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Electric ENERGY T&D MAGAZINE

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Plus

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Construction of Path 15, Western Area Power Administration.

Electric Energy T&D MAGAZINE

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BECAUSE
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"January 9th, 2003, began like almost any other day -- but would end like none I've ever known. By midnight, I would be in intensive care, fighting for my life."

> "While working on switchgear, I took 14,400 volts and lived to talk about it."

"I was burned over 40% of my body ... had been airlifted to the nearest hospital ... and then transferred to a burn center. The prognosis was uncertain, but I was still breathing and still had a fighting chance.

If it hadn't been for the Bulwark protective apparel I was wearing that day, my burns would have been 3 times as severe, and no one would be reading this.

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And thank you, Bulwark."

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The Need For A Collaborative Electricity Agenda

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

Since its introduction over 125 years ago, electricity has provided the energy behind dramatic growth, our thriving economy, and our enviable standard of living.

The construction of the first generation, transmission and distribution facilities had a phenomenal impact on the lives of citizens. Understanding how electricity so quickly and definitively transformed our lives is fundamental to understanding the role electricity continues to play, and how that role will unfold in the lives of our children and future generations.

Our rich electricity tradition continues today, as our industry refines and redefines itself to meet the new challenges shaping our world in a responsible manner, and with the interests of our communities at heart. Meeting new demand must be approached through sustainable, reliable, secure and cost-effective ways, and this can only be achieved through a common agenda between industry and government. As electricity demand continues to grow, we must build on our strong foundation through collaboration and innovation to ensure our future electricity supply.

Decisions to Meet Future Demand

When our electricity infrastructure began to take shape in the late 1800's, the lives of citizens were transformed by such innovations as the telegraph, incandescent lights, streetcars, the electric oven, movies and radio, to name a few. In the case of Canada, from 1920 to 1960, the demand for electricity grew by about 7% each year, forcing utilities to double their grids sixteen times over. Commercial demand, especially in the retail trade and service industry, jumped 600% from 1957 to 1974. As our economy and lifestyle continued to require more and more power, the trend persisted. From 1990 to 2003, Canada's total domestic electricity demand grew by 19.2%. Despite gains in energy efficiency, national demand is projected to grow at an average annual rate of 1.0-1.5%..

In order to meet electricity needs over the next 20 to 30 years, the electricity sector and government must collaborate on an effective electricity policy framework. We need to build to meet future demand growth, as well as upgrade or replace aging generation, transmission and distribution capacity built over the last 50 years. Replacing or refitting old power plants, achieving environmental approvals to build new facilities on new sites, ensuring the transmission and distribution infrastructure keeps pace with electricity generation, and developing new technologies to minimize environmental impacts and maximize efficiency all take time and significant capital investment. If we do not succeed today in attracting the necessary investment to finance tomorrow's electricity infrastructure, our competitive economy and standard of living may be at risk.

The Investment Imperative

Current generation, transmission and distribution decisions must be made to meet this future challenge in a context where a significant portion of the existing infrastructure will be retired or renewed over the forecast period. Despite the clear need for investment in the electric power sector, recent capital expenditures in electric power production, transmission, and distribution have remained relatively flat since the mid 1990s, in contrast with capital investment in the oil and gas sectors.

Investment in generation must account for both refurbishment of existing facilities and the addition of new capacity. Given long planning and construction lead times, ensuring an efficient, diverse and reliable power supply for tomorrow depends on investment decisions made today.

Meeting future electricity demand will mean new generation in addition to energy efficiency and demand side management (DSM) measures. To ensure sustainability and reliability, this new supply will also need to be met by a broad spectrum of fuel types. Opportunities for fuel diversity will vary significantly across regions, depending on a range of factors, including fuel availability, geography, environmental concerns, technical feasibility and reliability, market structure and political climate.

Meeting demand into the future will also require significant investment in transmission and distribution infrastructure. Investment in new generation is predicated on a reasonable expectation that power can reach consumers cost-effectively. As it becomes increasingly difficult to acquire new rights of way for green-field transmission, the sector must also invest in new technologies in order to increase the capacity of existing transmission corridors and to optimize the regional grids. As the August 2003 blackout clearly illustrated, a reliable transmission system is vital to serve both the domestic and North American power markets.

The IEA estimates that the investment requirement in transmission and distribution in Canada and the United States will reach US$910 billion by 2030. Such investment is critical in delivering electricity to market. The Conference Board of Canada recently identified a number of impediments to investment in Canada's transmission infrastructure, although they apply to non-transmission assets as well. The obstacles include: long planning horizons to obtain regulatory approval; low regulated rates of return for investors when compared to the United States; difficulties in acquiring capital financing; and regulatory uncertainty in the face of continuing market restructuring.

The International Energy Agency (IEA) estimates that over the next 30 years, the need or investment in the electricity sector worldwide will approach US$10 trillion, with US$1.7 trillion required in the United States and Canada.

Distribution Systems: Into the 21st Century

Our existing distribution infrastructure was designed to move electricity one-way from transmission lines to end-use consumers prior to the astounding advances of the information age. Because the end-use market consumer is increasingly digital-dependent, the current distribution system is challenged to deliver high-value bundled services to an increasingly segmented consumer base, for instance, by delivering in the future both electric and telecommunication technologies such as broadband over power line (BPL) communications.

Distribution utilities must adapt to stay competitive in this new environment. To survive, the distribution system will need to manage electricity flows in real-time using an intelligent, reliable, two-way distribution infrastructure to support a digital society. The power network of the future will be real-time, responsive, adaptive, eco-sensitive, flexible, price-smart, self-diagnosing, self-healing and interconnected. Meeting this challenge will require significant investment in such initiatives as distribution automation and automated metering technologies (AMT).

Governments at all levels are continuing to push distribution companies for improvements in reliability, cost of service, power quality, consumer service and safety. The regulatory treatment of industry investment in technology does not always encourage innovation, and this lack of investment is problematic as the distribution infrastructure ages.

CEA is recommending a distribution utility/supplier/government partnership to accelerate innovation, investment and implementation for electricity distribution infrastructure automation, AMT technology, BPL communications services, distributed resources interconnections, as well as regulatory innovation in support of sustainable development, customer choice and economic opportunities.

Innovation, Improving Efficiency and Reducing Environmental Impact

At the present time, there is no technology available to deliver electricity at the scale society requires without having some impact on land, water, air, habitat, and/or local communities. A diverse generation mix grounded in regional resources and opportunities, and backed by robust transmission and distribution systems, will best serve the needs of customers in all regions for reliable, affordable, low environmental-impact electricity.

Due both to natural regional endowments and the economics in favour of maintaining a diverse fuel portfolio, electric power production in Canada is a multi-fuel exercise. Hydroelectric power's prominence in Canada (providing 60% of Canadian electricity versus 7% in the United States) means that significant Canadian energy requirements are met without producing greenhouse gases (GHGs) or air emissions. Nuclear generation also has an important role to play in managing the sector's GHG and other air emissions, as it provides approximately 13% of the electricity generated in Canada, and 21 % of the electricity produced I the United States. Investments in low-emitting technologies such as clean coal, CO2 capture and storage, and highly efficient Combined Cycle Gas Turbines also promise a cleaner and exciting future.

Overall, our sector is intent on reducing its environmental footprint, which is dependent in part on regional endowments. An important first step is to ensure there is an accurate measure of our industry's environmental impact. One example of this is CEA's Environmentally Preferable Power Task Group which, in cooperation with Natural Resources Canada, is undertaking a major study aimed at measuring the environmental performance of a range of generation technologies within specific regional settings. In order to decrease the sector's overall impact, we must support ongoing efforts to improve the performance of existing technologies, and also support new technologies that have a smaller footprint. We encourage opportunities for market access of energy generated from emerging renewable energy sources (e.g. wind, solar, biomass, biogas). CEA member companies, over the course of the last decade, have become the pre-eminent developers of wind power in Canada. This trend shows every sign of continuing as members advance major wind projects right across the country.

Advancing the Agenda

In order to sustain our competitive electricity advantage into the future, governments and the electricity sector need to collaborate on a sound public policy agenda that will ensure adequate supply, encourage efficient use of our energy resources, and promote environmental sustainability. This will necessarily involve a renewed attention to investment in the electricity sector. Refurbishing existing infrastructure, building new facilities to meet future demand, supporting technological innovation, and ensuring the viability of a skilled labour force are key issues on which industry and government must collaborate. ■

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Improving Business Operations with Smart Metering Systems

Irvin Lane at Orlando Utilities Commission (OUC) talks about how they improved the bottom line through state-of-the-art technology

OUC has been serving commercial and residential customers with friendly, dependable, electric and water service in and around Orlando for more than 80 years. The company's goal is to provide the most reliable service, at rates among the lowest in Florida. Called OUC -The Reliable One - they live up to their name with the best record of electric reliability in the state and by delivering high-quality, award winning drinking water to their customers.

Throughout its history, OUC has a record of forward-thinking expansion to improve service. "Faced with Orlando's steady growth rate, we recognized the advantages of automated meter reading (AMR) technology to streamline operations and maximize productivity," said Irvin Lane, OUC manager of electric metering. "We wanted a solution that would expand easily and enable us to enhance customer services in the future."

In January 2004, OUC installed Elster Electricity's EnergyAxis® System to fill the gaps in a comprehensive automated meter reading (AMR) strategy. Said Lane: "We were using A2 ALPHA® meters with internal modems to automate demand meter reading of commercial and industrial (C&I) accounts." For light commercial and residential automated meter reading OUC selected Elster's EnergyAxis System with REX® meters and A3 ALPHA® meter collectors.

"This system has enabled us to begin to automate the residential meter reading process and make daily demand readings," Lane said. "Plus, we now have the ability to remotely connect and disconnect service at the meter, and have the capability to automate water meter readings in the future."

OUC cites several factors driving its decision to deploy the EnergyAxis System with smart meters. "First, we have a strong business relationship with Elster Electricity and have worked with them over the years when they were formerly ABB Electricity Metering and Westinghouse," Lane said. "And we worked with them in the development of their ALPHA® meter line."

The utility also has a successful metering alliance with WESCO – Elster Electricity's major distributor in North America – so the purchasing process for meters was already in place.

"We tested the system and found that the communication technology offered by the EnergyAxis System was excellent. Its smart meters were capable of delivering very reliable daily meter reads," Lane said.

The self-registering mesh network technology simplifies system expansion to the task of installing additional meters. No additional equipment or network infrastructure enhancements such as pole mounted data collectors are needed to expand the system.

"The repeating technology used by the REX meters really optimized the communication network and consistently gave us reliable meter reads," Lane said. "And we found the frequency-hopping technology very reliable, allowing us to cover large populated areas with virtually 100 percent successful meter reads every day," Lane said.

System Deployment

OUC initially deployed 500 REX meters in two locations, an entire apartment complex and an OUC facility in the Orlando area. By September 2004, they had expanded the system to an adjacent trailer park and house meters at another apartment complex. The system now covers one square mile with approximately 914 meters communicating with one collector.

OUC is very pleased with how well the EnergyAxis System's spread-spectrum frequency-hopping communication technology works. "In our initial deployment we found that REX meters were able to communicate with A3 ALPHA meter collectors that were a half-mile away. And although the meters installed in the trailer park have meter sockets placed inside metal boxes, called Walker boxes, the REX meters have no problem communicating with the A3 meter collector," Lane said. In the apartment complex, REX meters are installed in meter rooms with metal louver doors and OUC reports no problems with meter communication.

Based on the success of the pilot project, OUC has plans to deploy additional REX meters in this fiscal year and to begin using the remote connect/disconnect feature on the REX meter. Approximately 500 of the meters with the remote connect/disconnect feature will populate an apartment complex in another geographical location. Lane says the next step in their AMR deployment is to commission a full time Metering Automation Server (MAS) to handle the load of several thousand meter reads daily. The utility also plans to move monthly billing data from the MAS server into its Customer Information System to automate monthly billing for these meters. All it takes is a single telephone call to the A3 ALPHA meter collector for the MAS server to collect data from REX meters on the local area network.

In Central Florida, a significant number of residents live in multi-family apartment units, with the turnover rate at some apartment complexes averaging 50 percent annually. Many apartment complexes have what OUC calls Leave Service Active (LSA) accounts. These customers prefer to leave the electrical service on when an apartment is vacant so they can do repairs and maintenance., With the EnergyAxis System, OUC expects to see a significant savings in operational expenses by eliminating the need to send a meter reader to do off-cycle meter reads on LSA accounts.

From left to right: Stan Cording, Analyst-Meter Data Management Team, Irvin Lane Manager-Electric Metering, Jay Peacock, Meter Technician I.

Going forward, OUC also plans to use the remote connect/disconnect feature in apartment complexes without LSA accounts.

