenging applications, introduces the new Nortech TT. This simplified and cost-effective solution is now accessible for hot spot monitoring of lower rating Generation, Transmission and Distribution transformers.

The Nortech TT responds to the needs of direct and accurate temperature measurement associated to monitoring and maintenance of small and medium transformers. Electrical Utilities targeted by this product, now have access to a reliable and cost effective fiber optic hot spot temperature monitoring system entirely dedicated to their needs ranging from transformer design and validation, safe loading and/or overloading which consequently has a positive turnaround on operation and maintenance costs.

This new signal conditioner, designed for direct and real time measurement of hot spot monitoring in lower rating transformers, is intended for Electrical Utilities concerned about safety and reliable operation of their high voltage equipment. The multi-channel Nortech TT is available with or without display. Equipped with RS-232 and RS-485 ports, the Nortech TT offers MODBUS (ASCII, RTU) communication designed for easy integration to existing substation platforms. The use of this communication protocol allows simple and customizable data acquisition integration according to specific needs.

The Nortech TT is compatible with FISO's fiber optic temperature sensors, offered and

installed worldwide for transformer temperature monitoring. FISO Technologies' Nortech TT represents a significant development and cost reduction effort to meet the electric industry's ever-growing requirements in terms of monitoring. FISO multi-point hot spot temperature measurement monitoring system's distinctive design proposes a reliable solution in applications that are hostile to traditional sensors. This product joins the reputable Nortech Sentinel solution, offered for the past 5 years, dedicated to the large power transformers. ●

For more information, contact:
Circle 47 on Reader Service Card

Sensus Installs Canadian Smart Metering Network

Cambridge and North Dumfries Hydro Inc. to Test System

Raleigh, NC – Sensus Metering Systems announced that they have installed the FlexNet™ with AMDS Connect™ Advanced Metering Infrastructure (AMI) system for Cambridge and North Dumfries Hydro Inc. (CNDHI) with the cooperation of their Canadian Distributor, KTI Limited.

CNDHI will be piloting the FlexNet system as part of their involvement with the Ontario Utilities Smart Metering (OUSM) Working Group.

The FlexNet with AMDS Connect system enables CNDHI to collect hourly interval and time-of-use metering data on electricity consumption from residential and commercial customers across their service territory. CNDHI will also be testing the two-way features of the FlexNet system by installing remote disconnect, remote load shedding and advanced in-home display devices.

"Our first concern was finding a system that was truly capable of collecting hourly interval data from our residential customers. We were also looking for a system that could support both our urban and rural customers with a simple system architecture, and that is easily expandable to cover water and potentially gas meters in the future. We believe that the FlexNet system delivers on all of these requirements without issue. We are also intrigued by the comprehensive Conservation and Demand Management (CDM) tools built into the FlexNet network." said Michael Knox, Director, Customer Information Services and Conservation for CNDHI.

The system consists of the Sensus solid-state iCon™ meter integrated with AMDS Connect (FlexNet) transceivers, the AMDS fixed network infrastructure and system software.

"We are very pleased that CNDHI has chosen the FlexNet System to meet the Government of Ontario's Smart Meter Initiative and we look forward to a long term and successful relationship with CNDHI and the opportunity of providing the FlexNet system to other Canadian utilities," comments David Herchko, VP of AMR Product & Services for Sensus.

Because the FlexNet system is a tower-based AMR network with extraordinary range, reliance on additional infrastructure, such as numerous collection points is avoided. The system has a simple, single-tier design - from meter to tower, substantially reducing infrastructure cost. Furthermore, AMDS provides a services agreement that handles installation, operation and maintenance of the network which releases the Utility from having to allocate manpower and resources to maintain the network.

The CNDHI project is one of many FlexNet deployments completed in the past few months. The Sensus/AMDS partnership was formed earlier this year to bring one of the most advanced 2-way AMR systems to the North American Utility marketplace. In this short time many utility customers have embraced the FlexNet system in their search for an AMR system that can deliver real operational savings and CDM features that reduce system load. ●

For more information, contact:
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SmartSynch

SmartSynch® Inc., serving the electric utility industry since 2000, focuses on delivering automatic meter reading (AMR) systems linked through two-way communication architecture. SmartSynch's solution enables utilities to quickly implement a cost-effective, real-time metering solution to its most important customers. The plug-and-play nature of SmartMeters provides easy installation, supporting rapid deployment schedules. In addition, the SmartMeter SystemSM is a proven, reliable solution enabling the utility to offer a host of value-added services to its commercial and industrial customers. SmartSynch presently has over twenty major U.S. utility companies as customers.

The latest wireless SmartMeter was integrated on the Elster A3 ALPHA? meter – the prototype of which was completed in February of 2002. Power supply size, life and cost were key challenges faced by the company in creating this new wireless meter. Lead Acid batteries were the original power source, but the limited life expectancy of three to five years, the relative heaviness, difficult health assessment, and costly battery replacement process were all undesirable aspects of the technology. In some instances physical leakage was also an issue.

INDUSTRY NEWS

A3 SmartMeter integrating Elster's A3 ALPHA® meter with SmartSynch's SmartMeter module

Maxwell Technologies PC10 Ultracapacitor

The company needed a power supply capable of effectively running internal components at a generally constant rate, but one that could also handle the power peaks demanded by the unit's wireless connectivity – something that sharply reduces the life of most batteries. SmartSynch also needed to find a power source able to withstand operating temperatures ranging from -40°C to +85°C, extremes of which significantly reduce the operating performance and life of batteries as well as causing degradation to their packaging.

During the company's investigation into alternative power supply options, SmartSynch discovered ultracapacitors (also called "supercapacitors" or "electrochemical double-layer capacitors") as an innovative technology for energy storage and power delivery. They came to realize that ultracapacitors would provide many benefits over the components currently in use. One of the manufacturers SmartSynch considered as a possible supplier of ultracapacitors was Maxwell Technologies - a leader in ultracapacitor technology and manufacturing. The company chose Maxwell's BOOSTCAP? PC10 ultracapacitor, based not only on the high-quality of it's components, competitive pricing, and availability due to the company's substantial production capabilities, but also because of the positive name Maxwell has in the industry.

By using Maxwell Technologies' BOOSTCAP? ultracapacitors in the SmartMeter, instead of more traditional energy sources such as Lithium Ion or Lead Acid batteries, the life expectancy of the power supply in the SmartMeter is extended to over ten years – representing a one hundred to three hundred percent improvement over lead acid batteries. The six PC10's in each unit are also lighter, smaller, and facilitate a simpler design-in process due to the components' configuration, allowing them to be mounted flat on the board. SmartSynch realized an overall cost savings of over two hundred dollars per unit – a savings that the company has been able to pass on to its customers – due to the system redesign that the use of BOOSTCAP? ultracapacitors enabled.

SmartSynch customers have provided very positive feedback on the new version of the SmartMeter, for which distribution began in early 2003. For the few hundred A3 SmartMeters in the field, customers have reported that the units are easy to install and operate, have better product integration, and the units are performing well, meeting or exceeding all expectations.

The improvements in the performance and price of the SmartMeter resulting from the migration to Maxwell Technologies' BOOSTCAP ultracapacitors is so significant that SmartSynch considers the components a key selling point of the SmartMeter. In fact, such improvements have helped make possible the signing of an exclusive distribution agreement with Itron, one of the largest energy technology companies in the United States. ●

For more information, contact:
Circle 49 on Reader Service Card

Go for the bananas!

By Michael A. Marullo, Contributing Editor

Well, it's a new year; a good time to break away from old ways and try something new. Sometimes, however, trying new things can be a little intimidating. Conventional wisdom tells us that it's always safer (and generally more comfortable) not to rock the boat by questioning established policies, processes and procedures. When we finally do summon the courage to venture outside the box (admittedly a tired cliché, but appropriate here nonetheless!), it can be quite difficult to decide how to go about causing real change. Consider this…

At one time or another, someone has probably suggested to each of us: You need to know what you don't know! (Or, at least something along those lines.) However, there is also a little known corollary to that axiom regarding not just knowing what you don't know but why you don't know it. Yet although we do many things by rote (heck, if we had to analyze everything as if we're doing it for the very first time we'd never get anything done!), there is also an argument to be made for understanding why we do things the way we do – especially when millions of dollars are involved. Maybe – just maybe – there's a better way.

Thinking about this reminded me of a behavioral research project I heard about many years ago that went something like this:

First, they put a monkey in a room housing a single banana tree. At the top of the tree was a bunch of bananas connected to an electrified wire. As soon as the monkey went after the bananas, he received a mild electric shock, and after several attempts, he finally stopped trying to get the bananas.

Then, one by one, they let additional monkeys into the room. Predictably, each immediately went for the bananas, but before getting halfway up the tree, monkey #1 yanked each newcomer down by the tail. Then, after several new monkeys had tried and failed each time they tried to get the bananas, they all finally succumbed to the reality that the tree was off limits. At this point, the original monkey was removed from the room. (Remember, he was the ONLY monkey who was ever actually shocked trying to grab the bananas!) But even after he was removed, none of the other monkeys tried to go after the bananas again, even though the protector of the bananas (aka monkey #1) was gone.

Here's where it gets really interesting. A short time later, a new monkey – one that had never been in the room before – was allowed to enter. Spying the ripe bananas, he immediately made a beeline for the tree, but each time the new monkey tried to climb the tree, he was slammed back to the ground by one of the other monkeys in the room. After several more failed attempts to win the tempting banana prize, albeit without ever being shocked, he too finally gave up the quest.

What's interesting to note here, of course, is that none of the monkeys in the room at that point had any first hand knowledge of exactly why the bananas were off limits, nor did they know what would happen if they actually got their hands on them. They just "knew" that going up that tree after the bananas was not a choice – without having a clue in the world why not! That is to say: They had a good handle on what they didn't know; they just didn't know why.

Okay, so we'd all like to think we're better than a bunch of monkeys, but I'll bet we can all identify something we learned do a certain way yet don't have any idea whatsoever why we do it that way. Before you waste any valuable time on this mental exercise, let me save you some time while also bringing this theory back into the real world of automation.

Within the first few years after starting out in this field, I had the opportunity to work on a wide range of automation projects in various market sectors including oil/gas pipelines and production; gas, electric and water/wastewater utilities; heavy rail, light rail and vehicular transportation; telecommunications networks; and discrete, batch and continuous process industries. At that time, the projects were all very different, using different hardware (there was no software then!) and employing very different technologies and operating philosophies.

Appropriately, each project within a given market sector was planned, designed, budgeted, implemented and supported on its individual merits. There was no "cross platform" technology – it was still a very proprietary world at that point – and the concept of interoperability had not yet been seriously contemplated; in fact, I'm not sure the term even existed in the automation vernacular of the day. So, everyone went along their merry way, albeit in blissful ignorance, that any of their efforts could, should or ever would be shared with their comrades on the other side of the cubicle.

However, as the years wore on, share they did. I recall one municipal water utility customer in the early 1980s that bought a SCADA system from the supplier I worked for at the time. They were quite proud of the fact that the system they purchased shared absolutely nothing with the electric utility side of the house. Although the water and electric factions sat on opposite sides of the same hallway, they might as well have been in different countries; they wanted nothing to do with one another, mainly because they were convinced that they had nothing in common.

About five years later, I came across a friend of mine at a conference who had worked for the electric side of that same utility. Inevitably, the conversation came around to the system they had purchased from us. When I asked him if the system had been changed or expanded, he told me that the whole master station had been scrapped along with that for the electric side and was being replaced by a new computer host that would talk to all of the legacy water and electric RTUs (remote terminal units) that had been purchased from disparate vendors at various times. I suppose that was the beginning of not just an evolution, but perhaps what might even be termed a revolution that brought us to where we are today.