Automated meter reading is helping OUC with its revenue protection efforts - the utility is finding that frequent meter readings can help detect and prevent meter tampering and even identify meter failures.

"With the EnergyAxis System we are able to read meters daily, do monthly billing reads, and remotely reset demand on meters within the system every month. With over 200,000 electric meters in the field, the potential benefits of deploying a successful AMR system at OUC are huge."

About the Interview

Irvin's commentary was written as told to Sheridan Becht from OUC.

Irvin Lane is the manager of OUC's electric meter section. He has 15 years of experience in electric metering and holds a bachelor's degree in electrical engineering from the University of South Florida. He is a member of the Southeast Electricity Metering Association Executive Committee.

EnergyAxis System Technology

The EnergyAxis System is a powerful, intelligent two–way, 900 MHz radio frequency (RF) network for metering communications. The EnergyAxis System consists of the EnergyAxis Metering Automation Server (MAS), REX meters, and A3 ALPHA® meters that act as local data collectors.

Metering Automation Server

The MAS server communicates with A3 ALPHA meter collectors via a public wide area network (WAN). The A3 ALPHA meter collector uses a two-way radio frequency communication system to communicate with Elster's electronic single phase REX meter meters within the two–way RF local area network. The REX meters read billing data, instrumentation data, demand, and change energy reads, time-of-use rates, start or stop load profile interval recording, and initiate service connects and disconnects.

A3 ALPHA Meter Collectors

Each A3 ALPHA meter collector contains an internal telephone modem and a local area network (LAN) option board with two–way 900 MHz transmit and receive capability. The collector is the interface between the Metering Automation Server and the 900 MHz radio frequency network of REX meters. Collectors are installed at residential or commercial meter locations. Thus, collectors perform two functions in the network, acting as a meter and as a data collector for a group of REX meters.

REX Meter

The REX meter is an electronic, single phase electricity meter with remote communications that is designed for residential metering. The REX meter is designed to be a component of the EnergyAxis System which provides two–way communications to the meters for selecting metering functionality, collecting meter readings, performing voltage monitoring, reading status and error messages, and controlling an optional internally mounted control switch. The REX meter allows users to read demand and kWh consumption, check the line voltage at the meter, and do remote service connects and disconnects.

About OUC

OUC is owned by the city of Orlando, and serves more than 196,000 customers in Orlando, St. Cloud, and parts of unincorporated Orange and Osceola counties. OUC delivers more than 7 trillion kilowatt hours and 31 billion gallons of water to its customers per year. Visit OUC's website at www.ouc.com

About Elster Electricity, LLC

Elster Electricity, LLC, a subsidiary within E.ON's Ruhrgas Industries, offers integrated, cost-effective solutions including advanced electricity meters, communication solutions and metering automation systems for residential and commercial and industrial applications. Elster Electricity (formerly ABB Electricity Metering) is located in Raleigh, North Carolina and is a leading provider of electricity metering products and services throughout the world. Designed to meet the diverse electricity metering requirements of a global customer base, Elster's metering products include advanced high accuracy ANSI and IEC electricity meters, the EnergyAxis System with intelligent two-way communications featuring the new electronic REX® meter, and the ALPHA® meter line. Elster Electricity serves customers through a global sales force.

Visit Elster Electricity's website at www.elsterelectricity.com. ●

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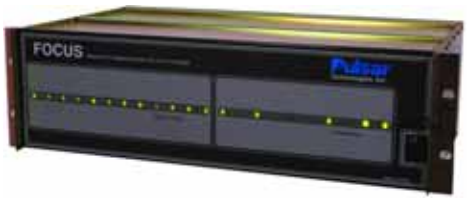
Pulsar Technologies, Inc. Introduces Fractional T1/E1 Channel Modules for FOCUS



CORAL SPRINGS, FL – As a result of continued demand for increased data channel bandwidth, Pulsar Technologies, Inc. has released a group of fractional T1/E1 modules. Fractional T1/E1 channels are used for protective relaying, video, security and Ethernet.

Fractional T1/E1 modules provide data circuits, or channels, over which you can transmit and receive data at bandwidths greater than the standard, single DS0 (64kbps). A variety of electrical and fiber interfaces are available including RS-422, V.35 and IEEE 802.3 electrical interfaces along with IEEE C37.94 fiber interface.

FOCUS 6NR (RS-422) and 6NV (V.35) modules can be used wherever synchronous bandwidth from 64 kbps to 1,472 kbps (N = 1 to 23) is desired. Operating as a synchronous pipeline, the 6NR/6NV channel does not process the data passing through it. Since the data is not processed, there are no concerns about data protocols or formats.

The 6NF (IEEE C37.94) module provides protective relay data circuits, over which you can transmit and receive data at bandwidths from 64kbps to 768kbps (N = 1 to 12). The 6NF module is supplied with an IEEE C37.94 compliant 850nm optical interface.

6NE is also a fractional T1/E1 module used to extend the corporate Wide Area Network (WAN) at data rates from 64 kbps to 1,472 kbps (N = 1 to 23). Any Ethernet compliant (IEEE 802.3 protocol) devices connected through FOCUS form the WAN extension. 6NE is unique in that it has Ethernet-inherent packet switching and multiplexing abilities capability, which allows a substation with numerous devices, to communicate through the FOCUS system to the corporate WAN. The 6NE module offers an option for two inde-pendent channels for chaining a WAN to many locations that requires only one module per location.

For more information on FOCUS, fractional T1/E1 modules and to see our full line of substation communication products, including our new UPLC Power-Line Carrier, please visit our website at www.pulsartech.com. ●
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Powel-MiniMax Unifies Utility Operations

UDSP Software Suite Provides Immediate Engineering Analysis and GIS Results through a Single Database

DENVER, MARCH 8, 2005 — Powel-MiniMax Corporation today demonstrated the ability to run Electrical Engineering Analysis and GIS from a single data source through their new suite of software, Utility Decision Support Platform (UDSP). UDSP's shared database and single user interface allow utilities to run multiple engineering calculations directly from their GIS, providing immediate graphical and tabular results. The company exhibited the new UDSP solution at the Geospatial Information & Technology Association (GITA) 2005 Annual Conference in Denver, Colorado.

Utilities will now have the ability to maintain electrical and geographical models in a single user interface. Before UDSP, most utility companies completed engineering calculations through a lengthy process of imports and exports between point solutions with conflicting data sources and interfaces. This process, which traditionally took hours to complete, will now take only seconds through UDSP.

"Powel-MiniMax's UDSP solution finally brings practical application convergence to GIS," said Corey Maple, CEO of Powel-MiniMax. "For example, utilities are now able to run Electrical Engineering Analysis within a GIS, along with multiple additional applications on one common platform. Imagine instantly calculating the load flows and voltage drop on your system as you switch feeders during an outage and showing over-limit conditions right on your maps."

Maple continued, "By establishing a platform, utilities can now have universal access to accurate data. Our single source approach already provides a comprehensive suite of powerful applications for over 1,200 utilities worldwide – UDSP is revolutionizing the way utility companies access information and make decisions."

UDSP provides a revolutionary universal source for integrated data, from planning through operations, all accessible from the field or the office. Powel-MiniMax configures each UDSP database to the specific needs of the utility, allowing for customized access to all critical business information and making possible more informed, real-time decisions. The software modules of UDSP are available separately or as part of an integrated platform. ●
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New URD Trouble Shooting Technique with the EZ-RESTORE™

There is a strong trend within the utility industry to make trouble shooting of underground power cable faults less time consuming, shorten restoration times and achieve a more favorable SAIDI index. (29)

Most trouble shooting situations involve one of two commonly applied methods, checking of fault indicators or Hipot testing of cable sections. Both methods require the trouble man to go to each transformer, which is time consuming, especially in back-lot situations. (40)

The **EZ-RESTORE™** allows a trouble man to quickly and easily identify and isolate a faulted span or section of underground cable and restore service as quickly as possible. The **EZ-RESTORE™** provides an alphanumeric readout to identify the location of the fault in relation to the 2 closest transformers. The **EZ-RESTORE™** is the first unit worldwide, which displays the relevant trouble shooting information in alphanumeric form. The basis is a

patented algorithm, which together with a proprietary software interprets the combination of 2 TDR generated and digitized fault locating traces. (82)

The use of a TDR based sectionalizing approach eliminates the need to have to go to each transformer. Typically the trouble man will connect the **EZ-RESTORE™** at the first transformer from the riser poll and "shoot" towards the normal open point. In case where this section contains 6 or more transformers it should be broken up in 2 sections with 3 to 5 transformers each. In this situation the trouble man hooks up in between and performs 2 tests, shooting back to the riser poll and shooting to the normal open point. (86)

The EZ-RESTORE™ is a fully self contained, battery operated and weatherproof unit. The entire test sequence is microprocessor controlled and initiated with 2 push buttons. The alphanumeric display will indicate the fault by placing its distance footage in between the 2 transformers, which are nearest to it. (44)

Because of the fully automatic high voltage (12kV) test sequence special safety features have been built in the hardware to protect the operator. (22)

The technology is protected by US Patent # **Patent No. US 6, 683,459 B2** and a Trade Mark Registration for the name EZ-RESTORE has been applied for. ●

Circle 65 on Reader Service Card

Hunt Technologies' Time-of-Use AMR System Approved by Measurement Canada

PEQUOT LAKES, MN – March 24, 2005 – Hunt Technologies, Inc. announced today that Measurement Canada has approved the TS2 CENTRON endpoint for kWh, kW and time-of-use metering in Canada.

(View more information at http://www.turtletech.com/canada.aspx.)

"Measurement Canada's approval of our TS2 System and the TS2 CENTRON endpoint provides additional opportunities to improve customer participation in energy conservation and load shifting programs while reducing the utilities operating and management expenses," said Hunt Technologies COO Todd Headlee.

Hunt's TS2 System delivers daily kWh consumption, peak kW demand in 15, 30 or 60 minute windows. Further, each TS2 equipped CENTRON® solid-state meter supports aggregation and transmission of time-of-use consumption and demand billing determinants based on customer-specific rate schedules. This feature allows utilities to offer customer-specific, time-of-use pricing plans designed to promote energy conservation. Time-of-use pricing programs were tested in California, successfully demonstrating load shifting can be accomplished in both residential and commercial market segments.

Tom Damon, regional sales manager in Canada for Hunt Technologies, Inc., said the TS2 System is one of the most efficient and economic AMR applications available for suburban and rural populations. "Hunt's exclusive "Always On" communications provides superior outage detection capability as compared to alternative PLC based processes which require frequent customer meter polling throughout the day," he said

The TS2 Turtle System uses two-way power line carrier (PLC) technology to communicate over existing power lines, eliminating the added cost of installing a dedicated RF network or phone line. Hunt's solution provides enhanced customer service through accurate billing and detailed time-of-use consumption patterns, as well as:

• continuous, customer specific outage detection and restoration monitoring;

• load control and energy management program capabilities;

• remote service disconnect and reconnect options;

The CENTRON is the first of many new solid-state meter applications Hunt will be offering in Canada. Several additional meters coupled with the TS2 System are in various stages of gaining Measurement Canada approval. Hunt's goal is to maintain meter platform independence, allowing utilities to select from the variety of available meter options. ●

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Ndb Technologie has a solution to increase reliability of electric networks.

Ndb Technologie developed a new instrument to increase reliability of your electric networks. In fact, the company announces the release of a new product, the ULD-40. This instrument is used to detect and locate any type of defect generating ultrasounds in the air, like Corona effects and arcing that are sometimes found on overhead power installations. The ULD-40 can improve electric networks reliability. The principle of the ULD-40 is to capture ultrasound signal and convert it in audible signal so that the user can "hear" the defect. Traditional use of infrared cameras reveals hot spots that the naked eye otherwise misses. Corona, arcing and tracking do not always generate significant increases in temperature. It is why the ULD-40 is so useful. Simple and quick to operate, the ULD is an ideal tool for any maintenance and inspection program.

The ULD-40 is useful in many sectors like electricity, aerospace, chemical industry, pulp & paper and textile. In fact, this tool can be used everywhere ultrasound is tracked to detect and pinpoint defects. A user-friendly instrument, the ULD-40 doesn't require any training and can be put in service straight out of the box. It can be used with its parabolic sensor, equipped with a laser pointing device, for precise remote inspections. Also, headphones are available for noisy environments.

Ndb Technologie is located in Quebec City since 1992 and they designed and developed electrical testing instruments. They offer many solutions to increase reliability of electric networks and workers security. In fact, Ndb Technologie has acquired solid expertise in the field of electric network. They manufacture high voltage test instruments and they are a reference for predictive maintenance equipments. Several of its products are used around the world, including Europe, Asia and Australia. The company has three product lines: cable and phase identification, partial discharge detection and very low resistance measurement.

For more information, visit the web site at www. ndbtech.com ●

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Solidification Products Expands into Canadian and Foreign markets

Solidification Products Int'l. Inc. (SPI) products Petro-Plug®, Petro-Pipe™, Petro-Barrier™, Petro Barrier™ Storm Water Boxes, provide oil spill containment from floor drains to large oil containment areas. All products are passive systems with no moving parts and allow water to filter through, but instantly seal in the event of an oil or fuel spill. Our products can be adapted to existing floor drains, refueling areas, and oil containment systems. The Petro-Plug® will fit 3 inch plus floor drains for oil spill protection. All products are patented in the United States with Canadian, and other foreign patents and trademarks pending.

SPI has over 1500 installations in the US and is branching into the Canadian market with the upcoming North American Transmission & Distribution (NATD) Expo in Toronto May 9 – 11, 2005. We will be showing potential customers how our products and systems can be used for oil spill containment for retro-fitting and new construction applications. SPI recently presented our products and systems at the Doble conference in Boston with great success. We had interest from over 40 different companies and engineers from Canada alone, with other new potential application in South Africa, Latin America, Europe and the US.

What makes our Petro-Barrier™ systems so ideal is the simplicity of use. Our early customers had concerns about maintenance with the Petro-Barriers™ blocking with dirt and debris. We design into all of the Petro-Barriers™ a filtering technique that allows the water continual drainage and with all of are installations water drainage has not been a problem. Small oil drips and leaks do not block the Petro-Barriers™, the media filters out sheen before discharge and only seals in an oil spill.

Petro-Barriers™ installed at Substation on Long Island Sound.

Petro-Pipes™ come in various sizes and have a quick clean out filter in the event of dirt build up. The Petro-Pipes™ are used for both retro-fitting and new installations for containment areas.

Petro-Plugs® are designed to be used in existing floor drains and are installed with are unique click and lock system. As with all of SPI products water will discharge, but no oil gets through.

SPI systems and products have been used successfully by hundreds of companies; we have the expertise to work with you for all your containment design and application needs. Please visit with us at the NATD in Toronto May 10 -11, 2005,.Booth 230 where we can show you the benefits of using SPI. Visit our web site at www.oilbarriers.com or phone us at 1-800-758-3634. ●
Circle 68 on Reader Service Card

What's in a name?

By Michael A. Marullo, Contributing Editor

Utility Horizons. What exactly does that mean? Well, it means a lot of things, but the way I look at it the door to the future of utilities (its horizons, if you will) is now wide open. Utilities have operated in much the same way for the better part of the past century, but as is often said: That was then, and this is now! Today, things are not only different but also changing at an unprecedented pace and on multiple levels.

Over the course of the year, this column will delve into what the future might hold for utilities, suppliers, consultants, and anyone with a stake or interest in utility automation and information technology markets. We'll explore marketplace characteristics; market drivers, issues and trends; market size and growth profiles; supplier dynamics and competition; and many other dimensions of this new and exciting era – all from a utility automation/IT perspective.

It is my personal, as well as my professional belief that automation is all too often either taken for granted, or conversely, overlooked entirely as a safe, effective, efficient and economical way to solve many of the problems facing the utility industry today. Whether the issue is customer service, conservation, demand response, real-time operations, mobile computing, regulatory compliance, reliability, safety, asset management or other business or operational considerations, automation is increasingly at the heart of the solutions.

However, although some utilities have begun to realize that automation can save time, money and critical resources, all too many still fall back on what have, until now, been considered tried and proven methods. This approach, though familiar and comfortable, typically involves protracted planning, design, permitting and construction that can take many years to accomplish. This is not meant to imply that automation can cure all or even most of the problems, but it definitely CAN solve some of them; or at the very least, provide some valuable time by mitigating problems and averting a crisis while more permanent solutions are developed and put in place. (This is not to say that automation is a temporary fix. Indeed, many of the long-term solutions are also heavily automation-centric!)

Taking full advantage of all that automation has to offer necessarily begins with knowledge and awareness. As with most things problematic, education is not only at the root of the solution; it often is the solution in the longer term if not immediately. That's where this magazine and, I hope, this column can help pave the way to a more enlightened set of automation users. However, just reading about what others are doing is not sufficient in and of itself.

Ever since September 11, 2001, most of the conferences I attend (about a dozen each year, give or take a few) as well as those attended by clients and colleagues have experienced at least some decline in their attendance. At first, this was blamed almost entirely on the 911 attacks and the resulting security concerns that brought travel for all but the most critical reasons to a near standstill for more than a year. Now, although business travel has made a remarkable rebound, conference attendance remains well below pre-911 levels. Why is that? Well, in part it's because like many things, 911 caused us to rethink and reevaluate our priorities.

With the growing power of the Internet, the vast resources brought to our desktops daily by the Web and the rapid proliferation of electronic communications, I think we are all feeling a certain sense of closeness that in reality does not exist. There is a growing tendency to think that we don't need the more traditional forms of human communications we enjoy at industry gatherings and personal meetings because we feel that they are too costly, too time-consuming or simply redundant. Sorry, but I must strongly disagree.

As the High Tech/High Touch axiom introduced in the best selling 1980s novel, MegaTrends so accurately captured, we are all human beings who need direct contact with other human beings. The book goes on to explain that when high tech offerings are introduced, if there isn't a counterbalancing high touch component, the technology is rejected. So, as we continue to downsize our human contact through greater dependencies on email and the Web, I can't help but wonder if that isn't at least part of the reason why automation technology seems to be getting less attention than it deserves.

Whatever the reasons for this reluctance might be, the fact is, there already exists a vast array of automation solutions (with many more on the way) that are just begging to be employed. Therefore, I challenge each of you to expand your own Utility Horizons: Go out and actively seek new and innovative solutions. Don't wait for the justification of a budget to create a project; justify the budget from the needs – and I really doubt that anyone could argue there is any deficiency of those! ■

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.

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Original painting
by Peter Alexander

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Path 15: A to Z

by Tom Boyko, Path 15 Project Manager

Gary Bates, Lead Civil Engineer, center, discusses the project with attendees on the pre-bid tour.

Completed slightly ahead of schedule and costing about $50 million less than the original $306 million project cost, the Path 15 upgrade eliminated a longstanding transmission bottleneck that contributed to the 2001 Northern California rolling blackouts. It also brought a new way of doing business to the industry.

The upgrade was placed in commercial service on Dec. 22, 2004, just 15 months after construction started on the 84-mile, 500-kV transmission line in Central California.

On Dec. 14, 2004, California Governor Arnold Schwarzenegger and U.S. Deputy Secretary of Energy Kyle McSlarrow attended a Path 15 commissioning ceremony in the California Independent System Operator Control Room in Folsom. It marked the first time a California Governor had visited the state ISO.

"Path 15 is a crucial link in our transmission grid," Schwarzenegger said. "This new line will allow the state to deliver power more effectively and prevent blackouts in California." McSlarrow agreed, saying Path 15 stymied Federal and state energy officials during the energy crisis that caused rolling blackouts in 2000 and 2001.

The Path 15 upgrade consists of:

- A new 84-mile-long, 500-kV transmission line between PG&E's Los Banos and Gates substations.
- Modification of the existing Los Banos and Gates substations to accommodate new bays and equipment.
- A second 230-kV circuit between Gates and Midway.
- Other related system improvements.

"One thing that kept coming up over and over and over again was this thing called Path 15," McSlarrow said. "It was something everyone identified as needing to be fixed."

A drill rig augers a hole for a tower foundation on the Path 15 project.

Crews attach the tower section to the aircrane at the fly yard.

Western takes on new role

The project was initiated in May 2001 after Energy Secretary Spencer Abraham directed Western Area Power Administration to explore the possibility of constructing a transmission upgrade using a first-of-its-kind public-private partnership. Western received 13 responses to a Federal Register notice by the July 2001 deadline and recommended nine of them as project participants.

Six of the nine participants withdrew at various times in the process leaving the final project participants as Western—a Federal agency; Pacific Gas and Electric Company—an investor-owned utility and Trans-Elect New Transmission Development Company—an independent transmission company.

Western, as the project manager, completed all planning work, acquired land rights and managed the construction of the project. Western owns and maintains the transmission line, and retains a 10-percent share of the transmission rights.

PG&E performed the substation and 115- and 230-kV system work and receives about 18 percent of the new transmission capacity.

Trans-Elect provided the remaining funding for the transmission line and owns the remaining transmission rights (about 72 percent).

Congestion on Path 15 contributed to the Northern California blackouts of 2001, and the Path 15 upgrade was seen as a priority to eliminating the bottleneck. Throughout the project, Western participants looked for ways to fast track the work to eliminate the transmission bottleneck. The unique nature of the project, combined with other events, presented challenges to actually implementing a fast-track schedule.

Lenders were cautious about lending money due to:

- accounting scandals on Wall Street
- regulatory and economic uncertainty in the utility industry
- a new business model with the public-private partnership

Partners shape new way of business

Western and Trans-Elect needed to develop a model that was both practical and provided certainty to the financial community. To achieve that, a single contractor, Maslonka & Associates, was used for engineering, procurement and construction (EPC), also known as the design-build approach. The use of a single contractor, along with fast-track engineering and construction techniques, allowed Western to complete the project in 15 months. The use of a single contractor also provided certainty to lenders by making a single entity responsible for engineering, procurement and construction.

Streamlining the project began before the request for proposals from potential contractors was issued. Western provided potential contractors with a complete set of documents at the time it issued its request for proposals to complete the design, procure the materials and construct the line. Evaluation criteria, in addition to price, included consideration of such things as:

- Proof of the ability to obtain bonds from appropriate sources
- Proof that prime or major sub built 10 miles of 345kV or higher
- Plan for accessing capital and amount available
- Affirm other commitments would not preclude performance
- List of insurance policies
- A narrative description of the plan to achieve the schedule
- Supply information for major components
- Detailed construction and milestone schedule
- Milestone schedule with critical path
- Quantity and source for key resources
- Up to 5 past references for design work
- Up to 5 past references for construction work
- Historic Accident Incident Rate
- Description of Safety Program

The aircrane sets the tower center section on top of the structure's base.

Price was a consideration but not the determining one. Based on the criteria, Western evaluated numerous bids and eventually awarded the contract to Maslonka & Associates.

Materials and equipment at the base of this tower are ready to begin installing conductor.

Elverta Lineman Kevin Carpenter inspects tower footing bolts.

The commissioning ceremony was held in the Calif. ISO's control room, Dec. 14.

Streamlining the process

Western took many steps to streamline the construction. Western required the EPC contractor to incorporate existing environmental and survey work. A transmission corridor had been previously identified through the Federal environmental process. PG&E had completed preliminary survey work and identified a centerline for the new line. Western acquired that work from PG&E and modified it based on Western's own standards. Western also acquired the easements and provided right-of-way and access roads criteria, design criteria for operations and maintenance, a design family of towers and preliminary tower center points. Western also provided conductor and insulator requirements, preliminary tower type selections, and preliminary sag (clearance) calculations. This resulted in an approximately 60 percent design package when the contract was issued. Western created a unique bid item and paid Maslonka to accept and complete all designs. As part of the contract, the EPC contractor reviewed and accepted the existing information, and finished the design based on Western's criteria. Maslonka completed final site surveys at each tower site and accepted all environmental requirements in the Biological Opinion and employed environmental monitors. Construction contractor staff confirmed the sag calculations, finalized the tower type and height, including body height and leg extensions and also did the geology work for the foundations and the foundation designs.

Maslonka fast-tracked construction to meet the schedule, doing geotechnical engineering, procurement and installation simultaneously. The right-of-way was divided into four sections. The construction contractor began ordering materials for the least-complicated section before geology or design work was done using a conservative design approach. Crews poured foundations before all the geology work was done using a conservative design and refined the design as the geology work proceeded. Different phases of construction were done simultaneously. For example, crews poured foundations in one area while constructing access roads in another area.

To minimize financial risk to the parties funding the project, Western's EPC contract contained financial penalties whereby the contractor would pay liquidated damages if the work was not completed on schedule. The EPC contract also contains a 10 percent "retention" clause on payments during construction.

Maslonka contracted with vendors for materials, with matching financial penalties for a failure to meet the schedule and was responsible for acquiring all materials, therefore taking the risk of supplier non-performance. It was more efficient for Western to manage one construction contract on Path 15 instead of multiple contracts, as it did on the California-Oregon Transmission Project, a 350-mile line from the Oregon border to Central California constructed in the early 1990s.

Since the contractor was responsible for coordinating engineering, material deliveries and the construction workforce, any issues associated with this coordination was the contractor's responsibility. This greatly reduced the risk to

McSlarrow thanks Calif. ISO Interim CEO Marcie Edwards.