Indeed, over the decade or so that followed, the now widely accepted concepts of COTS (commercial off-the-shelf) automation products and interoperable systems caught on, slowly at first, but eventually reaching an avalanche pace. Today, no one even contemplates buying proprietary solutions and multipurpose offerings are plentiful, often crossing vertical markets, platforms and applications. However, when it comes to planning and budgeting, most utilities are still acting like they're dealing with apples and oranges even though virtually every platform uses fundamentally the same hardware and foundation software.

For decades, users have been screaming for broader use of standards and improved interoperability. Guess what, folks; it's here! In fact, even systems with, heretofore, disparate components and applications can increasingly be procured from a single source, due in part to recently escalating merger/acquisition activity among automation/IT suppliers.

So, why then do utilities go on planning and budgeting for automation the old way, implicitly pretending that these are still isolated projects that have nothing in common with one other? Why keep trying to justify a system one year that needs the 2-way communications backbone that won't be budgeted until two years later in order to make the cost-benefits analysis work? Why not change the budgeting process to buy solutions – whatever fiscal or departmental boundaries that might cross – rather than simply buying equipment? The answer is actually quite simple, I think: Go for the bananas! (Sometimes a little shock is a good thing.) ■

About the Author

Mike Marullo has been active in the automation, controls and instrumentation field for more than 35 years and is a widely published author of numerous technical articles, industry directories and market research reports. An independent consultant since 1984, he is co-founder and Director of Research & Consulting for InfoNetrix LLC, a New Orleans-based market intelligence firm focused on Utility Automation and IT markets. Inquiries or comments about this column may be directed to Mike at MAM@InfoNetrix.com.

STRATEGIC CHALLENGES FOR THE ELECTRICITY INDUSTRY OVER THE NEXT FIVE YEARS

By Dwight Allen, Deloitte Research

What do the next five years hold for the North American electricity industry? For many industry executives, the answer is straightforward. They believe the future can be seen from here, and it isn't all that different from today. There will surely be challenges, but the business conditions utilities will face during the rest of the decade won't deviate much from the trends that prevail today.

The majority view may turn out to be right. However, utilities working on strategic plans should consider other possibilities. Surprises may lie just around the corner in areas such as electricity demand, rate regulation, capital availability, and environmental policy.

The potential for surprises emerged from interviews with 20 industry executives and 20 people with other perspectives on the issues, including regulators, investment bankers, and issue advocates. Some of those interviewed cited credible reasons for anticipating developments at variance with the conventional wisdom. And recent events bolster the notion that it's a good idea to question the industry's mainstream view.

Electricity Demand

A key question for the industry looking out to 2010 is the rate of power consumption. Will the economy continue to expand, increasing electricity use, or will there be a slowdown?

Generally people in the industry expect demand in coming years will grow at current rates or better, driven by steady economic expansion. As a utility CFO said during an interview: "Technology keeps evolving, and technology uses electricity." The director of an energy users' association agreed: "I've seen nothing except projections that electricity demand is going to continue to grow at the same pace that it's been growing."

Support for the optimistic view can be found in projections by the U.S. and Canadian governments, the International Energy Agency, and U.S. Energy Information Administration. All expect at least moderate economic expansion and concomitant growth in electricity consumption.

However, there are more dismal scenarios for the North American economy, which could curtail electricity demand. Some industry executives express concern about the effects of rising interest rates and higher energy costs.

Some outside the industry are much gloomier. They contend budget deficits, trade deficits, and international financial imbalances are jeopardizing the U.S. economy. Those sounding the alarm include the Comptroller General of the U.S., the director of the Congressional Budget Office, the Concord Coalition, and the Committee for a Responsible Federal Budget. The dangers they see are discussed at length in the books Running on Empty, by former U.S. Secretary of Commerce Peter Peterson, now Blackstone Group chairman, and Restoring Fiscal Sanity, by two former U.S. budget officials now at the Brookings Institution in Washington. Former Federal Reserve chairman Paul Volker finds it worrisome that there is no sense of urgency among political leaders, and says "it is more likely than not that it will be financial crises rather than policy foresight that will force the change."

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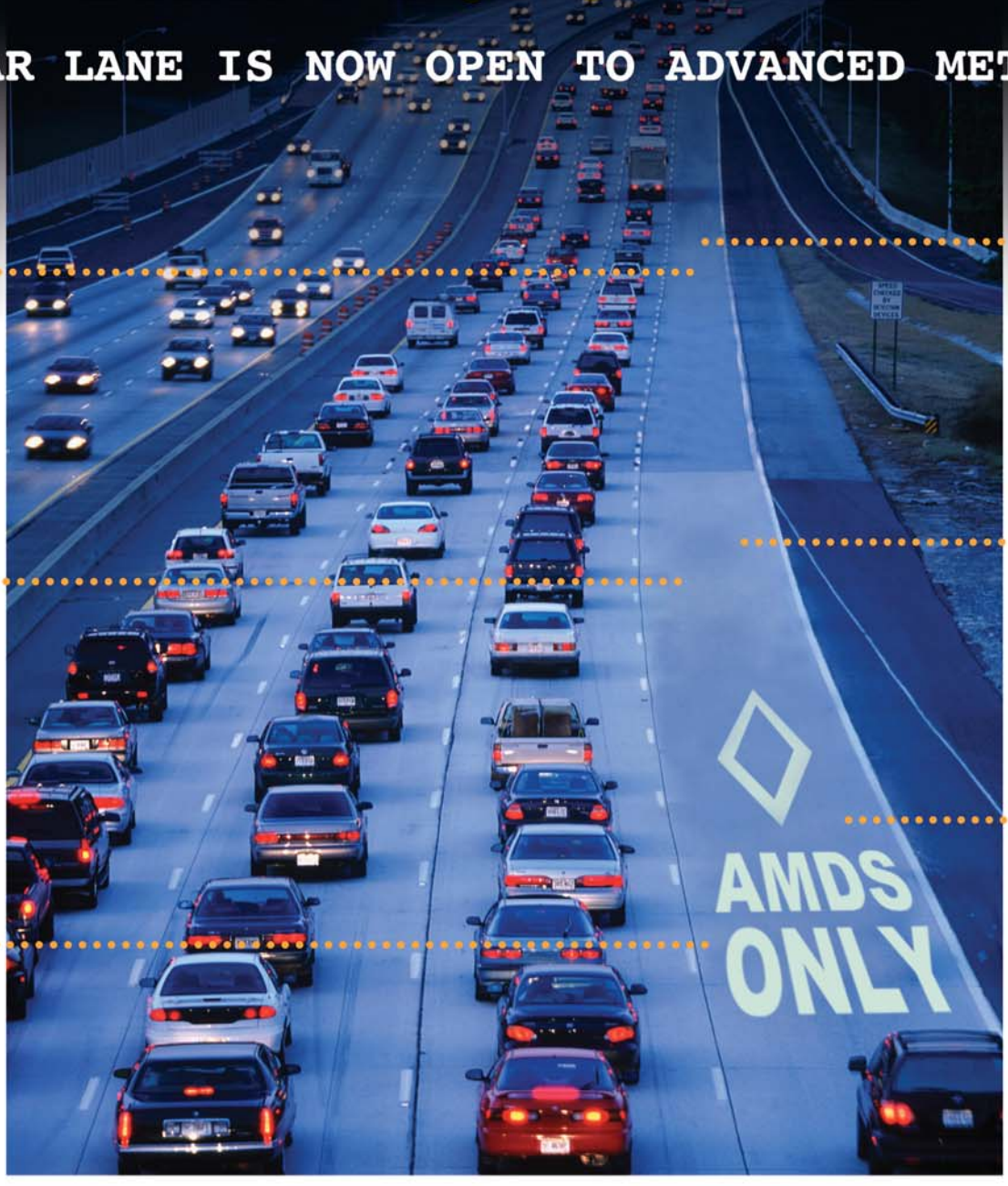

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Rate Regulation

How will state and provincial regulators respond to utilities seeking to add assets to their rate base and raise rates? Many industry executives are confident as they look ahead five years. "I don't worry too much about risks on the regulatory side," said a utility COO who was interviewed. "We always get to where we have to be."

Some have made favorable regulatory treatment a key component of their corporate strategy. A utility CEO expects the regulated side of the business to provide the "principal increment in shareholder value" between now and 2010. Another company's CFO said, "the top growth prospect is to make that investment and to secure a regulatory return on that investment."

An investment banker calls attention to environmental investments: "The states have now decided that putting scrubbers and other pollution-control equipment into rate base is a good thing."

Some regulators endorsed this view. One commissioner said she and her colleagues are working to make it easier for utilities to upgrade facilities and cut emissions. "The traditional rate case is becoming less important because we're allowing more pass-throughs and up-front investment recoups."

Another regulator argued that today's energy prices are still cheaper than they were 25 years ago, and stated, "We are not yet at the breakpoint where we say, 'We cannot afford these prices.'"

Others interviewees are less sanguine. They see rising fuel costs exhausting customers' tolerance for increases in their electricity bills, and causing adverse reactions from regulators and government policymakers. In his interview, the CFO of a distribution utility was particularly frank:

> We're coming towards a head-on collision. The regulators are saying, 'We know your fuel costs are going up, and we understand that part of the bill's going to have to go up. But a distribution increase?' What worries me is that you'll see a lot of utilities like ourselves take one on the chin.

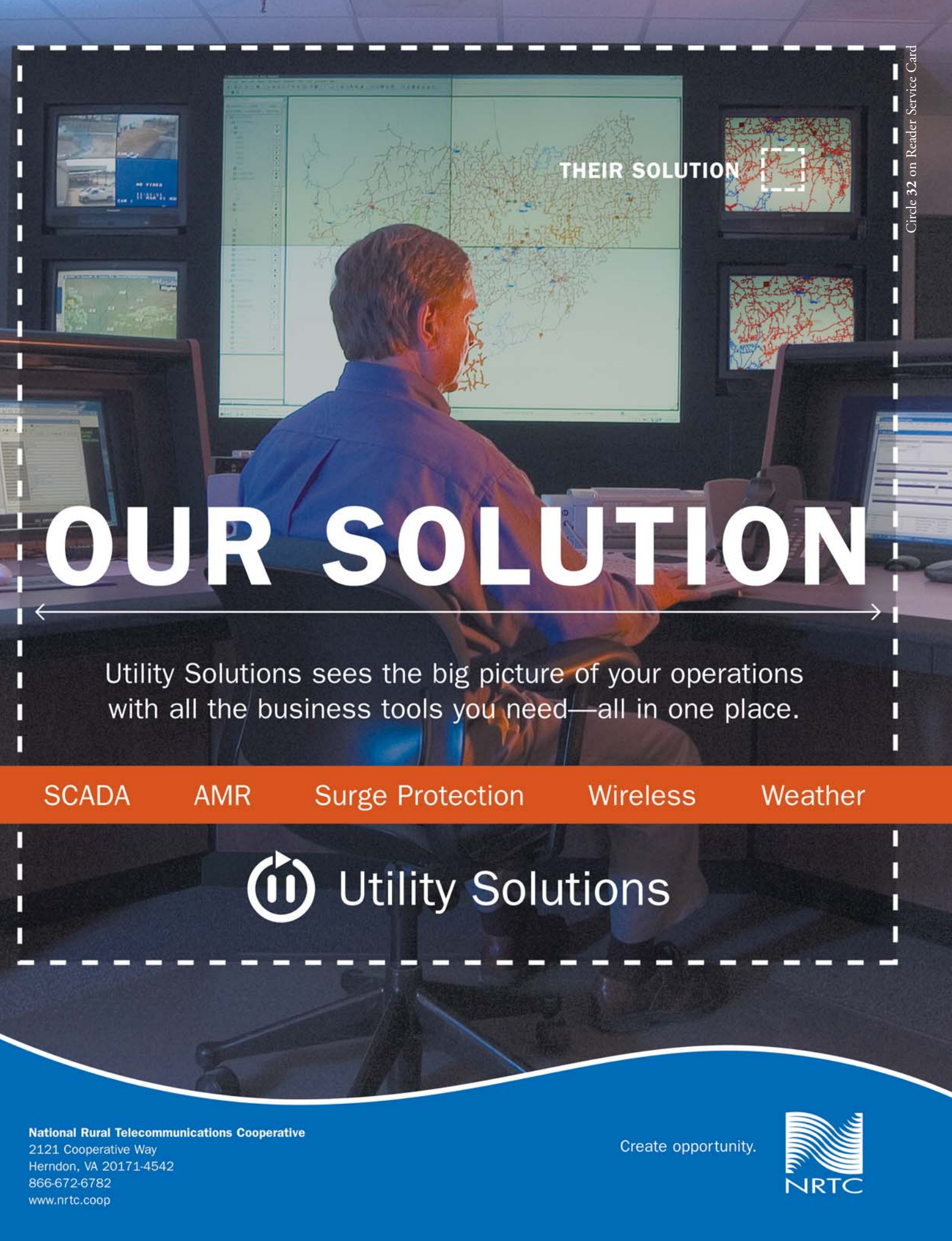
A private equity fund partner concurred: "Regulators are going to feel a lot of pressure if rates go up because of rising fuel prices. Adding assets to rate base and raising rates will be very politically sensitive."