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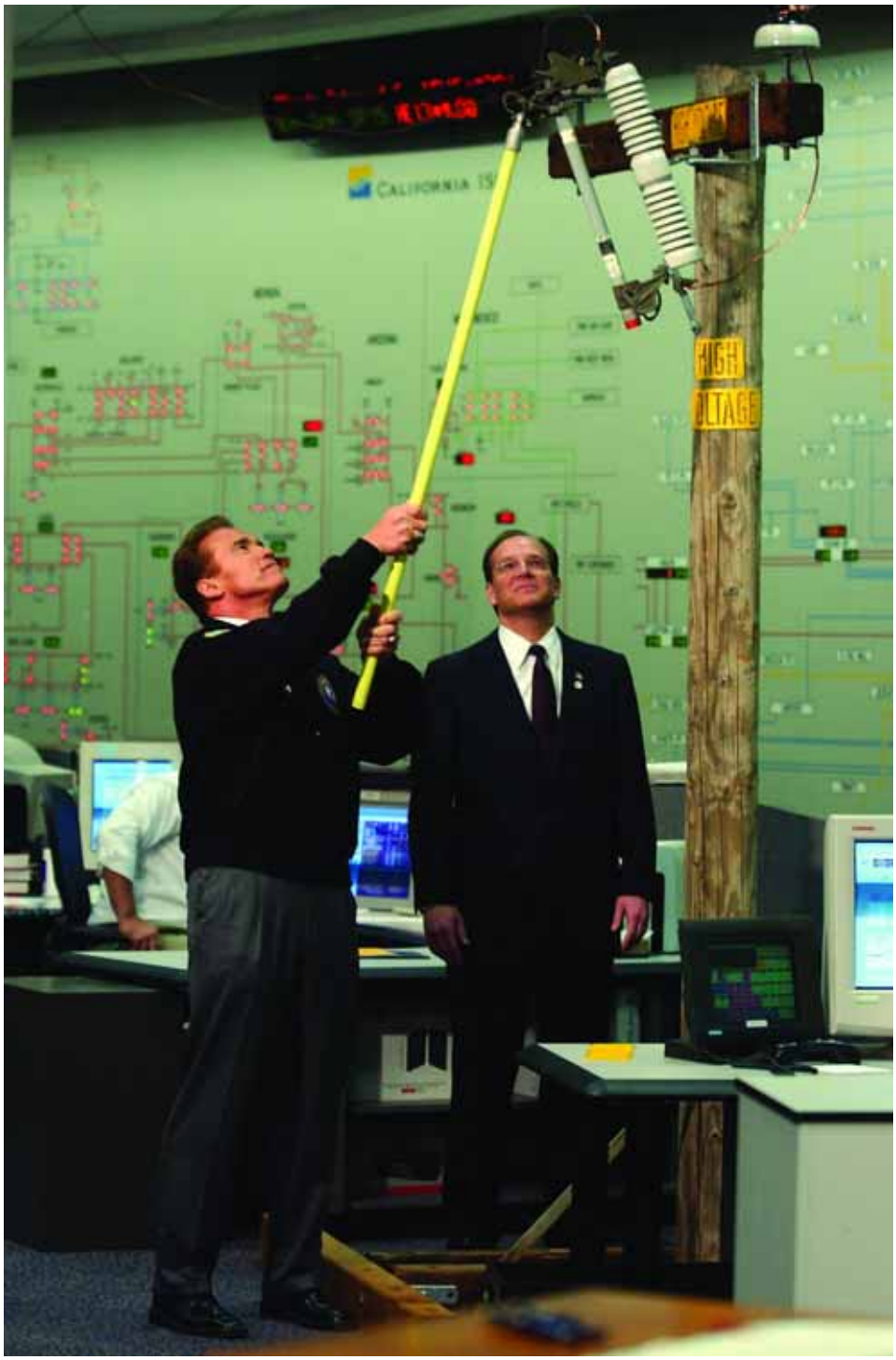
Western and the Project participants. As a trade-off, there were increased costs due to requiring the contractor to assume all design risks.

When all was said and done, the project came in on time, under budget and within scope. According to initial reports from the California Independent System Operator, south to north transmission loading on the newly increased Path 15 route show an up to a 40-percent increase in scheduled flows and the increased 1,500 megawatts of capacity has significantly reduced congestion costs. ■



Calif. Governor Arnold Schwarzenegger, left, closes a disconnect switch as part of the commissioning ceremony while Deputy Energy Secretary Kyle McSlarrow monitors the action.

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North American T&D Conference & Expo

The future of the network

Networks - Systems - Technologies - Equipment

Conference:
May 9-11,2005

Exposition:
May 10-11, 2005

Metro Toronto Convention Centre

Monday, May 9th
7:30 a.m.
- Registration opens

8:30 a.m.
- Conference begins

12:30 p.m. - 2:30 p.m.
- Keynote Luncheon

2:45 p.m. - 4:30 p.m.
- Sessions

5:00 p.m. - 7:00 p.m.
- Welcome Reception

Tuesday, May 10th
8:00 a.m. - 9:30 a.m.
- Plenary Power Breakfast

9:30 a.m.
- Exhibit Hall opens

10:00 a.m.
- Conference begins

5:00 p.m.
- Exhibit Hall closes

Wednesday, May 11th
8:00 a.m. - 9:30 a.m.
- Plenary Power Breakfast

9:30 a.m.
- Exhibit Hall opens

10:00 a.m.
- Conference begins

4:00 p.m.
- Exhibit Hall closes

Welcome to the North American T&D Conference & Expo

On behalf of our sponsors, vendors and review committee we would like to take this opportunity to welcome delegates to the first annual North American T&D Conference & Expo. Never before has Canada had such an exciting T&D event. With hundreds of speakers eager to provide utility professionals with the most up to date information and technology, we are confident that you will leave the show having learned more, experienced more and networked with both suppliers and your colleges.

We encourage you to take your time on the show floor and experience what these vendors have put in place for you. They will be demonstrating the latest technology, solutions and be at the ready for any questions you may have.

We also invite you to attend our kick-off welcome reception on May 9th at 5pm. This is a great opportunity to meet and greet, be entertained and relax after a long day of learning and listening.

Join us next year when NATD goes to Montreal, June 13,14,15, 2006

Sincerely,
Lee Baker
Show Manager

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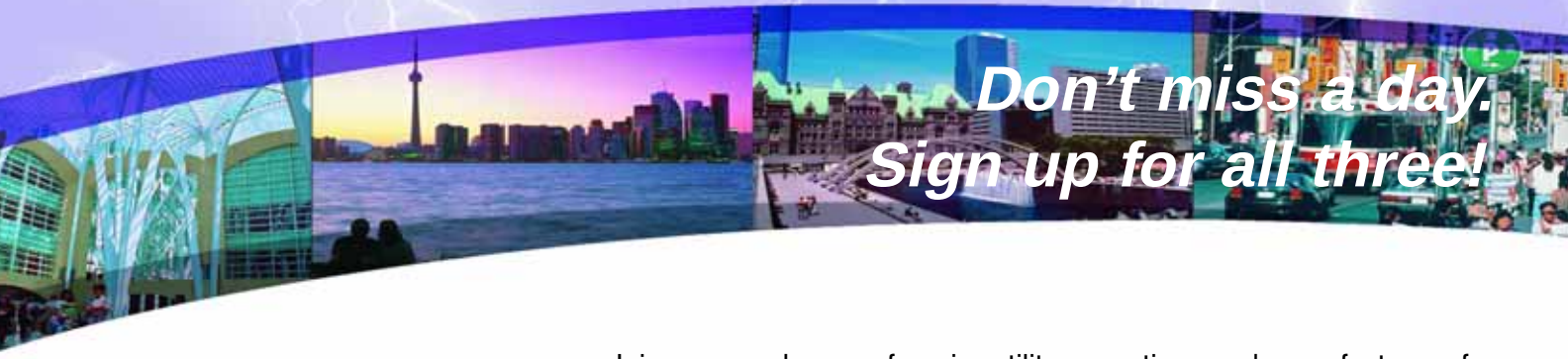

Join a power house of senior utility executives and manufacturers for the T & D industry over the course of 3 days, at Canada's most comprehensive conference and exposition.

These plenary sessions will feature head table guests from top utilities and vendors. They will be presenting their concerns for the future, reliability, and their suggestions and requirements to achieve these objectives.

Keynote Luncheon - Monday, May 9th - 12:30 p.m. - 2:30 p.m.

T & D Reliability: A Different Perspective from Top Utilities and Vendors

Nairn McQueen, Vice President, Hydro One Networks, Inc.

Hydro One Networks depends on Nairn McQueen to deliver all aspects of the company's approximately $400 million engineering and construction activities and projects on time and on budget. His depth of experience in project engineering began in 1973 when he graduated from McMaster University's engineering program. Later postgraduate work at the University of Toronto focused on chemical reactor design and environmental chemistry.

After a successful career in project engineering and management with Agra, Nairn joined Hydro One in 2000. Under his guidance, Hydro One's Engineering and Construction Services group has successfully bid on and built construction projects for selected electricity sector partners. The success of projects such as the company's Parkway Transformer Station reflect Nairn's ability to manage the complexities of large-scale construction projects that also demand strict attention to detail. With Nairn's pragmatic approach to efficient planning and execution, Engineering and Construction Services will help Hydro One intelligently expand Ontario's transmission and distribution network.

Head table guests:

- **Guy Bridgeman,** Vice President of Operations, EPCOR
- **Peter Gregg,** Vice President of Corporate Communications, Hydro One Networks, Inc.
- **Chantal Michaud,** Vice President of Operations, Hydro-Québec TransÉnergie
- **Rana Mukerji,** Vice President & General Manager, Electric Systems Consulting, ABB Inc.
- **Larry Sollecito,** President & General Manager, GE Power Management

Keynote Power Breakfast - Tuesday, May 10th - 8:00 a.m. - 9:30 a.m.

Unleashing Innovation in the Electricity Industry

Clark W. Gellings, Vice President, Innovations, Electric Power Research Institute

Clark W. Gellings is Vice President - Innovation of EPRI - the Electric Power Research Institute. He joined EPRI in 1982 progressing through a series of technical management and executive positions including five previous Vice President positions and CEO and member of the Board of several of EPRI's subsidiaries.

Mr. Gellings has received distinguished awards from a number of organizations, including The Illuminating Engineering Society, the Association of Energy Services Professionals and the South African Institute of Electrical Engineers. He is a 2003 recipient of CIGRE's (International Council on Large Electric Systems) Attwood Award for notable contributions.

Mr. Gellings is a registered Professional Engineer, a Fellow in the Institute of Electrical and Electronics Engineers (IEEE), a Fellow in the Illuminating Engineering Society (IES), and President of the U.S National Committee of CIGRE. He has degrees in Electrical Engineering, Mechanical Engineering, and Management Science and is a graduate of the Wesley J. Howe School of Technology Management at Stevens Institute of Technology.

Head table guests:

- **William Arrington,** President & COO, Composite Technology Corporation
- **Dennis Frehlich,** COO, AltaLink
- **Roger Moore,** Vice President, Engineering, RuggedCom Inc.
- **Gary Reid,** Vice President, Siemens Germany
- **Professor Tarlochan Sidhu,** Chair, Power Systems Engineering, Hydro One Networks, Inc.
- **Bill Smith,** Vice President, Power Transmission & Distribution Systems, Siemens Canada

Keynote Power Breakfast - Wednesday, May 11th - 8:00 a.m. - 9:30 a.m.

Smart Meters - LDC Perspective

David O'Brien, President and CEO, Toronto Hydro Corporation

David O'Brien is President and CEO of Toronto Hydro Corporation, a position he has held since 2004. From February to July 2004, Mr. O'Brien served as Deputy Minister of Energy. Prior to joining Toronto Hydro, he progressed through a series of executive positions including: President and CEO of Enersource Corporation, City Manager for the City of Mississauga, Chief Administrative Officer for the cities of Ottawa, Gloucester and Sudbury and for the Regional Municipality of Ottawa-Carleton.

Mr. O'Brien is currently Chair of the Board of Sheridan College and serves on the Boards of the Mississauga Living Arts Centre, the Credit Valley Hospital, the Electricity Distributors Association and the Ontario Energy Association.

Head table guests:

- **Carolyn Kinsman,** President, Automated Communication Links Inc.
- **Art Leitch,** President & CEO, Hamilton Utilities Corporation
- **Ken Pearce,** Partner, Blake, Cassels & Graydon LLP
- **Brian Pollom,** President. AMRA
- **Dr. Gregory Reed,** Vice President, Marketing & Technology, Mitsubishi Electric Power Products, Inc.
- **Jack D. Robertson,** Vice President & General Manager, Elster Metering

Preliminary Schedule
Monday, May 9th

Registration opens for all tracks: 7:30 a.m.
Keynote Luncheon for all tracks: 12:30 p.m. - 2:30 p.m.
Welcome Reception for all tracks: 5:00 p.m. - 7:00 p.m.

Energy Management

MO1A - 8:30 a.m. - 9:30 a.m.
IESO Demand and Load Response Strategies
- Eric Langford, Langford & Associates Inc.

New Method and System for Verifying, Calibrating and Tuning the End-to-End Accuracy of a Live High Voltage Revenue Metering System
- Paul Doig, Power Measurement

MO2A - 10:00 a.m. - 11:00 a.m.
Modernization of a Large Industrial Plant/Independent Power Generator and Interconnection with Utilities
- Brent S. Hancock & Ralph Kurth, Teshmont Consultants

"HiQgrid" Streetlight Management System with NESA A/S (Denmark's Largest Utility)
- Martin Speirmann, Magnetek S.P.A.
- Henrik Vikelgaard, NESA A/S

MO3A - 11:15 a.m. - 12:15 p.m.
Service Delivery Management: An Innovative Approach to Effective Management in the Utility Industry
- Charles Goodman, Indus International

Leveraging Customer Consumption Data with GIS and SCADA Data to Improve Circuit Utilization
- Rick Brakken, Nexus Energy Software

MO4A - 2:45 p.m. - 3:45 p.m.
Wide Area Measurement and Demand Side Management - A Cost Effective Application for More Effective Network Utilitization
- John Andreas, Enermet AG

New Technologies

MO1B - 8:30 a.m. - 9:30 a.m.
A New Power Electronics Device for Protection of HV Cable Sheath Overvoltages
- Luis Marti & Lianxiang Tang, Hydro One Networks, Inc.
- Henry Tachick, Dairyland Electronical Industries, Inc.

Condition Assessment of HV Cable Sheath Insulation
- Luis Marti & Lianxiang Tang Hydro One Networks, Inc.

MO2B - 10:00 a.m. - 11:00 a.m.
Maximizing Automatic Reverse Power Operations with LTC Transformers and Regulators
- Erwin T. Jauch, Beckwith Electric Co., Inc.

New RTU Technology for North America
- Thorsten Platz, ABB Inc.

MO3B - 11:15 a.m. - 12:15 p.m.
Applicability of Wireless and Broadband Technologies to the Continuing Evolution of AMR
- Arun Sehgal, Itron

Empowering Utilities with Fixed and Mobile Data on One Infrastructure
Arturo Herrera, Microwave Data Systems

MO4B - 2:45 p.m. - 3:45 p.m.
Using Steam to De-ice Energized Substation Disconnections
- Robert Lanoie, Institut de Recherche d'Hydro-Québec
- Dave Bouchard & Yvon Turcotte TransÉnergie, Hydro-Québec

MO5B - 4:00 p.m. - 4:30 p.m.
Ethernet in Substation Automation Applications - Issues and Requirements
- Roger Moore, RuggedCom Inc.

Operations and Maintenance

MO1C - 8:30 a.m. - 9:30 a.m.
Combination of Technologies Gives Best Distribution Asset Control
- Mark Dixon, Beckwith Electric (A Partner of Inelap)

New Process for Performance Analysis of Distribution Circuits
- Norman Hann, Hydro One Networks, Inc.

MO2C - 10:00 a.m. - 11:00 a.m.
The Canadian Electricity Workforce: A Talent Shortage
- Lloyd MacNaughton, Fortis Alberta

Ergonomics in Electricity Utility Suffering from Skills Shortage - An Effort to Document Worker Job Knowledge
- Sreekanta Banerjee, Public Utilities Corporation, Republic of Seychelles - Indian Ocean

MO3C - 11:15 a.m. - 12:15 p.m.
Connector Application and Performance Survey
- Gary Di Troia, FCI Burndy Products

Use of Large Capacity Screw Piles for Transmission Towers
- Mamdouh H. Nasr, ALMITA Manufacturing Ltd.

MO4C - 2:45 p.m. - 3:45 p.m.
Defusing "Time Bombs" of Aging Assets and Performance Risks
- Jonathan Hou, Randy Schrieber, ABB Inc.

MO5C - 4:00 p.m. - 4:30 p.m.
Mitigration of Human "Operational" Errors
- Chris Cooper, Ken Kopechanski, Kim McArthur, Hydro One Networks, Inc.

Planning and Design

MO1D - 8:30 a.m. - 9:30 a.m.
Applying Pareto's Law (the 80/20 rule) to Distribution Operations
- John Brett & Eric Murray, Tantalus Systems Corp.

New High Temperature Low Sag Conductors
- Anand Goel, George Watt, Craig Pon & Amir Kamarundin Hydro One Networks, Inc.

MO2D - 10:00 a.m. - 11:00 a.m.
EMPT Model Validation of an Induction Wind Turbine Generator
- Andrew Yan & Michael Dang Hydro One Networks, Inc.
- Dave Klachan, ESAC Inc.

MO3D - 11:15 a.m. - 12:45 p.m.
Distribution Line Hazards that Affect Reliability and the Conductor Repairs and Solutions to Avoid Future Damage
- Mark R. Burns, Preformed Line Products

MO4D - 2:45 p.m. - 3:45 p.m.
Benefits of Power Swing Recording
- Richard Hunt, NxtPhase T & D Corporation

MO5D - 4:00 p.m. - 4:30 p.m.
Cost Effective "GIS" for Small Electricity Utility Case Study of the Public Utilities Corporation Republic of Seychelles-Indian Ocean
- Sreekanta Banerjee, Public Utilities

Preliminary Schedule

tuesday, May 10th

Plenary Power Breakfast for all tracks: 8:00 a.m. - 9:30 a.m.
Lunch for all tracks: 12:30 p.m. - 2:00 p.m.

Energy Management

TU1A - 10:00 a.m. - 10:30 a.m.
Electricity Sector Framework for the Future: A New Paradigm for the 21st Century
- *Mark Gabriel, Positive Energy Directions*

TU2A - 11:45 a.m. - 12:15 p.m.
Voluntary Demand Response as a Non-Wires Alternative to New Transmission Infrastructure
- *Eric Watson, Apolgee Interactive, Inc.*
- *Brad Miller, Bonneville Power Administration*

TU3A - 2:00 p.m. - 2:45 p.m.
Requirements for Automated Analysis of Substation Data
- *Mladen Kezunovic, Texas A & M University*

TU4A - 3:00 p.m. - 3:45 p.m.
The Impact of Government, Regulator, Shareholder and Customer on the Development of Utility Distribution Management Systems, SCADA and Outage Management Systems in the 21st Century
- *David Hawkins, GE Energy*

New Technologies

TU1B - 10:00 a.m. - 11:00 a.m.
Application of Distance and Line Current Differential Relays in Breaker-and-a-Half Configurations
- *Bogdan Kasztenny, GE Multilin*

How Does Wireless Mesh Network Technology Work in a Utility Environment?
- *John Brett, Tantalus Systems Corp.*

TU2B - 11:45 a.m. - 12:15 p.m.
Leveraging IT Methodologies to Secure and Control User Access to Substation Data
- *Travis Jaffray, SUBNET Solutions Inc.*

TU3B - 2:00 p.m. - 2:45 p.m.
Data Fusion for a Smallworld Deployment at Hydro-Québec
- *Frank Fata, JCMB Technology*
- *Pierre Dupras, GE Energy*
- *André Potvin, Hydro-Québec*

TU4B - 3:00 p.m. - 3:45 p.m.
MV GIS a Safe, Reliable and Customer Friendly Solution for MV Applications
- *Heinz-Willi Juelicher, ABB Inc.*

TU5B - 4:00 p.m. - 4:45 p.m.
Composite Utility Poles: Advances in Design, Materials and Manufacturing
- *Brian Lacoursiere, RS Technologies*

Operations and Maintenance

TU1C - 10:00 a.m. - 11:00 a.m.
Increasing the ROI for Mapping Systems
- *Jeff Baumer, Powel - MiniMax, Inc.*

Managing Data for Effective Reliability
- *Sandra DiMatteo, Ivara Corporation*

TU2C - 11:15 a.m. - 12:15 p.m.
High Temperature Low Sag Overhead INVAR Conductors
- *Tarlochan Singh, Sanjib Dutta, Phillips Fitel Inc.*

The Asset Retirement Model
- *John H. Walewski, Joseph P. Toneguzzo Hydro One Networks, Inc.*
- *Victor Stein, Ontario Ministry of Energy*

TU3C - 2:00 p.m. - 2:45 p.m.
Wide Area Monitoring Systems
- *Sudhir Vaishnav, ABB Inc.*

TU4C - 3:00 p.m. - 3:45 p.m.
The Independent Asset Management Review
- *Harry Haag, EPCOR Corporation*
- *John Meehan, PowerNex Associates Inc.*

TU5C - 4:00 p.m. - 4:45 p.m.
Refurbishment of Electrical Contacts and Air Break Disconnect Switches
- *Dharmesh Shah, Mahendra Doshi Southern Switch & Contacts*

Planning and Design

TU1D - 10:00 a.m. - 11:00 a.m.
Mitigating Excess Sag in Overhead Transmission Lines - Improving Performance and Reliability
- *Duc Hai Nguyen, IREQ & Manuchehr Shirmohamadi, Material Integrity Solutions*

TU2D - 11:15 a.m. - 12:15 p.m.
What Does the Command and Control System (CCS) Look Like for an Electric Utility?
- *John Brett, Tantalus Systems Corp.*

The Composite Conductor: A New Technology to Relieve Transmission Capacity Bottlenecks
- *Doug Johnson, 3M Specialty Materials*

TU3D - 2:00 p.m. - 2:45 p.m.
The DAO Model for Distribution Planning and Optimal Asset Utilization
- *Dennis Stephens, Xcal Energy*

TU4D - 3:00 p.m. - 3:45 p.m.
Comparison of Fiber vs. Copper Based High Voltage Isolation Equipment for Telecommunications Circuits Entering Substations, Cell Site on Electric Power Structures and Stand Alone Antenna Towers
- *Steven W. Blume, Applied Professional Trainings, Inc.*

TU5D - 4:00 p.m. - 4:45 p.m.
Newfoundland Power - As Solid as the Rock it Stands On!
- *Terry Wildman, TVD Inc.*

Preliminary Schedule
wednesday, May 11th

Plenary Power Breakfast for all tracks: 8:00 a.m. - 9:30 a.m.
Lunch for all tracks: 12:30 p.m. - 2:00 p.m.

Energy Management

WE1A - 10:00 a.m. - 11:00 a.m.
Compact, Smart and Reliable. ABB GIS Keeps the Lights On
- *René Kaiser, ABB Calor Emag Hochspannung, GmbH*
- *Cornelia Zachaeus, ABB Switzerland, Inc.*

WE2A - 11:15 a.m. -12:15 p.m.
A Review of the Smart Meter Program in Ontario
- *Carolyn Kinsman Automated Communications Links Inc.*

WE3A - 2:00 p.m. - 2:45 p.m.
Power Factor in Electrical Power Systems with Non-Linear Loads
- *Santiago Barcon, Inelap, S.A. de C.V. - A Beckwith Electric Solutions Partner*

WE4A - 3:00 p.m. - 3:45 p.m.
Internal Data - Key to Diagnosis
- *Tom Knutsen, Lower Colorado River Authority (LCRA)*
- *Steve Kearney, Hunt Power L.P.*

WE5A - 4:00 p.m. - 4:45 p.m.
Dashboard Technology for Energy Utilities
- *Steve Van Ausdall, KEMA, Inc.*

New Technologies

WE1B - 10:00 a.m. - 11:00 a.m.
Industry Standards and Guidelines for Cyber Security of T & D Systems
- *Joe Weiss, KEMA, Inc.*
- *Elizabeth Rhodenizer, Public Safety and Emergency Preparedness Canada*

Variable Frequency Transformer - A New Alternative for Asynchronous Power Transfer
- *Richard Bodo & Carl Wegner, GE Energy*

WE2B - 11:15 a.m. - 11:45 p.m.
Real-time GIC Monitoring in the Ontario HV Grid
- *Luis Marti & Chun Li, Hydro One Networks, Inc.*

WE3B - 2:00 p.m. - 2:45 p.m.
Application of Low-Energy Sensors for Differential Protection of Large Power Transformers and Generators
- *Martin T. Bishop, Cooper Power Systems*

WE4B - 3:00 p.m. - 3:45 p.m.
A New Measurement Method of the Dynamic Contact Resistance of HV Circuit Breakers
- *Fouad Brikei, Zensol Automation*

WE5B - 4:00 p.m. - 4:45 p.m.
New Out of Step Blocking Algorithm for Detecting Fast Power Swing Frequencies
- *Dr. Juergen Holbach, Siemens Power Transmission and Distribution, Inc.*