A commissioner said that in his state the governor's office and legislators are considering ways to shield ratepayers from rate shock despite earlier decisions to give market forces more play. "Commissions and governor's offices are going to be rather nervous about letting utilities fully recover because of the real concern about what electricity prices are going to be," he predicted.

Capital Availability

The interviews found executives generally optimistic about the reaction of capital markets to utilities embracing the back-to-basics approach. The majority thinks lenders and investors will be highly supportive of the stable, low-risk returns offered by the traditional utility template.

A CFO said, "Most utilities are going to be focusing on the old model, of investing in ratebase and ensuring a regulated return." A CEO was unapologetic: "There's nothing wrong with being a utility." The gains posted by utility



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stocks over most of the past two years tend to support this view.

Others believe adverse developments could dim the investment appeal of utilities, such as difficulty in recovering costs or high interest rates that make bonds more attractive. If such developments coincided with an economic slowdown they could tarnish the image of utilities as a safe and sane alternative in troubled times. A CEO warned, "To the extent you're getting stingy rate relief and your [fuel] costs aren't going down, that's going to have some credit quality implications." This dovetails with pessimistic views regarding the economy and regulators' decisions if fuel costs continue to climb.

Still others believe the next five years will bring a resurgence of investor demand for growth. If the economy is robust, this expectation could be borne out. Countering the sentiment that there's nothing wrong with being a utility, a CFO predicts, "The capital markets are going to get impatient with utility companies just being utility companies." And a CFO speculates that, "We probably have a couple more years – maybe – of the value of the dividend and the value of back to basics. We will move to a cycle where they're going to expect growth. And then the challenge will be: Where does that growth come from?

Greenhouse Gas Restrictions

As of early 2006 the Canadian and American electricity industries operate within different environmental policy frameworks. The Canadian government has agreed to lower greenhouse gas emissions as stipulated in the Kyoto Protocol. The United States has declined to sign on and relies on voluntary emission reductions and programs to promote new green-energy technology.

Will the distinction still prevail in 2010? Will the U.S. move closer to Canada's approach even though it isn't a Kyoto signatory and opposes a successor global climate pact?

Many U.S. utility executives foresee no change. When asked about emission restrictions, a utility CFO responded: "In the next five years, I'd put it at the lower end of the list." Others concur, such as the state commissioner who said: "I don't see global warming as a top policy issue coming out of the governor's office or the legislature in the next five years."

Skeptics anticipate lots of talk about greenhouse gas restrictions, but doubt the federal government will adopt any mandates, at least not before the decade closes. Some cite concerns about hurting economic growth, some question the credibility of global warming science, and others simply think it would take longer than five years to bring about any reversal of U.S. policy.

That isn't the future others see. Referring to the skeptics, a state commissioner commented, "It's going to be more rapid than these executives are anticipating." "There will be some form of carbon management in U.S. energy policy over the next few years," a utility CEO agreed. "Our company will embrace it as most utilities will."

An environmental group's senior attorney argued many factors are coalescing to produce change: "There's so much momentum. You've got lawsuits, you've got PUCs imputing carbon, you've got shareholder pressure, and then you've got big players in the industry saying mandatory caps are inevitable, saying we support a carbon tax – that does change the dynamics."

Another factor: Action by state governments. "You may see more state initiatives than anything else in the short term," suggested a commissioner. Over half the states have already approved measures that seek to limit greenhouse gas emissions in one way or another. In Statehouse and Greenhouse, University of Michigan professor Barry Rabe contends that states are building an "alternative policy architecture for greenhouse gas reduction that could be expanded to other states, the nation, or even other countries."

Among other things, the proliferation of state programs and policies creates complexity that could be a problem for utilities with operations in multiple jurisdictions. A state commissioner thinks this could lead the industry to lobby for federal preemption: "A lot of the utility companies are concerned that there won't be a level playing field unless the federal government takes charge."

Strategic Implications

In summary, this research shows that among electricity industry executives there is substantial agreement that the outlines of the business environment of the next five years are observable today, albeit with some dissenting views. However, the research also shows that the minority views are hardly unfounded. To the contrary, they are sufficiently accepted, corroborated, and plausible to warrant serious attention in strategic decision-making.

Utilities with strategies keyed to the majority view of what the next five years will bring may be preparing for the wrong future. Executives ought to be asking themselves "what if," and thinking about what would happen to their organization if any of the minority views turns out to be right.

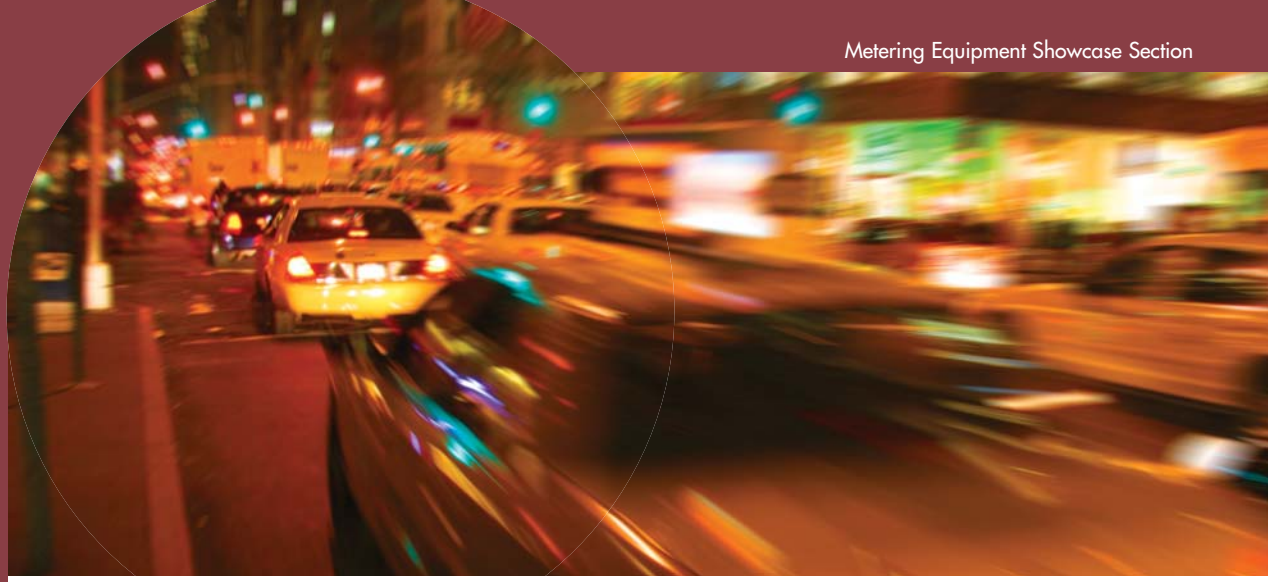
The problem is that there is no way of knowing for sure which view is the better bet. Corporate strategy requires a foundation of assumptions about how the marketplace will evolve in coming months and years, and yet uncertainty obscures what lies ahead.

How to resolve the strategy dilemma? Make some degree of preparation for each scenario, using contingent investments that provide the ability to increase ownership in those that turn out to be well-suited to the conditions that materialize, or to reduce or abandon ownership in those that represent bets on futures that don't arrive. To the extent this entails extra expense, it can be viewed as the price of an option that is worth the additional flexibility it confers.

Making contingent preparations for multiple futures does require special capabilities. For example, a company will need sophisticated asset management capabilities to properly operate assets that are there because they represent a hedge against potential future market conditions rather than because they are best for today's business environment. By the same token, it would be a departure from conventional practice to sell an asset that is doing well in today's environment because the head office sees indicators suggesting the marketplace is shifting to a different scenario and wants to shed assets maximized on the status quo. And this approach assumes the organization can identify and analyze developments that furnish clues as to which way the business environment is evolving relative to the different scenarios.

Although there are thus special demands associated with this approach, the situation calls for methods of making decisions and managing organizations that allow companies to leverage uncertainty to their benefit rather than ignoring or denying it. The next five years are obscured by complex possibilities, and it is best to embrace that reality. ■

This article is based on Which Way to Value? The U.S. Utility Industry, 2005-2010, which is available for download at http://www.deloitte.com/research *under Energy and Resources*



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Looking Forward and Planning for the Future

The Energy Policy Act (EPACT) was enacted in 2005. EPACT requires U.S. utilities to have a plan in place to offer any customers who request it, time-of-use (TOU) pricing, critical peak pricing (CPP), and real time pricing (RTP) within 18 months after its enactment. For those utilities already using the EnergyAxis System, much of their work to meet EPACT requirements is already done. The EnergyAxis System's smart metering technology allows utilities to execute TOU metering, interval metering, and dynamically change rate tiers as often as needed without visiting the meter for programming.

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ADVANCED APPLICATIONS

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DCSI's customers include ATCO Electric, Bangor Hydro-Electric, Florida Power & Light Co., Idaho Power, PPL Electric Utilities, Puerto Rico Public Power Authority, TXU Energy Delivery, Wisconsin Public Service Co., and over 180 electric cooperatives and municipal utilities. PPL's project is the largest two-way AMR deployment in North America, and FPL's TWACS Load Management program is the world's largest two-way PLC Load Control project.

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A POWERFUL LINE OF THINKING

Smart Metering Provisions in the Energy Policy Act of 2005 Require Action by State Utility Commissions and Utilities

By Scott H. DeBroff

So far, industry response to the Energy Policy Act is mixed, with some organizations questioning the significance of the act, and others interpreting it as calling for specific action.

In the case of the smart metering provisions in the Act, there is specific direction to state utility commissions, regulated Investor owned utilities and nonregulated municipal utilities and cooperatives alike, to implement time-of-use and demand response capabilities. Depending upon the action taken by regulatory bodies, these requirements could lead to the implementation or upgrade of technologies at many utilities.

Some of the requirements outlined in the act include:

- A requirement that utilities offer and provide customers with time-based rates within 18 months of enactment, or in the case of large customers, with capacity credits. There is an accompanying requirement that the utility must provide a suitable meter to any customer requesting such rate, or demonstrate why compliance cannot be achieved.
- State commissions must conduct an investigative proceeding into demand response and advanced metering, initiating it within one year and completing it within two years.
- Within one year of enactment, FERC must begin to conduct annual regional assessments of demand response resources and the penetration of advanced metering and other technologies, and identify any barriers to adoption.
- The Act makes it official policy of the U.S. to encourage demand response and adoption of devices which enable it, including advanced metering.
- The Department of Energy (DOE) must submit a report to Congress within 180 days that recommends how to achieve specific national levels of demand response by 2007.