Operations and Maintenance

WE1C - 10:00 a.m. - 11:00 a.m.
Aerial Data Acquisition for Transmission Facilities and ROW's. High and Low-Level Imagery Merged - A Case Study for Georgia Power, a Southern Company
- *John Leahy, Optimal Geomatics, Inc.*
- *Dawson Ingram, Georgia Power Company*

Co-op Combines Good Planning with Good Tools - Eliminates $1.5MM in Construction and Maintenance Costs
- *Dean Hubbuck, United Power*
- *Debbie Tatum, Avistar Inc.*

WE2C - 11:15 a.m. - 12:15 p.m.
Asset Management: Defining the New Frontier in Distribution Planning and Operations
- *Stephen Hayden, GE Energy*

Diagnostic and Monitoring Tools Applied to Asset Management
- *Thierry Jung, AREVA T & D Inc.*

WE3C - 2:00 p.m. - 2:45 p.m.
Using SFRA as an Engineering Tool
- *Tony McGrail, Doble Engineering*

WE4C - 3:00 p.m. - 3:45 p.m.
New Technologies for the Hydro-One Mobile Work Force
- *Derrick Brydges, Hugh Crockett, John Bosomworth, William Chisholm Hydro One Networks, Inc.*

Planning and Design

WE1D - 10:30 a.m. - 11:00 a.m.
Plug and Play Distribution System
- *Dale Avery & Nick Bada Hydro One Networks, Inc.*

WE2D - 11:15 a.m. - 12:15 p.m.
Siting New Transmission Lines: Automated EPRI Methodology
- *Jesse Glasgow, Photo Science, Inc.*

Hydro One Strategic Sourcing Initiative
- *Charles Guthro, Hydro One Networks, Inc.*

WE3D - 2:00 p.m. - 2:45 p.m.
Control System Modernization and Issues with Integrating New Technology at a Major Strategic Hydro-Quebec Substation
- *Julia Marciano, Bastien St-Pierre, Hydro-Québec*

WE4D - 3:00 p.m. - 3:45 p.m.
Economic Electricity Network Restructuring Plan for Conversation from Low Voltage Distribution (LVDS) to High Voltage Distribution (HVDS): A Case Study of Noida Power Company Ltd. (NPCL)
- *Sreekanta Banerjee, Public Utilities*

WE5D - 4:00 p.m. - 4:45 p.m.
Substation Automation at WE Energies
- *Jim Bourgie, WE Energies*
- *Gene Grace, Convergent Group Corp. - An Affiliate of North Star Structural Contractors, Ltd.*

EXHIBITORS

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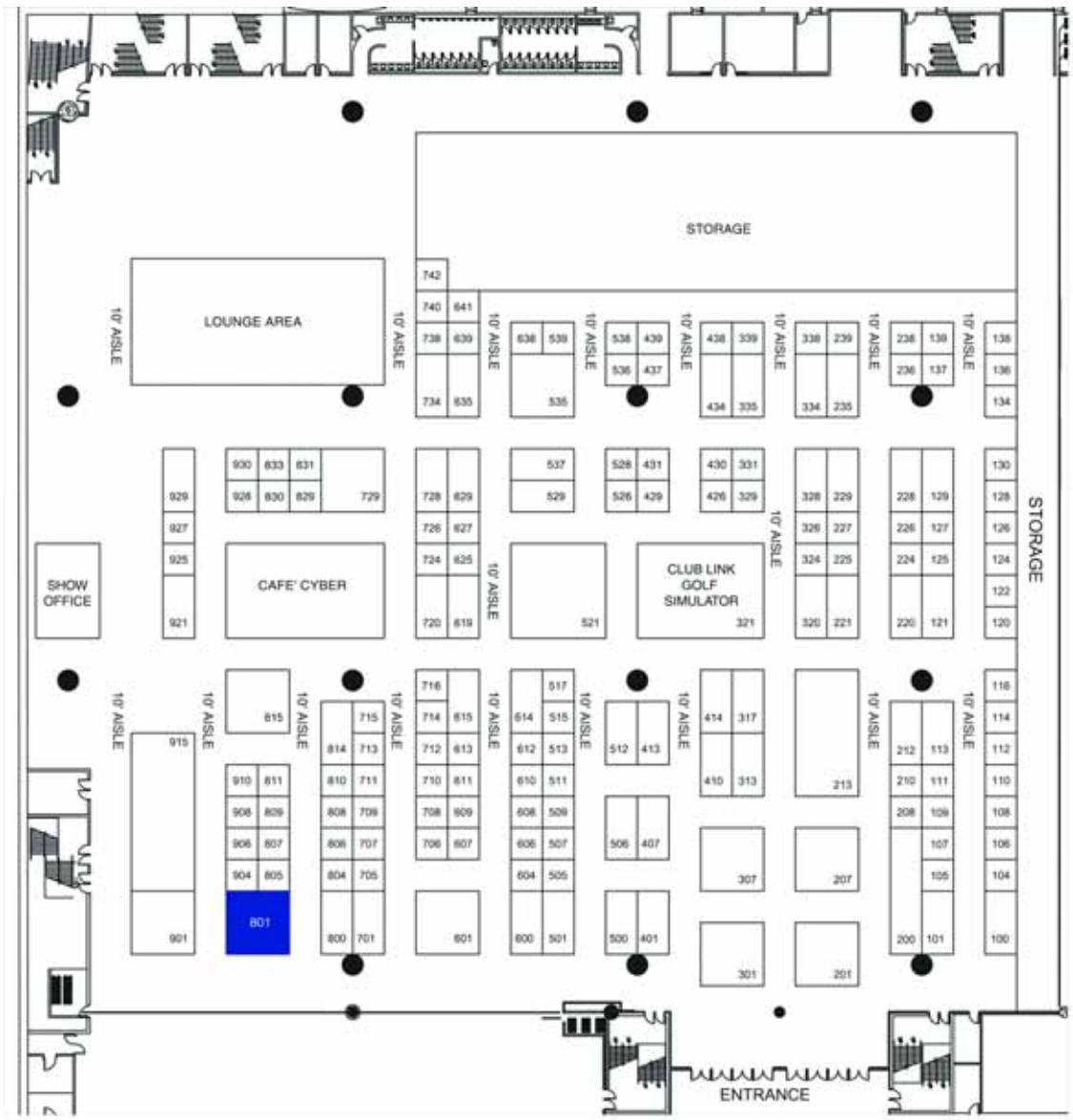

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- ☐ Communications and Control
- ☐ SCADA; EMS; Demand Side Management-Distribution Automation
- ☐ AM / FM GIS
- ☐ Meters and Metering Devices
- ☐ Transformers
- ☐ Safety Products; Tools; Rope
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Utilities Get Their Feet Wet with AMR

Can Electric Utilities Count on Reading Water Meters when building their AMR Business Case?

By Carolyn Kinsman, President of Automated Communication Links Inc.

Why would anyone write about the status of water AMR in an electric utility trade magazine? Due to the recent flurry of AMR business case and deployment activity occurring in the electric utility industry------in particular those in California and Ontario, the subject matter is actually very relevant when considering all aspects of AMR cost justification.

The consideration of AMR and fixed networks continues to gain high levels of interest as well as accelerated deployment growth for both electric and water utilities. There are, however, many preconceived ideas about which utility sector actually requires the high level of data collection functionality that can only be delivered with the implementation of fixed AMR networks.

Fixed networks are selected by utilities that require--and can justify--that they need more than simply a monthly meter read. That being said, the actual data collection and functionality requirements beyond the basics vary significantly depending on what a particular utility is trying to achieve. Utilities may prove that increased data will optimize their day to day operations. Others, with a close tie to their customers, want to increase their level of customer service program options, and in turn improve their overall customer satisfaction and loyalty levels. Still others, see AMR as a means to improving cash flow, providing new rates and incentives that enable resource monitoring and in turn result in deferral or even negating the need for increased capital for new capacity and/or supporting resource infrastructure.

Much press is devoted to the electric utility markets in California and Ontario. Both regions are attempting to justify advanced AMR systems that are able to collect profile data, and in addition are able to offer customers Time of Use (TOU) as well as Critical Peak Pricing (CPP). Mitigation of a utility's overall load from a peak demand perspective is the expected result and accrues significant savings in capital that would have been used for building new generation. Deployment of AMR can take place over a one to three year period (much faster than lead time needed for a cogeneration or peaking plant) and is in effect, much like building a virtual power plant, only with far more positive affects on the environment.

While many in the electric utility sector, appreciate the potential financial payback achieved with the implementation of advanced AMR, an equal number of people still wonder who will ultimately pay for the installation and management of these automated systems. Customers are perceived as the most obvious option. However, commissions and regulators are hoping new revenue streams including that of reading city and municipal water meters may be a way of enhancing the payback on most electric utility AMR cost justification spreadsheets.

The theory is that if electric utilities select and install leading edge AMR networks (with possibly a two way communication link) that this same system infrastructure can then be easily configured or adapted to connect to water utilities and hence provide municipal and cities with an automated meter read.

For those in the electric business, the ability to provide this service to water utilities is a very common line item on the business case cost justification spreadsheets. Most electric utilities believe that being able to offer water utilities a monthly meter read, when up until now these utilities have read quarterly, is akin to offering these cities and municipalities the ability to leap into the 21st century of meter reading and billing.

Electric utilities are not alone in this long standing assumption that water utilities would be happy, in almost cases, with a monthly meter read. Many of the electric AMR system vendors that sold only to the electric utility sector have incorporated only a minimalist data collection attitude when building the "add-on" water AMR functionality. Electric AMR marketing and engineering gurus have used water's past history of infrequent meter reads to determine a very basic level of read functionality, even though the data is retrieved and transmitted over a fixed network system. In the past, it was perceived that water was a cheap commodity, that actual billing for most water utilities is bi-monthly, and that at best, water meter reading would only migrate to monthly reads and bills, at any point in the foreseeable future.

The result based on these past hypotheses has now left some AMR vendors, particularly those that dominated the electric AMR sector, with a less than robust option for water data collection and management software.

Water – Not A Cheap Commodity Anymore

More than two years ago AWWA indicated that water utility costs, and hence rates, would increase by 18% - 20% over the next five years. For just about everyone who pays for city water and sewer services, this increase has not only already occurred, but is now slated to keep reoccurring every year for the next three to five years! That means water and wastewater rates are increasing at a faster pace than any electric utility's rates in North America today!

Backflow water prevention, decaying infrastructure, exponential customer growth, lack of capacity, and unaccounted for water are just some of the major reasons why water utilities need to adopt a customer usage and conservation mentality. This cannot be achieved with a monthly meter read generously provided to them on a monthly basis by their good friends in the electric business.

If just the water that is lost could be identified, and then used instead of wasted, most water utilities would be able to harness and control some of their escalating operational costs. Sadly, for the electric utilities that have included water utility meter reading on their business case spreadsheets, this

August 14, 2003

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means providing near real time data to identify "no flow" that in turn can be converted into leak detection alarm and notification reporting. Bandwidth, high/low data analysis in near real time, along with robust "water-centric" data archiving and management software are big selling features for water utilities who are now dealing with capital intensive and resource constriction issues.

Should Electric and Water AMR systems converge?

The answer from a prudent taxpayer perspective is "yes." The answer based on current AMR technology deliverables as well as overall utility understanding and skill sets in managing a multi-utility AMR system with extensive data collection and management functions is most certainly "no."

ACL Inc. is well known for its landmark work in multi-utility AMR systems. In 1993 the Region of Peel with Brampton Hydro, Hydro Mississauga and Consumers Gas proved that utilities could read meters using a jointly owned AMR system in both a centralized and de-centralized data collection configuration. What was never explored, at that time, was intensive data collection requirements and the resulting software management and trending capabilities that would be needed to address a high frequency of reads and differential rates for both water and gas. This data requirement has basically evolved over the past 5 years.

Most electric utilities have not yet even put in mobile meter reading much less an AMR system that is connected to a standalone telecommunications infrastructure which is responsible for collecting and managing hourly data collection tasks on a daily basis from every meter in their service territory. In fact, most utilities' total experience in this area revolves around commercial and industrial daily profiling data collection primarily connected to dial up and dedicated phone lines. The AMR systems needed to collect hourly data and manage communication networks connected to all residential customers must operate at a much higher level of sophistication where automated programs provide daily or more frequent reporting of network status, meter read anomalies, trending of meter reading and network anomalies, and generation of trouble tickets for visual checks, etc.

Couple the above network management reporting requirements with the integration of work-order management that is necessary to install and track both the meters and the AMR device at each customer site, perform nightly updates to the CIS, maintain meter and AMR device inventory, perform device upgrades, change AMR device parameters in conformance with ad hoc pricing for CPP and TOU, perform first and last reads, track soft connect/disconnects, etc. and it is undoubtably wise for most electric utilities to get their own houses in order prior to offering the same level of intensive data collection to address water utility issues.

Utility personnel and inter-departmental organizational structures are in for significant changes with the implementation of a fixed network AMR system--especially if they are to use the customer information to its true value potential. Most importantly, electric utility staff must become adept at using the information to address all facets of their core business. With this achieved they now have the proven expertise to show they are capable in providing data collection and network management on their AMR systems and can confidently provide the same level of service to their water utility counterparts.

Will Water Be Waiting?

Maybe not too surprisingly, water utilities have purchased more fixed network systems than electric utilities in the past year. It is also not so surprising that water utilities are progressing more quickly into building in-house reporting capabilities using the customer usage information to identify leaks in addition to building and offering time of day and water conservation monitoring programs. Water AMR vendors specializing in water utility metering applications, offer the data collection capability lacking in some "electric-first" AMR systems. Escalating water/wastewater rates make many city utilities act now even if they would be happy with an outsourced AMR system.

Is there a Business Case Line Item? Yes and No.

Core business requirements and new business mandates for peak load management must come first. Ancillary services devoted to new revenue can follow. Most AMR adjunct or enhanced businesses will be better defined as utility staff gain the experience necessary to run their own AMR systems and networks. With AMR lifecycle and change-out policies averaging between 10 – 15 years, it is anticipated that convergence of water and electric AMR networks will occur as the second iteration of these systems is implemented. Right now it is just a question of can all utilities get their feet wet with AMR. After that it is only a matter of determining whose feet are wetter! ■

About Carolyn Kinsman

Carolyn Kinsman, President of Automated Communication Links Inc., has been consulting to the utility industry for over 15 years. She is well known for developing successful and innovative AMR system analysis, building business cases and deployment strategies for electric, gas, and water utilities in North America. Comments and discussions regarding this article can be directed to aclinc@aol.com

ABB: a leader in Power and Automation Technologies

With our technology leadership, global presence, application knowledge and local expertise, we offer products, systems, solutions and services that allow our customers to improve their operations – whether they need to increase the reliability of a power grid or raise productivity in a factory.

ABB (www.abb.com) is a global leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. Our 100,000 employees are close to customers in around 100 countries.

ABB is headquartered in Zurich, Switzerland. ABB Ltd shares are traded on the stock exchanges in London/Zurich, Stockholm, Frankfurt and New York.

The ABB Group was formed in 1988, when the Swedish Asea and Swiss BBC Brown Boveri merged under the name ABB. Asea's history dates back to 1883. BBC Brown Boveri was founded in 1891.

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Our utility and industrial customers around the world rely on proven power technologies, researched, developed and made by ABB. In power transmission and distribution ABB is the recognized leader, with a world market share of some 20 percent.

Blackout challenges

The power grids of the 21st century must incorporate such high-end technology if they are to meet all the challenges that lie ahead. The blackouts of 2003 served notice on the utilities, and demonstrated to the wider public, that power grids are vulnerable. In many countries, deregulation has all too often undermined the will to make necessary investments in high-end technology.

Faster and faster

ABB not only provides superior power products, systems and services, but something else that is just as important to customers -- speed. Short delivery times, supported by our commitment to be the fastest in everything we do. Power consumers around the world do not want to wait, and should not have to wait, one moment longer for a reliable power supply.

Research and Development

Technology plays a key role for ABB. By continuously developing innovative new technologies and improving existing ones, we aim to provide our customers with products and services that help make them more competitive while minimizing environmental impact.

Research and development is essential to our success. We employ some 6,000 scientists and technology experts at our corporate research centers and R&D laboratories all over the world, and invest a significant part of our revenues each year in research.

ABB maintains long-term strategic collaborations with more than 50 universities worldwide.

ABB researchers have been recognized and given awards for innovative robot programming, safeguarding power transmission systems, creating faster and more efficient automation systems, improving electrical insulation, and finding industrial applications for nanotechnology and wireless technology.

Sustainability

At ABB, sustainability means seeking a balance between economic development, environmental stewardship and social progress. Sustainability is built into different aspects of our business, including the manufacture of energy-saving products, systems and solutions, the sharing of technology throughout our group, particularly with developing countries, and joining multilateral efforts to raise living standards in developing countries. As part of its commitment to support sustainability, ABB is actively develoing solutions to integrate wind farms into power grids.

About ABB in Canada

In Canada, ABB (www.abb.ca) employs 2,100 people in about 25 locations from coast to coast. It primarily serves the utilities (electricity, water and gas), mining and metals, pulp and paper, automotive, chemical, oil and gas, food, aerospace, life science as well as the remote sensing/aerospace industries.

To learn more about ABB Inc.

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We can see a blackout coming from miles away.

A remarkable satellite-based monitoring system from ABB helps utilities get an early look at potential power outages before they can become wide-spread disturbances. No wonder ABB technologies are installed on over two-thirds of North America's electrical grid. Preventing problems is just one of the ways we deliver competitive advantage to our customers. Over 100,000 power and automation professionals around the world. Over one million solutions delivered every day. Welcome to the world of ABB.

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Almita Manufacturing Ltd.
CORPORATE PROFILE

When you build some of the biggest screw piles in North America (up to 36" diameter pipe shafts with helixes up to 48" in diameter)**, and you have the largest installation equipment in the industry** (140,000 ft. lbs. of torque, with research to increase torque capacity to 240,000 ft. lbs.)**, what do your clients have to say about you?**

"We are pleased with the innovative large screw piles used for two 240kV transmission line projects and for supporting a 240kV transformer. We have found that the time per structure is faster than other options. The varying soil conditions (muskeg, tar sands, etc) required a variety ofconfigurations and challenges, and we are impressed with ALMITA's skills to accurately set adjacent anchors. We have found that Almita responded very well to our fast tract projects by increasing their manufacturing and installation capabilities. This ability to adapt will serve ALMITA well."

Mark Dyrbye R.E.T. Contract Administer Transmission Engineering, Atco Electric

Almita installed screw piles for the largest high-voltage line (240kV 347 km long) **ever built by Atco Electric and the largest in Alberta for decades.**

This line has over 1200 structures, self supporting lattice towers, h-frames and three pole structures; they were built in the winter because frost was required to access many of the locations. The schedule was 24 hours a day, in temperatures as cold as -40 C. We installed, cut to elevation and welded pile caps on 3100 piles in just 10 weeks. An additional challenge to the project was that it had to be completed before spring thaw.

"Challenges such as the tight schedule and adverse working conditions meant the material manufacturing sequencing was a critical element in the overall project success. ALMITA's screw piles were used as the primary foundation type for most poles along the 347 km. Overall, we were pleased with these screw piles, which were used in soil conditions with varying water levels, depth of muskeg and frost. Installation was efficient and, in addition, we were able to minimize ground disturbance by using screw piles."

C. Albert Lai, Manager, transmission and Distribution Projects, Atco Electric

Westower required a turn key approach for foundations for communication tower projects in a wide range of soil conditions. They needed everything from engineered pile designs, including pile fabrication and installation, to the welding of the pile cap.

"We have been using Almita's screw anchors for monopole, self-supporting, and guyed tower foundation applications. The service we get from Almita is always very effective. Their office personnel is helpful and deals with Westower in a professional way. Their field employees are reliable and can work easily with our field foremen. Their final product is of the highest quality and the screw anchor installation process often is completed ahead of schedule. Their extensive experience in the design and installation of screw anchors has been benefiting for us and for our clients.

Simon D'Amours, P. Eng., Director of Engineering, Mid-West Region, Westower

With the need to work quickly and efficiently Safety is always a priority.

"Your efforts and day to day communications helped CBS Construction achieve the goal of delivering a safe and quality product to our client. The professionalism and dedication regarding safety greatly enhanced the final product. I would like to thank Almita for the day to day cooperation in maintaining the schedule, and working through problems to achieve the final results.

Brian Henstridge, Project Manager, CBS Construction Ltd.

Concrete foundations were crumbling and needed to be rescued under an energized line in the short winter building season.

"This is a major export line to the U.S.A .and due to supply commitments the work had to be completed while the line was energized. Almita was due on the site on Feb 16th and completed the installation of the piles in 11 days. They complied with all the safety rules and were very cooperative to work with. The owner Manitoba Hydro complimented our crew and Almita's for the safe working practices that were carried out during installations."

Marvin Desjarlais, Project Coordinator, Interlake Power Line Contractors Ltd.

Almita fabricates screw piles and anchors at their state-of-the-art fabrication plant in Ponoka, Alberta; from there product is shipped throughout North America. With equipment ranging from computer controlled plasma cutting table and a six axis robotic arm to our overhead wire fed welding system, with a lean manufacturing approach to fabrication, (in time on time), and quality management system (ISO 9001) our goal is to produce a quality, cost effective product for every project.

"We recently completed a project that required approximately 300 piles. From the design stage through to installation, there was an impressive degree of professionalism. This installation was completed on schedule and proved to be cost effective. One of Almita's key assets is the shear size of their install units, which should open up a variety of opportunities. We have benefited by our alliance with Almita and will be using them on future projects. I would recommend that their piles and installation system be given serious consideration as they are a viable alternative."

Shawn Woon, Project Manager, Casca Electric

With our customers saying this, what more can we add.

Submitted by:
Collin Bootsman, Sales Manager
Almita Manufacturing Ltd.
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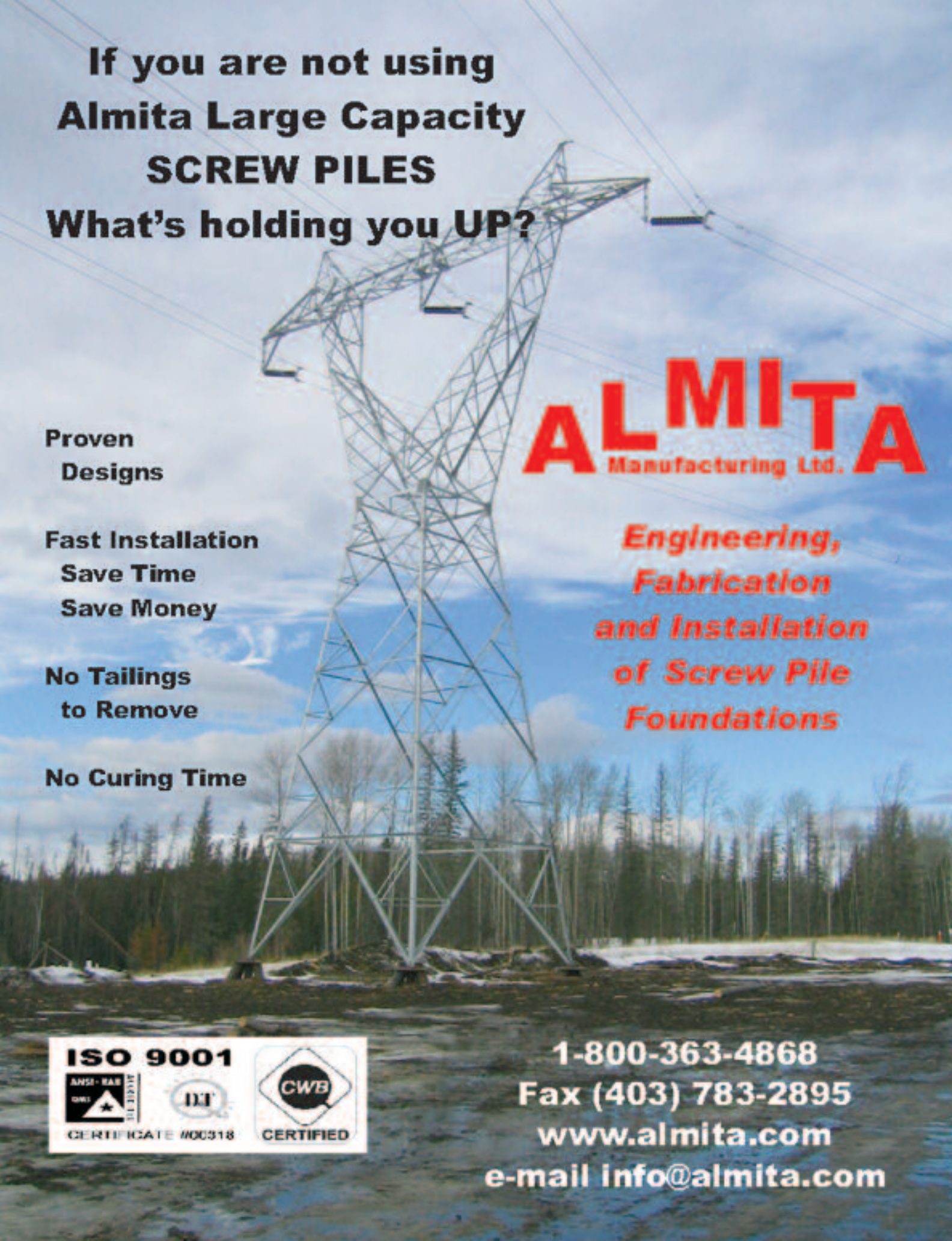
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Focus on Key Trends

THESE CRITICAL ISSUE FORUMS GIVE YOU INSIGHT FROM THE HIGHEST LEVELS.