The Energy Act requires all electric utilities to follow standards adopted by regulatory or governing bodies with jurisdiction over the utility. In the case of investor-owned utilities, this typically means state public utility commissions. For cooperatives and municipal utilities, this means the board of directors or councils with controlling authority.

As regulatory bodies begin implementing the smart metering provisions in the Act, utilities that do not possess system-wide time-of-use capabilities may have difficulty maintaining compliance.

At this point in time, many state commissions and their staffs are still trying to interpret the law and decide upon next steps. Over the course of the next several months, it most likely will be up to the utilities, working in collaboration with the commissions, to come up with a process that works and that everyone can agree upon. There is also an opportunity for the "technology community" to participate in the pre-process activities as well as the process itself, to help support a sound effort, one that will lead to intelligent smart metering implementation.

For all investor-owned utilities, the state public utility commission will be host to a rulemaking or similar proceeding to address the Act directives and establish a forum for discussion, debate and an ultimate determination. If a state has already started a proceeding, they may attempt to show how that proceeding is in compliance with the federal Act. If a state has not begun a proceeding, then there will be a process to start one.

For all utilities not under PUC oversight, which will include municipal electric utilities and electric cooperatives, the process to review opportunities for time-variant pricing tariffs and smart meters, while similar to the IOUs, will be unique.

Unlike the IOUs, municipal electric companies and electric cooperatives may not have a process implemented by the commissions. The commission/governing body, either as a component of their smart metering rulemaking, or as a stand-alone proceeding, must make decisions about time-variant pricing tariffs and deployment of smart meters to support them. Again, this is a prime opportunity for the utilities and technology companies to work in partnership with the appropriate entity and make decisions that are in the best interest of the consumer, the utility, and the commission or governing body.

Finally, the Act presents opportunities for funding these policy changes. The Department of Energy has been directed to be a resource for the states that need or would like help to look into the benefits of Advanced Metering technology and support in the creation of Demand Response programs that will be successful in the states. Utilities of any type could request federal support as could public utility commissions.

In an effort to contribute to the understanding of the Act by utilities and regulatory agencies alike, Hunt Technologies has published a white paper and will be hosting Web seminars to highlight Hunt's interpretation of the smart metering provisions. More information can be found on the Hunt Web site at www.hunttechnologies.com.

"...these requirements could lead to the implementation or upgrade of technologies at many utilities."

About Scott H. DeBroff, Esq.

Mr. DeBroff is Hunt Technologies' outside national regulatory counsel and an attorney with the international law firm of LeBoeuf, Lamb, Greene & MacRae LLP, and works from their Pennsylvania office in the state capitol of Harrisburg. He brings with him over 13 years of experience in working on regulatory utility issues and now maintains a national government and regulatory affairs energy practice as a part of LeBoeuf's Energy Practice Group.

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FlexNet™ with AMDS Connect™ Promises Increased Productivity

Two industry leaders team to provide advanced system

North America's electricity industry can now benefit from a unique, new Advanced Metering Infrastructure (AMI) system solution, thanks to a partnership of two industry leaders.

Sensus Metering Systems, a long-time leading provider of utility metering and automatic meter reading systems, has partnered with Advanced Metering Data Systems (AMDS), a wireless connectivity company, to provide utilities with FlexNet with AMDS Connect, a radio frequency fixed network utility meter reading system designed to increase meter reading efficiency, reduce overhead costs, and enhance customer service.

FlexNet offers both two-way and one-way fixed based monitoring from electric, gas, and water meter endpoints for up to 300 square miles of coverage from one network tower. The patented technology upon which the AMDS Connect™ network architecture is based allows for the programming of the network and any two-way meter endpoint, as needed. In addition, the system is designed to be scalable to accommodate growth as a utility expands meter deployments throughout its service territory.

Simplicity. Flexibility. Reliability.

The FlexNet system consists of Sensus' solid-state electricity iCon meters integrated with AMDS Connect transceivers, AMDS fixed network infrastructure, and the FlexNet system server and software.

Because the FlexNet system is a self-sustained, tower-based AMI network, there is no need for additional fixed network equipment piggy-backed onto the utility distribution system. This solution not only eliminates the need to have electric company staff involved in the network deployment process, but all network and operations maintenance responsibilities can be covered under a service agreement with AMDS Services – further reducing the need for utility manpower and resources to maintain the fixed network equipment. The system is continuously monitored by professionals at a central AMDS Services monitoring station to ensure optimal 24x7x365 network performance.

Simplicity is gained through:

- No complex distributed databases or thousands of store-and-forward nodes
- Low cost infrastructure
- Low capital, installation and maintenance cost
- Tower-only systems that do not require access to easements
- No concerns with utilities having underground services

Flexibility is enjoyed because of:

- Two-way and one-way reading capability
- Remote network and endpoint features control
- Diverse deployment topography
- Performance in various terrains
- Scalable system
- Programmable read interval and numerous warning signals
- Internet-based programmable meter functions
- Network capacity to handle demand response and customer messaging transactions

Reliability is gained through a:

- 20+ year life expectancy
- Federal Communications Commission (FCC) and Industry Canada (IC) protected, primary-use, licensed spectrum
- Temporal redundancy in meter messages
- Error detection and correction
- 24x7x365 system monitoring and repair
- 30-day data back-up and 8 hour power back-up

The patented AMDS Connect wireless network architecture coupled with the latest generation of Sensus iCon meters has already demonstrated to be a winning combination in several utility operating environments, including some of the most varied and unforgiving terrains in the country.

Alabama Power Taps Into FlexNet™ with AMDS Connect™ Technology

Among the first to capture the benefits of the new technology is Alabama Power Company, which installed 45,000 residential and 5,000 commercial customers in the Birmingham, Alabama market with a full two-way fixed network meter reading system.

"From day one, we told vendors we wanted a full two-way system directly to the meter, with all the bells and whistles to achieve our value add economic benefits, while keeping within our budget," said Derl Rhoades, Principal in Alabama Power Company's Power Delivery Metering. "Sensus and AMDS proved their technology could deliver on each of our requirements. The ability to provide a comprehensive suite of functionality with such a simple system architecture was a key factor in the decision to select FlexNet, not to mention the applications this network can provide beyond metering."

A FlexNet pilot system has been installed at Alabama Power since the fall of 2004. Other technologies were evaluated including competing fixed networks, mesh and power line carrier. This will be Alabama Power's largest automated meter reading project to date.

"Alabama Power is recognized as an innovative utility, and we believe FlexNet with AMDS Connect is a natural system for their high demands for technology," said Tom Haven, Sensus Sales Manager. "The service agreement allows Alabama Power to secure a fixed ongoing operations cost and guaranteed level of performance."

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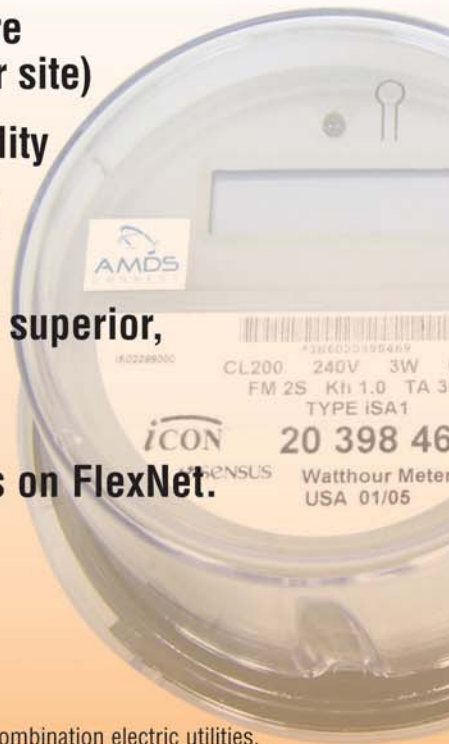
FlexNet with AMDS Connect technology offers utilities a comprehensive fixed network solution, providing advanced meter reading information, demand response and customer messaging capabilities. Features of this superior and powerful fixed base system include:

- **2-way and 1-way communication options**
- **Long range means less infrastructure (40 to 200 square mile coverage per tower site)**
- **Incorporates demand response capability**
- **Flexible – handles both residential and C&I metering installations**
- **Operating and maintenance services ensure superior, maximum operation of network**

*Advanced Metering Infrastructure



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Securing Meter Data on Automated Meter Reading (AMR) Systems

How important is it?

By Edward Beroset

Advances in metering technology over the past three decades have made today's AMR systems economically viable for utilities to use. Over the next five to 10 years most utilities will likely use some type of AMR system to both comply with energy policies and regulations, and increase their profit margins with more accurate billing reads and lower operating cost. But will these policies and regulations in the U.S. and similar requirements in other countries turn AMR into a zero-sum game for utilities? How can a company determine if its internal processes and controls are sufficient to ensure that its revenue data is secure and accurate?

Utility Information Technology (IT) departments commonly understand security aspects of the backend which runs the AMR system, and metering departments usually understand the security aspects of the meters themselves, but everything between those points could be the weakest link of your AMR system. Just as the strength of a chain is no greater than its weakest link, an AMR system's security depends on the security of every piece of the application, the communications devices, communications media and protocols. This article describes some of the security aspects to consider when evaluating various AMR communication systems available today and provides questions you can ask vendors to assure that your entire AMR system is as secure as it needs to be.

What is AMR link security?

The purpose of the communications link from the back-end system to the meter is to be able to provide reliable communications to authorized users. A system is reliable if it is both available when you need it and accurate in relaying your messages. To say the link is secure means that it is available to authorized users and free from being intercepted, altered, or listened to by unauthorized agents. I use the word agents in this article not to imply secret agents, but to emphasize that the participants in the network aren't necessarily human beings. We want to assure that agents such as unauthorized communications or computing equipment are also prevented from access.

Three properties of security

There are three essential properties of security. They are confidentiality, integrity and availability. All must be present for a communications link to be considered secure.

Confidentiality

The first property of security is confidentiality. "Confidentiality" means information is never disclosed to unauthorized agents. If your email is able to be read by an unauthorized third party, its confidentiality is being violated.

Integrity

The second property of security is integrity. If information is never altered in any unauthorized way, then a system manifests the property of integrity. Although they seem very similar, confidentiality does not guarantee integrity. For example, an encrypted message might be altered without the perpetrator knowing what the encrypted message actually says. One might expect that decrypting a message that had been altered would normally reveal that it had been altered, but this is not always the case. In the original version of the IEEE 802.11 standard describing WiFi, the encryption method used was found to be easily decrypted because of confusion between the two properties of confidentiality and integrity.

Availability

The third property of security is availability, which means that the system always responds to authorized agents. If a vandal breaks off a key in your car door so that you can no longer unlock the door, the transportation that the car provides is no longer available to you. In communications, the analogy is a denial of service attack in which an attacker could issue millions of data packets to a router to overload system capacity and deny you access to your AMR communications system. Even though the attacker might not be able to penetrate your defenses (i.e., the confidentiality and integrity of the system are not violated) you will still have a problem if you are denied availability to data.

Three things that can go wrong

There are three fundamental things that can go wrong with a communications link: interruption, corruption, and interception.

Interruption

Unintentional interrupts could be as simple as a homeowner inadvertently digging through the telephone line to a meter or as complex as an unintentional harmonic generated in a nearby television transmitter jamming the system's radio frequency (RF) signal. Note that both of these interrupts could also be caused intentionally. That is, someone could intentionally cut a telephone line or jam an RF signal.

Corruption

Corruption of data can occur on any media. It can be caused by such things as a noisy connection on a telephone line, intermittent RF interference or fading on a radio link.

Interception

Interception is different from the interruption and corruption because it is almost always intentional. A hacker can theoretically intercept your communications by physically tapping into wired lines or by monitoring a radio signal. I say "theoretically" because while it is always possible to intercept a communication signal given enough time and resources, it may not be practical for anyone to actually do so. For instance, it would take sophisticated spread-spectrum radio test equipment, custom built decoding hardware, knowledge of advanced cryptographic techniques, and three years of continuous brute-force computer time to intercept data from a communication system using controlled mesh network technology. The data would have to be extremely valuable for the interceptor to justify the effort and expense involved in intercepting and decoding it.

Link characteristics

Link characteristics are important because they can make any of the things that could go wrong (including hacking) either more likely or less likely. For example, if a communications protocol has a built-in retry mechanism, corruption and interruption are less likely because a missed data packet can be re-sent automatically, if required. Additionally, it is easier to intercept a simple data signal sent out over a single RF channel than it is to rent a submarine and tap into an undersea fiber optic cable. Another link characteristic you should consider is that it is easier to decode unencrypted data than encrypted data provided the hacker does not already know the decryption key and algorithm. These link characteristics suggest two preferred practices: that if all else is equal, you should prefer communications links that send encrypted data over those that send unencrypted data, and you should keep your decryption keys secret.

Data encryption

The problem with using encrypted communication links instead of unencrypted links is that all things are not usually equal because encryption is not free. Encryption requires computational resources and there are overhead costs associated with managing encryption keys. Consider this simple analogy. Doors with locks are more secure than those without, so why doesn't every door in every building have a lock? The answer, of course, is cost and convenience. Obviously, doors with no locks are cheaper than doors with them. It is also quicker to open a door if you do not have to fiddle with a key. Imagine a restaurant in which the waiters had to unlock the door to the kitchen before they brought out a tray of food! Service would be much slower and the restaurant would most likely soon go out of business. Now imagine a bank where the vault door does not have a lock. Clearly, it makes sense for banks to protect their customers' assets by locking them in the vault, but for a restaurant it does not make sense because speed and service are more important than securing the kitchen. These lessons apply to data encryption because it has a similar effect on communications as a lock on a door; encryption costs more and it slows things down.

Physical security

If the link is a wire, then a wire that is in a steel conduit is probably more secure than wire which is not. It is not impossible to tap into an armored cable, but it is a lot more difficult. In the case of radio systems, physical security still applies. For instance, on WiFi systems, the output power is often adjustable. If the power is turned up to maximum, the WiFi signal can penetrate the walls of a building and be accessible outside the building. A hacker in the parking lot would have access to the signal. However, if the output power is turned down so that it can only be picked up inside the walls of a building, then a hacker in the parking lot can no longer receive the signal.

Mesh radio systems also help with physical security, since the self-healing properties of a mesh network tend to make the loss of a single node less likely to render any but that single node's data inaccessible. This is different from a system in which the links are point-to-point in a chain because in such systems, disruption of a single node can render many other nodes inaccessible. Frequency hopping spread spectrum transmissions also help because the signal is spread out over a wider bandwidth. To jam such a signal, a hacker would have to send out a wider bandwidth signal than would be required to jam the corresponding single frequency signal. In order to jam such a signal, the jamming signal would also have to transmit more power. Transmitting a more powerful signal generally requires a more expensive transmitting system and it becomes less economical for a hacker to disrupt such a system.

Passwords

Passwords are very useful to restrict access, but they are only effective if used in a secure manner. For example, if I invest in a state-of-the-art lock for the front door of my home, it does not slow a thief down one bit if a key is hidden under the welcome mat. Under the mat is an obvious place for a spare key to be located, so it is not a very secure place to hide the spare key. Likewise, if all of your meters are password-protected but every meter is programmed with the same password and everyone in the utility knows that password, the likelihood that your meter data is secure is less than if all meters had different passwords and every person authorized to read meter data had his own unique password. However, as with data encryption, a common sense approach is needed to determine what is more important; security or ease of service. It costs a lot of time and money to manage the logistics of maintaining many

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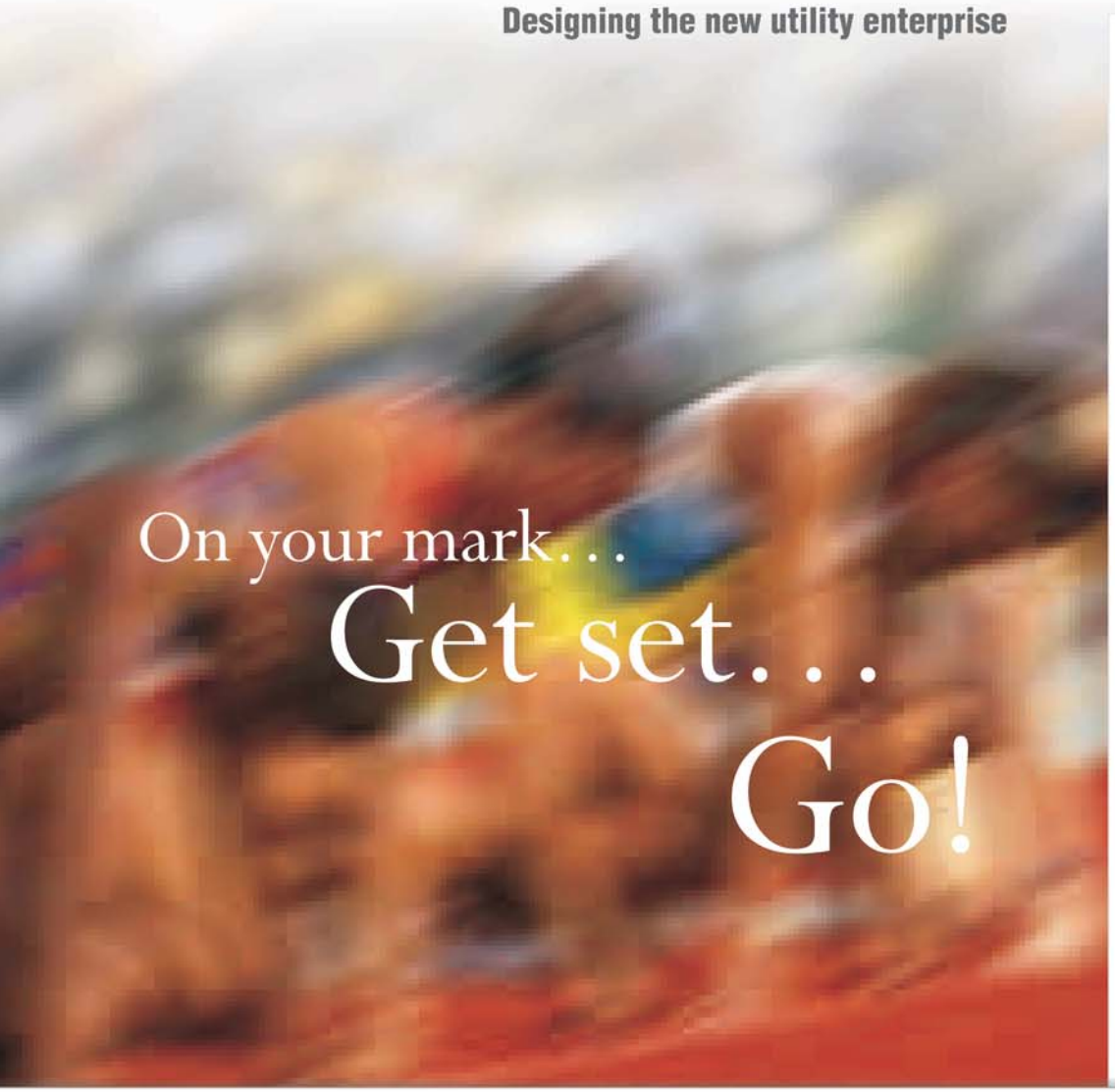

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different passwords. Real system designers must strike a balance between what is possible and what is realistic. One frequently used compromise is to only encrypt the password, but not the data. In that approach, each password is not sent over the communications channel "in the clear" (i.e., unencrypted) but the transfer of bulk data is not slowed down by trying to encrypt both the data and the password.

AMR link risk analysis

Once we have identified the generic risks involved with a communications link, the next step is risk analysis. One commonly employed method of risk analysis is to start with three pieces of data for each thing that can go wrong: a description of what could go wrong, the probability that it will go wrong, and the cost resulting from this failure. The cost times the probability will give a value which is called the Annual Loss Estimate (ALE). This can be used as a rough indication of how much it is worth to address this problem.

This is the classic approach to risk analysis, but assigning the probabilities and costs can be very difficult in practice. What is the probability that a given homeowner will dig through the telephone line for his meter? What is the probability that some unknown source will jam your radio signal? You may or may not have historical data to refer to when estimating these probabilities. Also, it is often difficult to assign costs to these items. For instance, if the threat is a customer resetting the peak demand just before the AMR system reads it, the cost might be small if the customer is a residential customer or the cost might be significant if it's a large industrial customer. Such a reset might also be merely an annoyance if peak demand is not used for billing.

Another method for risk analysis that is somewhat more qualitative and easier to use is to enumerate the threats, the vulnerabilities and countermeasures. As with the ALE method, it is still useful to estimate a cost resulting from a failure, but with this method an estimate is usually sufficient to effectively analyze risk. After enumerating the risks, the next step is to examine the countermeasures and determine which are feasible. Some of the kinds of countermeasures one can take may cost very little, such as enabling encryption over a WiFi link that already has encryption available even if you estimate that the probability of an attack on the WiFi link is very low.

Conclusion

When considering the security of your AMR system, whether existing or proposed, remember that there are three components to your system: the backend computer, the meter, and the communications infrastructure that connects them. When evaluating the security of the communications link, consider the characteristics of the data link that may make your communications link more or less secure, including its physical security and whether it uses encryption. Ultimately, any security considerations must be evaluated in the context of the real world in which we operate. AMR planners must balance the cost and performance of the system against the costs and probabilities of system failure. ■

About the Author

Edward Beroset has been working with computers and software for over 20 years. He is the manager of the software and test group at Elster Electricity, where he has worked for eight years. Prior to that, Edward worked in BIOS development at Compaq. He serves on IEC and ANSI electricity metering protocol standards groups and chairs the working group which is responsible for creating the C12.22 standard. He is a member of both the IEEE and the ACM, has published several articles and holds several US and foreign patents.

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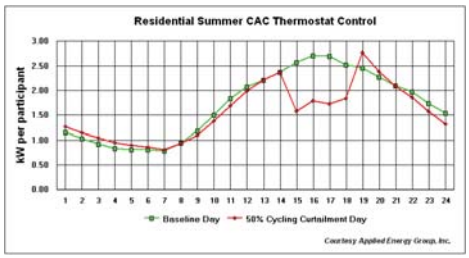
AMR/AMI: A Win-Win Situation for Utilities, Suppliers and Customers?

Ultimately, achieving a successful outcome for AMI will require enthusiastic customer buy-in of utility smart metering initiatives

By: Edmund P. Finamore, President, ValuTech Solutions

Given the slow moving drama currently playing out in California and Ontario, Canada, the so called front lines of smart metering deployment, some people may wonder if implementation of Advanced Metering Infrastructure (AMI) technology is really worth all this effort. Armed with sophisticated demand response study results that appear to confirm load shifting's potential, energy suppliers, AMI technology vendors, ISOs/RTOs and other supply side interests have for sometime been claiming that utility supply side programs, through a variety of incentives and penalties, can shape customer demand for energy, and in doing so can help balance the nation's energy supply. Washington has recently backstopped this assertion through enactment of the 2005 Energy



Policy Act, which tightens Federal Energy Regulatory Commission (FERC) oversight, promotes reliability standards, encourages investment in new facilities and recommends other measures to improve the nation's overall energy picture. With so much attention being focused on this issue, AMI must be good for the customer, right?

Would it be almost blasphemous to suggest at this stage that the intensity of the smart metering debate smacks of a little industry self interest? At first glance, the cooperative enthusiasm of an industry that stands to benefit from a mandated solution could tend to make one question the motives of some participants (remember Enron?) who are otherwise best known for, shall we say, their extremely competitive nature. Indeed, the normally cannibalistic tendencies of many high tech industries suggests that an unholy alliance exists among vendors, energy producers, regulators and other supply siders who believe, with the aforementioned demand response studies to back them, that achieving energy balance can best be accomplished by influencing customer behavior through implementation of

Home Energy Management System
Courtesy: USCL Corporation

load shifting and curtailment programs, and by implementing their enabling technologies.

Customer Enthusiasm Missing

What appears to be missing is a similar enthusiasm on the part of the customers who in the end must pay for high energy costs. It's true the California State-wide Pricing Pilot results appeared to confirm some public interest in load shifting and dynamic pricing alternatives. But I've yet to pick up a newspaper and find a customer testimonial enthusiastically announcing he has just saved $3 for the month by delaying the dishwasher cycle or washing clothes at night. So do we know if customers care? I suspect they do, if not for saving the $3 ice cream money then for some other more altruistic motive like "it's good for the country".

A fellow consultant of mine, Larry Barrett of Barrett Consulting Associates, has studied this phenomenon for many years, and claims there is a body of evidence that suggests people do care about using less energy, particularly if they are properly compensated in the process. "Significant numbers of customers are interested and willing to adjust their living habits if properly informed and reasonably compensated," claims Larry. "The problem is that utilities presume to know what choices their customers want, instead of simply asking them. If customers were consulted more, utilities would achieve much higher customer satisfaction levels than they do today. Utilities need to hear from the customer what options they will consider, and Barrett Consulting Associates is currently commissioning a study to do exactly that."

Some industry insiders are not quite so sure customers will participate. One well known expert provides some anecdotal evidence in a recent publication which describes a mid-70s program he once participated in, and where he laments the fact that "the $1 to $2 monthly net savings after deducting the metering charge was simply not worth the hassle." I'm convinced that he is not alone in this regard, and there are many similar stories if one is willing to search for them.

I also suspect that much of the ongoing policy and solutions debate taking place is slightly over the head of many consumers, and for many people the concept of electric demand is difficult to grasp. Discussions of high technology AMI solutions with reference designs and open standards used for monitoring and controlling electrical load to support some utility dynamic pricing initiative are probably quite daunting for most. It seems easier to defer such decisions to the utilities or regulatory commissions and then rely on their good intentions. In this confusing high tech environment, one could incorrectly conclude that continued silence implies acceptance.

Avoiding the AMI Train Wreck

So what do we make of all this? Is the push for residential smart metering destined to go the way of Hillary Clinton's national health care plan? Will it sink under its own weight? I don't think so. There are just too many good ideas being considered and too much hard work has been performed for these initiatives to simply fade from the public scene. Fundamentally, the concept of automatically reading a utility meter and remotely monitoring building energy usage is too good of an idea to simply cast aside.

As I gaze out of my office window at a building nearby, it seems difficult to accept the continuing prospect of a utility employee manually reading its meter in an age when my son routinely text messages friends and downloads music to his iPod. Many would argue that the iPod technology is much more rewarding. In contrast, many of AMI's economic benefits are not yet sufficiently recognized and accepted by consumers to be included by utilities in the hard dollar savings column of their AMI business case studies.

Something must be done to better educate consumers, to fairly allocate the benefits of demand response programs among all parties, and then to have all stakeholders share in the cost of implementation. To the degree that utilities and system operators benefit from operating savings and improved system reliability provided by demand response programs, they should be prepared to accept their fair share of the smart metering costs. Customers should not be expected to blindly embrace a technology and required change in living habits without being sufficiently convinced of the benefits for themselves and the general public. And they should be fairly compensated. What is their participation actually worth? Utilities should

attempt to find out more specifically from the customers themselves what the residential market will actually accept.

And what about the societal benefits? If market forces were permitted to work, a host of new generating facilities would spring up guaranteeing an abundance of generating and transmission capacity in every geographical market. But that's not the world we live in. Environmental, safety, zoning and other restrictions have all contributed to the industry's current tight energy supply. All citizens have a stake in resolving this problem and ultimately should accept some obligation in paying for the solution. Unless the communal benefits are better appreciated and included in the benefits side of the equation, AMI may be headed for a train wreck that could affect the utility industry for many years to come.

OpenAMI's Important Role

An organization called OpenAMI, of which I am a member, has taken on the unenviable task of developing AMI standards and promoting rapid adoption of AMI technologies to support load management efforts primarily taking place in the California market. Through development of various design principles and use cases, the OpenAMI Task Force has made significant progress in what has become a long hard slog to develop the necessary standards to accelerate AMI implementation. Some AMI enthusiasts believe that implementing such standards is necessary to reduce smart metering equipment costs and accelerate AMI implementation.

Working with the California Energy Commission, California Public Utility Commission and various standards groups, OpenAMI has taken on the challenge of reconciling a divergence of views involving the technical sophistication of AMI systems, required vs. optional features, communications options and other issues potentially having a significant impact on the costs and benefits of AMI implementation. If their efforts lead to the availability of additional utility and customer benefits while at the same time helping to reduce implementation costs, then the public will have been well served.

It remains to be seen just what effect additional consumer benefits will have on increasing customer interest, or if they will engender wide scale acceptance of smart metering technology. While the Energy Policy Act of 2005 requires utilities to offer time based rate schedules, and obligates state utility commissions to study the potential for requiring time-of-use metering, it appears that mandated smart metering for most U.S. markets is still a long ways off. OpenAMI's efforts can best influence the outcome of regulatory proceedings in the California market and across the nation if their effort is seen as a customer focused rather than industry supported initiative that produces clear advantages for the customer. The organization's mission statement contains some very positive objectives in this regard for AMI stakeholders, in particular the ones related to reducing technical risk, lowering cost and empowering consumers. A little more focus on the customer side of the equation would be welcomed and would help to balance out their overall mission.

While traditional AMI functions such as load control continue to be viewed as largely utility centric features, other benefits such as energy management and appliance monitoring could be supported that would provide real added value for the customer if implemented and priced properly. Utilities must do a better job of articulating the energy saving benefits to be gained through the introduction of AMI alternatives that use energy management gateways, home energy management systems and in-home displays. "Attractive" time-of-use rates should be implemented that adequately reflect the real value customers place on modifying living habits and cutting back on energy usage. After all, improving energy efficiency and reducing energy waste are objectives that are as important to

effective energy planning as shifting the time when that energy is used.

Some Suggestions

So it appears we are engaged in an approach to managed energy consumption that seems to be in the public interest, but which has thus far not fully convinced regulators and customers that the benefits are worth the cost. The industry has not adequately promoted the benefits of smart metering technology for energy conservation and other uses that go beyond demand response. In fact, it could be argued that years of studies, pilot programs, regulatory proceedings, etc. have in some ways clouded our understanding of the broader energy supply issues that got us here in the first place.

So how can the industry recapture the momentum that is needed to win the public over and in the process convince utility regulators that favorable regulatory treatment of smart metering technology is in the public interest? It won't be easy, but a win-win strategy can still be salvaged if some common sense steps are considered:

- Utilities should develop a better message that smart metering technology will support energy efficiency and energy conservation programs that can save the customer real money. Customers continue to view load shifting as something they are asked to do to help utilities out. Hence, the luke warm reception when only minimal savings are offered (witness Puget Sound Energy). More focus on benefits is certainly needed.
- Utilities should offer up some real dollar savings to customers that reflect the true value of load shifting when compared to other supply side solutions. Business case assumptions should place greater value on intangibles such as supply risk management, deferred new generation, predictable off system energy purchases, expensive wind and solar alternatives, avoided rights-of-way issues, and other avoided or delayed costs.
- Arguments in favor of smart metering implementation should be clearly communicated to the public, and not obscured or sidetracked over side issues such as who owns and pays for the metering, monthly meter charges, or how many usage blocks are appropriate for a time-of-use rate. Customers will usually act in their own best interest if they understand the basic issues at hand, but will frequently do nothing if the alternatives and benefits are not clearly understood.
- While the work of organizations such as OpenAMI is very important, it should not obscure the simple message that smart metering technology can benefit customers by supporting functions that promote efficient energy use and save the customer money. Advocacy groups should be touting the energy saving potential that advanced AMI solutions such as home energy management systems can create.
- Utility regulators should be more receptive to arguments advocating favorable rate base treatment of smart metering technology. It should be obvious by now that reduced meter reading costs alone cannot normally justify advanced AMI. However, additional benefits such as improved system reliability, deferred construction and better customer service, though hard to quantify, are real and should be treated more favorably by regulators in future rate proceedings.
- Utilities should be encouraged to explore different options for reducing customer energy use and should be compensated for these efforts by regulators through use of creative rate making measures that reward these types of programs. Rewarding utilities for promoting energy efficiency would encourage them to sweeten the customer benefits of load shifting and time-of-use.

Adoption of residential smart metering technology has been a painfully slow process in California and across the country, in part due to the industry's preoccupation with the rate making process rather than achieving the desired outcome. Few good ideas are ever adopted without the enthusiastic support of the general public, and an "energized" and motivated customer base could make the difference. A win-win result in California and elsewhere can still be achieved if the industry's message is less focused on technical issues and instead emphasizes the individual and collective potential for significant customer benefits that AMI can provide. ■

About the Author

Ed Finamore is Founder and President of ValuTech Solutions, a management consulting firm specializing in utility automation and AMR. With over 30 years of utility industry related experience, Mr. Finamore has participated in many utility automation projects and has authored many articles on automation systems including AMR. He is a licensed professional engineer in the Commonwealth of Pennsylvania, and can be reached at 412 299-5684 or EFinamore@valutechsolutions.com.

Advantages of Implementing an Advanced Metering Infrastructure

By: Bill Zorn, Electronic Data Systems (EDS) Energy Industry Executive

"Energy efficiency" is the latest buzz phrase since the Energy Policy Act of 2005 (EPACT) was signed in August. Both short- and long-term projections indicate the era of "cheap energy" is gone in America and energy costs will continue to rise. Energy companies are now under even more pressure to manage increasing costs. In order to control costs in the long run, it will be imperative to make investments today that will move them into the future. EPACT will force many utilities to transform metering and demand response systems, but the key will be in developing a long-term strategy on an adaptable infrastructure.

EPACT has the following national and state implications related to automated meter reading (AMR) efforts.

EPACT's National Implications:

- Demand response is official U.S. policy. The bill states that it is the official policy of the United States to encourage demand response and adoption of devices which enable it, including advanced metering.
- Department of Energy (DOE) must report. The DOE must submit a report to Congress within 180 days that recommends how to achieve specific national levels of demand response by 2007.
- There's a national metering standard. There is a requirement that utilities provide customers with time-based rates within 18 months of enactment (August 8, 2005), or in the case of large customers, with capacity credits. In addition, the utility must provide a suitable meter to any customer requesting such a rate or demonstrate why compliance cannot be achieved.
- Federal Energy Regulatory Commission (FERC) must annually assess the barriers to advanced metering and demand response. Within one year of enactment, FERC must begin to conduct annual regional assessments of demand response resources and the penetration of advanced metering and other technologies, as well as identify any barriers to adoption.

EPACT's State Implications:

- State public utility commissions must investigate advanced metering and demand response within two years. State commissions must conduct an investigative proceeding into demand response and advanced metering, initiating it within one year and completing it within two years.

Information and Customer Usage

Information management and customer-centric will be the first step in this evolution to "energy efficiency." In this new era, enabling customers to manage their own usage and capturing customer usage information to match peak load conditions will become imperative. This means utilities will have to develop timely, user-friendly tools that provide consumer usage information (and its related pricing information) so consumers can make almost real-time decisions pertaining to their usage.

When consumers are in control, more effort will be given to decrease usage during peak hours. California's experience with its Critical Peak Pricing pilot proved that residential consumers respond to price incentives. Consumers were willing to curb their peak-hour usage for off-peak (cheaper) energy thus decreasing the risk of power outages and blackouts. However, we will begin to see even more granular customer information surface in this evolving market.

Today, new digital metering technology readily exists that can generate consumer usage data at a granular level. With this technology, consumers can not only monitor usage but can answer more specific questions like, "Should I run the dishwasher now or wait for an off-peak time when rates drop?" or "Should I replace my old furnace with a new high-efficiency one?"

Is AMI the Answer?

With so many options in the new technology, it is unclear to some which approach is best. Questions exist about which metering technology, meter management system, and communication technology are best, but the questions should not be about the technology. The key is to build an infrastructure that will automate existing manual processes, reduce operational costs, improve data quality and equip utilities with the flexibility needed to move into the future.

Advanced metering infrastructure (AMI) can provide the necessary information to help improve energy efficiency and bring other operational benefits that will help utilities manage costs more effectively and improve customer service.

Key Benefits of Implementing AMI

Managing Supply and Demand

AMI improves the process of managing demand for natural resources. The demand management savings are certainly well-documented. These savings result from selective load control, where the utility or the customer (manually or automatically) schedules a time to use energy (e.g. scheduling the dishwasher to run during off-peak hours). If specific capacity constraints exist, utilities can offer customers near real-time price incentives to reduce consumption. This leveling of demand in turn allows for greater management of the supply. This impact of more accurate management of peak loads can mean substantial improvements in the high costs of buying electricity on the open market where electricity costs might be two to three times higher than normal.

Distribution Network Management

Making educated assumptions about future usage is one the most important uses of the data collected by AMI. It provides extremely useful information that helps utilities to more accurately size new transformers and circuits to match peak load conditions. Utilities using AMR data to plan new distribution networks have cited savings of up to two percent of the total cost of the project. Additionally, it provides information about factors stimulating peak consumption, which can be translated into business strategies such as proactive load management, outage prevention and consumer incentive programs, as well as optimizing distribution network planning. By feeding the AMR data into the utilities outage management system (OMS), outages are detected more quickly, the source problem is identified faster and restoration efforts take less time. These benefits can be translated directly into cost savings (in overtime) and greater customer satisfaction.

Variable Pricing Structures

Ultimately, AMI enables price structures to better align to customer usage – so those consuming energy at peak times are charged more. This places the proper price incentives for the efficient use of energy. Monitoring energy usage electronically on a daily, hourly or almost real-time basis creates the opportunity for services like variable pricing to encourage off-peak usage with reduced rates to customers. Most current pricing schemes actually hurt the efficient energy users by forcing them to pay rates that essentially subsidize inefficient energy users. By using pricing structures that better reflect what the utility pays for the electricity, efficient energy users are rewarded and inefficient users are penalized. Thus, the incentives for efficient energy use by all consumers are in the proper place.

Improved Data Quality

Automated, remote data collection streamlines the back office processing for billing, asset management and outage management. Machine-to-machine data transfers increase the quality of data collected by eliminating misreads, transcription errors and data recording errors. With AMI, it is no longer necessary to manually access "hard to reach" meters or reschedule meter readings. Improved data integrity eliminates the need to investigate, correct and reissue disputed bills. This increase in meter reading accuracy significantly reduces billing errors and customer disputes.

Shorter Billing Cycle and DSO

Replacing the traditional meter reading with AMI shortens the billing process by reducing the time and the number of steps between consumer usage and bill distribution. Cash flow is increased by an average of two days, thus decreasing daily sales outstanding (DSO).

Reduced Load In Call Centers

Most incoming calls are about billing errors, rescheduling meter readings and/or reporting outages. Accurate remote data collection and interactive voice response (IVR) technology can replace long hold times with instant, automated information. Instead of customers waiting to report an outage, utilities can proactively tell customers which areas are affected and the estimated duration. These efficiencies reduce call center costs and allow staff to provide better customer service.

Customer Intelligence

Without AMI, most electric bills simply provide consumers with a rate and total usage. In contrast, most telephone companies offer customers online access to itemized bills, which include the number of calls made, the time, date and duration of every call, the names and numbers of the people that were called, and the tariff used for each call. AMI provides utility companies the opportunity to increase customer satisfaction and consumer confidence by providing this same level of detail on the customer's energy usage.

AMI technology offers utility companies valuable insight into customer usage, including consumption behavior, effects of external variables and outages. Data collected at 15-minute intervals can be used for profiling

usage, time-of-use data, demand management and phase-load balancing. Both the customer and the utility are able to find out how electricity is used within the home. The knowledge of the customer's usage improves the call center agent's ability to work with a customer to understand his or her bill, which in turn increases customer confidence in the billing process. Additionally, the customer has the tool to adjust their usage to minimize their charge for that usage. Those who take the time to understand their usage can be rewarded with lower energy bills. The overall results are improved quality of service and shortened response times to outages.

Revenue Protection

AMR data can be used effectively to reduce theft. Load profiling can identify "strange" usage patterns (e.g. zero usage on weekends). Meters that run backwards can be readily identified. Remote disconnects can guarantee there is no usage on meters. Pre-payment options can be put in place to control usage on poor credit risks. Meter measuring usage at substations can be compared to the aggregate load from all the meters served by the substation to identify significant energy losses. AMR provides many tools to protect the utilities' revenue.

New Revenue Streams

AMI provides opportunities to turn knowledge into a competitive advantage. Energy and water providers need to look beyond their traditional roles as a conduit for utilities in order to generate new revenue streams. The right advanced metering infrastructure can be used to provide services for devices in the home. Examples include home security and appliance diagnostics, allowing the utility company to collect a fee from these other companies for usage of the infrastructure. There are several business models that can be employed here. The utility can enter into the new business themselves. They could also enter into a joint venture where they supply the network and the other company runs the business. Alternatively, the utility could "rent the network" from a current provider. All three business models offer opportunities for new revenue streams.

It's All About the Data.

AMI will help in the short-term to meet EPACT regulations; however, it will be essential to understand the uses for AMI in order to improve overall business operations. In the longer-term, utilities that develop an AMI technology platform and use the new data to improve business will remain competitive. When implemented and used properly, an AMI solution can help a utility improve business operations management, better manage customer energy usage and manage energy resources. Those utilities that learn to use the data will have the competitive advantage in the future. ■

About the Author

EDS Energy industry executive Bill Zorn specializes in Advanced Metering Infrastructure (AMI). With more than 28 years of delivery, sales and consulting experience in systems and services, Zorn is considered a subject matter expert in Automated Meter Reading (AMR) and Advanced Metering Infrastructure (AMI). In addition to his expertise in the energy industry, he has considerable expertise in the manufacturing industry as well as experience in corporate and divisional business planning, management, sales, delivery and consulting.

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AMR: Are We Trapping Utilities with Technological Myopia?

By Steve Metcalf, Business Development Manager, Hunt Power

Since its inception, electrical production has driven new technologies, and entire industries have sprung from our nation's abundant supply of reliable and relatively inexpensive power. It's no surprise that electric utilities continue to embrace technology to systematically improve their efficiency, especially as fuel costs vary day-to-day.

Today, automated meter reading (AMR) solutions promise to revolutionize the industry with downloadable, automated meter data that reduces costs and strengthens customer's service for those in inaccessible locations. Energy providers are revamping their business practices to download meter data automatically rather than by manually reading meters, thus reducing costs and customer service challenges that arise from estimating data from remote locations. These factors result in enormous industry impact.

At the same time, AMR manufacturers have added system features in recent years and utilities are getting even more value for their investment. Utilities can now meter and monitor substations, gather data, and gauge electricity supply and demand for an array of core business applications. Advanced AMR features include outage notification, brownout warnings, load research, energy management and more. The options along the evolutionary migration path of AMR continue to grow. Satellites, which began in the early 1970s to send communications networks into orbit, now provide remote meter reading to electric utilities and service companies as diverse as Caterpillar, GE and the U.S. Coast Guard.

Management, who is responsible for making AMR technology decisions at electric utilities, must attempt to balance the downstream interests of the company against an abundant supply of elegantly engineered products promising to make work faster, cheaper and easier. For some, analysis paralysis can set in.

Go Straight to the Source

Many investor-owned utilities, municipalities and cooperatives have explored a variety of AMR technologies in their efforts to optimize processes with a best-fit solution. Existing deployments have occurred across a wide chasm contingent on a variety of factors. According to industry research, some companies register as little as one half of one percent AMR coverage, and more aggressive companies can reach as much as 85 percent of the customer base with the technology. Accuracy, reliability and data security always rank highly on the list of criteria for choosing AMR technology and rightfully so. By listening attentively, you can also hear a deeper-rooted skepticism.

Open-ended dialogue with decision makers shows a common theme of frustration with AMR's rapid advancement and impending obsolescence. For some, it seems that every quarter bestows some new technology that could reshape the future value of AMR. Satellites have a lifespan of more than 10 years, but not all technologies hold up the same. Energy providers that are accustomed to choosing technology with an ROI over a 10- or 15-year lifespan are exploring uncharted territory in much of the rapidly changing AMR world.

Choosing a solution becomes the corporate equivalent of investing personally in a quality digital camera or a new cell phone. With prices dropping and features rising, you don't know where or when it's best to jump in. Common sense says that if you wait until you find a technology that's not going to be obsolete, you're in for a long wait. AMR purchasers are no different. They want a reasonably affordable, easy-to-grow-with technology that will not need to be replaced anytime soon.

Another emerging trend is that more buyers are asking about greater interoperability or common standards across today's discordant metering systems and communication devices. As productivity and the growing use of

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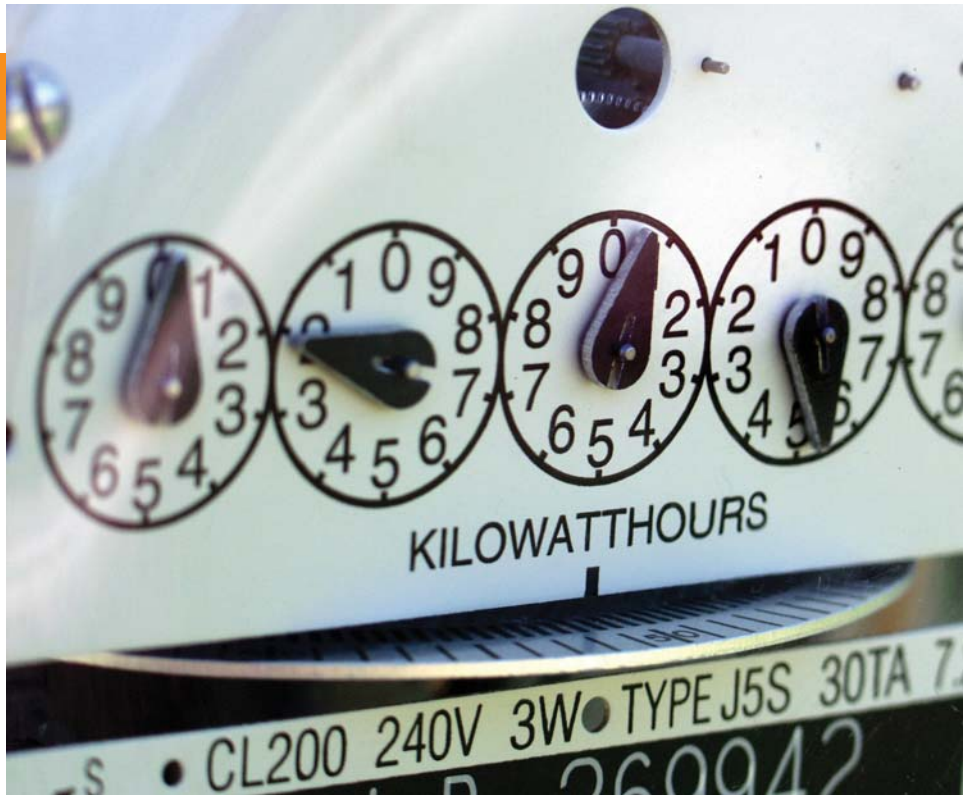

information and communication technology are further emphasized, it is clear that electric utilities desire more open architecture and compatibility over time.

Technological Myopia

For utilities considering AMR solutions today, there seems to be an inverse relationship between a wealth of available technology features and the level of certainty experienced in choosing an AMR solution. Ironically, AMR solution providers publicizing every incremental advance and product evolution only make it more difficult for the market of energy providers to decisively launch an AMR deployment plan.

The evolution of AMR can cause decision makers to become myopic and narrowly focused as new technologies and features are constantly introduced. Utilities, which tend to err on the side of caution, choose familiar solutions that other utilities have implemented or ones with proven technology history. Inevitably, the convergence of technology rewards those who wait, with the next state-of-the art solution and state-of-the-art implementation headache. That may be why an estimated 85 percent of the market is still awaiting conversion to AMR. While they do, a large segment of commercial and industrial customers are left unattended to look elsewhere for valuable energy management information.

In reality, choosing an AMR technology is more about measuring your options against the unique needs you are fulfilling and the unique customers you are serving today. Utilities should remain flexible in trying new solutions. As a trend, most AMR deployments will include a mixture of viable technologies to support residential and C&I customers, from RF to power line carrier to satellite service.

AMR in the Field

The unique needs of one investor-owned electric utility (IOU), serving the northern plains of the U.S., result from substations located in hard-to-reach and very remote locations. Despite this challenge, the IOU desired a timely and efficient way to provide daily load data from the substation's meters. The data, used for system optimization, load forecasting and determining system load, was in some instances taking up to six weeks to be delivered. This was also problematic because the IOU's independent system operator required daily system reports to forecast the next day's total load.

This IOU narrowed down the field of solutions based on the remote nature of its substations. Plain Old Telephone Service (POTS) was dismissed due to high monthly service charges and the fact that it was prone to lightning damage. The local cellular providers, anticipating the obsolescence of the service, discouraged the utility from pursuing analog cellular communication. Digital cellular service that might have been a good option normally was not, as its network footprint in the company's service area was very small.

The IOU ultimately chose satellite, the newest technology for AMR, and initially installed satellite kits at 165 substations to remotely collect interval data from its meters. Remote installation of a satellite kit is similar to a digital cellular phone installation. Only a whip or similar antenna needs to be mounted outside, and there is no cumbersome satellite dish involved. With installations complete, the utility began receiving data from its distribution substation metering sites back to the central MV-90 system. Using an FTP link right to the system, the data push was automatic.

The overall results have been positive, with a noticeable impact on efficiency and productivity, especially with the elimination of the six-week delay in determining system load data. With reliable 15-minute interval data being delivered daily, the IOU is now able to analyze its system load efficiently and accurately, and deliver timely data to the region's independent system operator (ISO). An added benefit discovered by the utility was that its engineers could use the satellite data to monitor their substation transformers. This allows the utility to ensure transformers are properly loaded, thus reducing costly repairs and keeping customers out of the dark.

With 96, 15-minute data packets being delivered daily, the utility does not need to communicate with its recorders directly or on-demand. They feel the increased AMR reliability offered through the satellite service continues to help the IOU focus on its core business and become a more efficient power company.

Conclusion

AMR manufacturers are certain to continue innovating and bringing new business value to the table and satellite technology is just one example of that. While the future of AMR technology may be difficult to predict, it continues to hold great promise for higher productivity, reduced costs, increased performance, and enhanced profits.

An underlying benefit sure to be identified quickly is an enhanced utility-customer relationship. Through energy measurement, analysis and control, AMR manufacturers' solutions improve that relationship. These quantifiable economic results at or near the point of energy consumption allow customers to satisfy regulatory, corporate and institutional requirements. It's also a feasible option to help utilities and customers identify and solve energy usage problems; update utility demand response programs to make them more responsive to customer requests; and validating and marketing customer-facing energy conservation programs.

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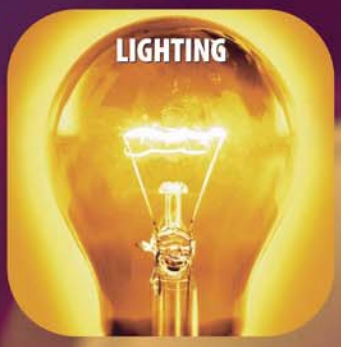

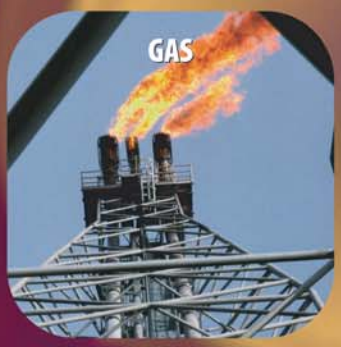

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In the final outcome, AMR technology will help electric utilities continue to kindle American industry with reliable electricity and a better way to manage it more efficiently than ever.

Avoiding Myopia: Technology & Communications Options For AMR

Dedicated Phone Line

- Can be costly on a monthly basis
- Requires costly installation
- May not be practical, especially when conduit or trenching is required
- Can be a location challenge for utilities in remote or rural locations, where installing a traditional phone line can be both expensive and a tumultuous event
- Can be rendered useless in an emergency, natural disaster or terrorist attack

Cellular Phones

- Can have intermittent issues with dependability - meters are stationary, so not every meter location will be able to receive a strong cellular signal, which can also change from day to day
- Are not always available in rural areas – digital services, for example
- Have systems that are constantly being upgraded, which goes against utilities' capital investment strategies – analog cellular networks, for example, are now being phased out
- Work off of towers - in many cases must be located a few miles apart
- Towers continue to be upgraded causing new dead zones that can leave some meters without a communications line; stranded meters must be read manually

Satellite Communications

- Remain in constant contact with the meters' radio modules, making them more reliable
- Worldwide coverage, can communicate with remote and hard-to-reach locations
- Are now affordable, but were cost prohibitive in the past
- Designed to transmit data seamlessly
- Installed similarly to an industrial cell phone, which is lower in cost and faster
- Can make a huge difference for utilities in their own transmission and distribution (T&D) operations such as substation monitoring
- Reliable daily communication allows some utilities to capture never before available energy usage information

Power Line Carrier

- Two-way, utility-owned fixed network for meter data collection
- Must use repeaters to communicate with very hard-to-reach locations
- Different communications media is required to get data from the substation to the host computer
- Higher bandwidth needed to prevent congestion as operational elements are added
- Prone to power line noise that can interfere with communications
- Advanced AMR capabilities are very limited because the communications is very slow, and the cost of substation equipment to support this type of network is quite high

Additional resources on AMR:

- AMRA
  http://www.amra-intl.org
- American Public Power Association
  http://www.appanet.org/
- US Department of Energy Office of Energy Efficiency and Renewable Energy
  http://www.eere.energy.gov/
- Federal Energy Regulatory Commission
  http://www.ferc.gov/
- Institute of Electrical and Electronics Engineers
  http://www.ieee.org/portal/site
- National Rural Electric Cooperative Association
  http://www.nreca.org/ ■

About the Author

Steve Metcalf, Business Development Manager for Hunt Power, works with utilities to provide comprehensive demand-response programs and energy efficiency solutions. For 26 years, he has worked with numerous utilities throughout the U.S. Mr. Metcalf received a master's degree in administration from the University of Northern Colorado.

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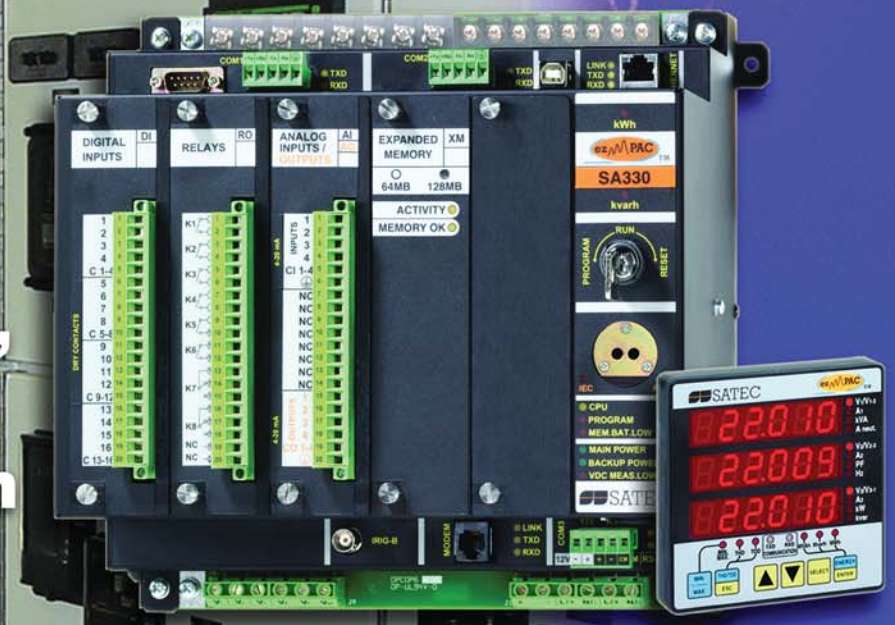

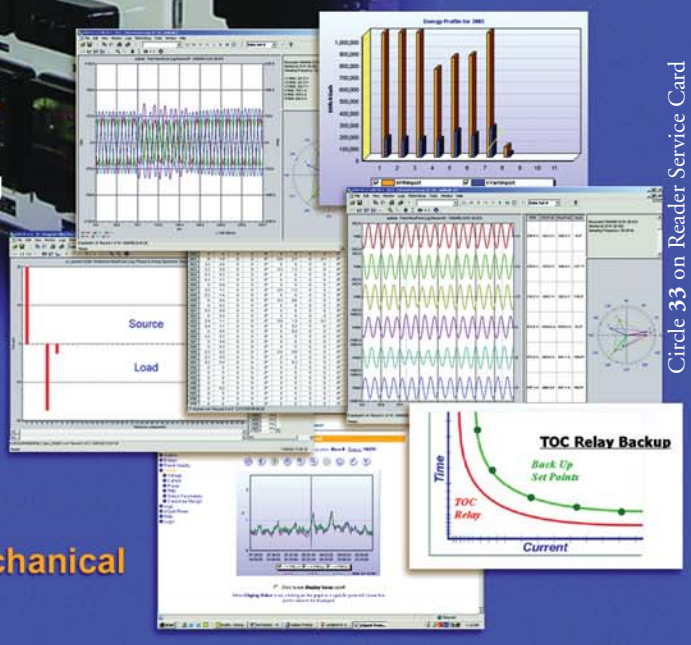

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