The Future of Transmission

Judith Johansen, President & CEO, PacifiCorp; **Wade Malcolm**, Vice President, EPRI; **Joseph Welch**, President & CEO, International Transmission Company; and others. (**Jim Hoecker**, Partner, Vinson & Elkins, moderator)

Meeting Environmental Goals

Gerard Anderson, President, DTE Energy Corporation; **Jeffry Sterba**, Chairman, President & CEO, PNM Resources; **David Ratcliffe**, Chairman, President & CEO, Southern Company; **Steve Specker**, President & CEO, EPRI.
(**Ron Wood**, President, Energy Engineering, Black & Veatch, moderator)

Opportunities in Broadband over Powerline

Fred Day, President & CEO, Progress Energy Carolinas; **Jan Packwood**, President & CEO, IDACORP Inc.; **Greg Wolf**, Vice President, Cinergy (invited); and others.

Where Will the Growth Come From?

Gary Rainwater, Chairman, President & CEO, Ameren Corporation; **Mayo Shattuck**, Chairman, President & CEO, Constellation Energy Group; **Mark Snell**, Group President, Sempra Global; **David Campbell**, Executive Vice President, TXU Corporation. (**Tom Flaherty**, Senior Partner, Booz Allen & Hamilton, moderator)

Developing New Baseload Capacity

Paul Hanrahan, President & CEO, AES Corporation; **Gale Klappa**, Chairman & CEO, Wisconsin Energy Corporation; **John Rowe**, Chairman, President & CEO, Exelon Corp.; and others. (**Roger Gale**, President & CEO, GF Energy, moderator)

Harnessing the Wind

Richard Kelly, President & COO, Xcel Energy; **Michael May**, President & CEO, Hawaiian Electric Company; **Greg Abel**, President, MidAmerican Energy Holdings Co; and others. (**Mark Little**, President, GE Energy Power Generation, moderator)

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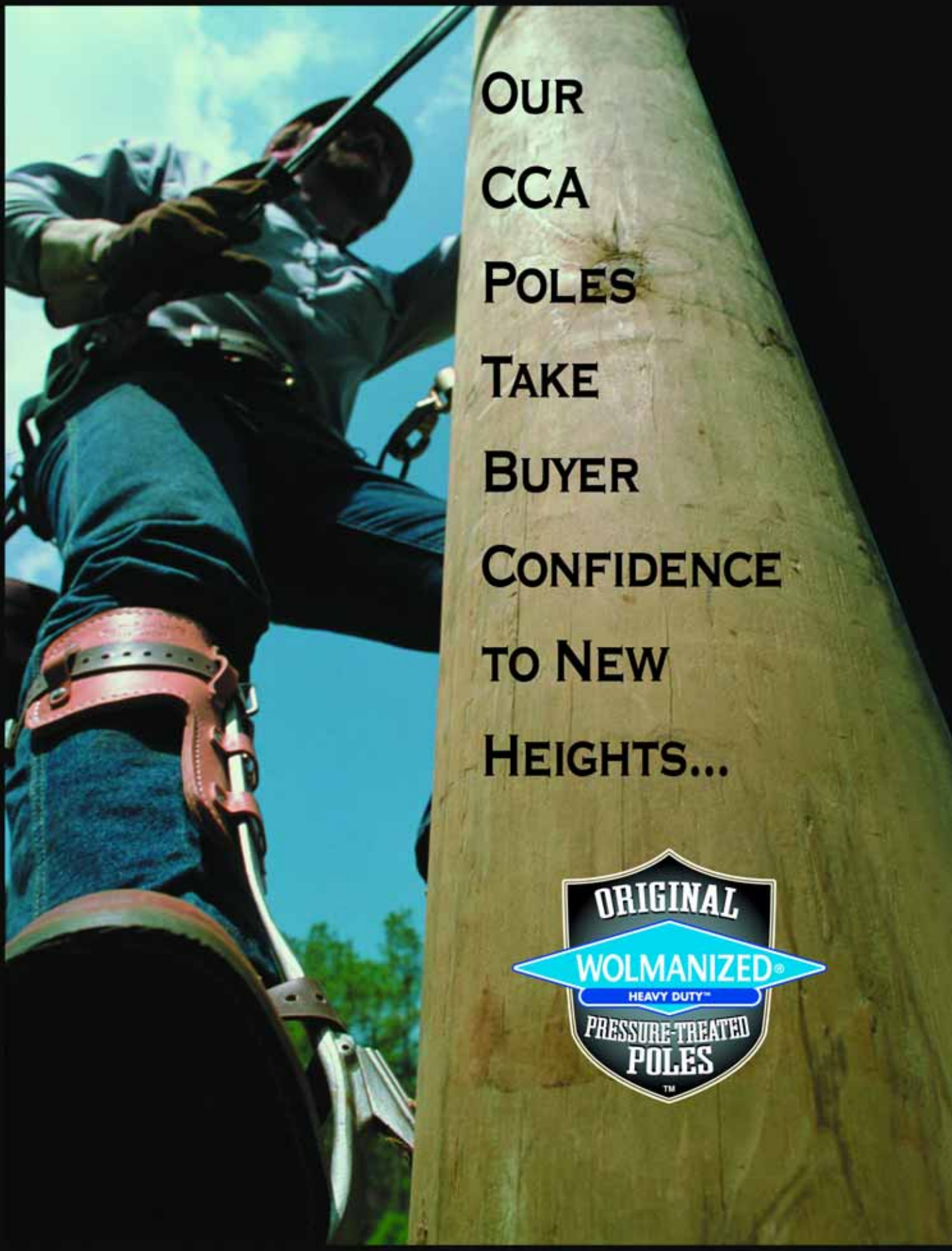

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Utility Decision Support:
Closing the gaps between field and financials

All industries face increasing pressure to reduce costs and improve service, but few must deal with the mix of challenges confronting utilities. They are required to maintain regulatory compliance while acting more market-driven. They must manage the depreciation of aging assets while maintaining system reliability. And, to increase productivity, they must often integrate new technology with existing IT systems, well-established work processes, and specialized data formats.

Given that operations and maintenance (O&M) expenses in the U.S. have grown at an average annual rate of 9.9% over the past five years, it might seem unrealistic to do more than slow the rate of increase. Yet, other markets have successfully addressed their aging infrastructures and deregulation challenges. According to IDC Energy Insights, electric distribution companies in the U.K. have decreased their O&M expenses at an average annual rate of 7.7%.

Where is the greatest opportunity to achieve such transformation in North America? By streamlining the support and decision-making processes that reside between real-time operations and enterprise business systems.

> "To effectively reduce operating cost and improve customer service, utilities must manage data once, instead of in multiple formats in different locations."
> – Corey Maple, CEO, Powel-MiniMax

Too many O&M support processes remain disconnected

Information technology has already been applied to automate many operational processes such as control, monitoring, and safety. Depending on the size of the utility, transactional business processes such as billing, payroll, and financials now typically share enterprise information on a common platform. However, many utilities still conduct operations support functions – such as work order management, engineering analysis, field design, and asset optimization – using a combination of legacy systems, individual point solutions, and traditional paper-and-pencil processes.

These disconnected systems typically do not share data, which often results in: cycles of rework as field data passes back and forth to design and analysis; overlapping databases, with the increased potential for errors; and increased cost and complexity for IT.

"Utilities now prefer to use fewer software suppliers," said Rick Nicholson, vice president of Energy Insights for IDC, a leading IT research firm. "Doing so reduces the risk of incompatibility and the cost of multiple licenses."

"We knew that it was unrealistic to expect our software to integrate seamlessly when it was pulling from separate databases," said Cris Banaban, an electrical engineer with Alameda Power & Telecom (APT), a municipal power company serving parts of the Northern California Bay Area. For example, APT had various data formats for components, transformers, geographic files, and customer information. It was impossible to view complete maps and run engineering analysis without reentering the data. The utility turned to Powel-MiniMax, which is based in St. Paul, Minnesota, to put together a solution that enabled APT to focus on its customers instead of managing its data.

To improve the support processes, integrate the data

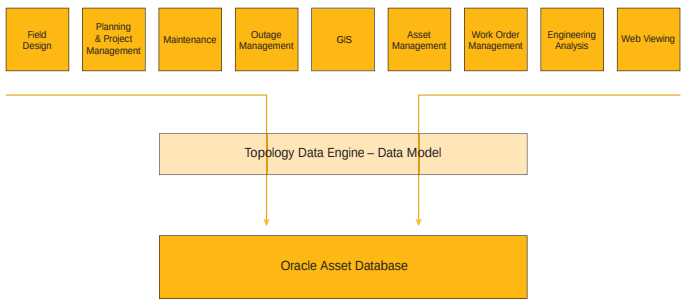
Powel-MiniMax is the first software vendor to provide a complete, integrated platform for utility decision support. As the industry leader in field design and work order automation tools, Powel-MiniMax is continuing its tradition of innovation by offering a complete solution to support engineering, maintenance, and operations professionals. Called the Utility Decision Support Platform (UDSP), the solution uses a single asset database to manage critical utility operations support information, from field to financials.

Corey Maple, CEO of Powel-MiniMax, explains the rationale for UDSP. "To truly reduce operating cost and improve customer service in the operations support area, utilities require four things. To manage data once, instead of in multiple formats in different locations. To quickly make decisions as close to the customer as possible. To use the best application for their specific business requirement so they are making the smartest decisions. And, to maintain flexibility to adapt as they grow or their marketplace changes.

"Our integrated platform approach allows utilities to manage assets from a single database that presents an appropriate functional view," Maple said. "With our modular platform, utilities can still add applications as they go, but the payback and business flexibility are even greater. Utilities can start by building the asset database and implement the front-end applications where they have a business need today. Then, over time, they can integrate additional modules to completely automate operational processes and tie back to transactional business systems."

Utility Decision Support Platform

The Utility Decision Support Platform (UDSP) supports up to nine modules, sharing one database.



Real-time decision support has been proven to help productivity of engineering, operations, and maintenance, and provide the level of service expected by today's utility members. By bringing together critical data in a single asset database with spatial visualization software and integrated applications, Powel-MiniMax is helping utilities adapt and act – faster than ever before.

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VS.

UDSP

Introducing the Utility Decision Support Platform

Now there's a better way to make decisions for your utility

If you're like most utilities, the data you need to run your business is scattered throughout your organization. It's a decision system that's only a little better than, well, a crystal ball.

Now, for the first time ever, the Utility Decision Support Platform (UDSP) from Powel-MiniMax allows you to manage your assets on one common platform. We're talking about better decisions based on our real-time, single-source platform providing GIS, Engineering Analysis, Outage Analysis, Mobile Work Order Management, Design, and more.

Best of all, Powel-MiniMax's "best-of-breed" applications like StakeOut, are integrated into your UDSP. Which means you can benefit from the latest information whether you're out in the field or in the main office.

To learn more about UDSP from Powel-MiniMax call 1-888-990-7591 or visit us at www.powelminimax.com

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Turning Energy Information into ROI

By Douglas Backer, VP of Marketing, Cannon Technologies

Most of today's digital systems create plenty of real-time energy data, but Cannon Technologies' Yukon™ Advanced Energy Services Platform was designed to go a step further, converting energy data into daily cost savings for electric utility distribution systems. We optimize energy delivery with integrated applications that touch every aspect of distribution from the substation to the end-use load.

Each end-to-end solution includes the necessary hardware, software, communications, and support needed to see improvements right away. Integrated solutions optimize power delivery in ways many have never considered. Chose individual web-integrated solutions (stand-alone or hosted), or install the complete Yukon platform.

Energy Information Bus

The heart of the system is an industry-standard, scalable MicroSoft Windows Server, combined with an SQL relational database, and protocol support for most digital metering, IEDs (third party or Cannon), plus many SCADA/EMS systems. Combined with a comprehensive list of communication paths, the energy information bus is designed to collect energy, demand, power quality, and power flow data from everywhere on the distribution system. Applications convert data into useful information; automating adjustments in power flow; and forwarding results to engineers, planners, marketing, operations, and consumers.

More Than Metering...

Yukon creates a fixed communication network for real-time remote metering using a variety of communication paths to popular three-phase and single-phase meters made by leading manufacturers. Load profile, voltage profile, time-of-use, critical peak, outage time/date & duration, are gathered automatically. Yukon aggregates meter data in real-time for virtual primary metering, sampling, rate research, power flow management, billing and demand verification. Yukon utilizes load profile metering for load management verification, high-bill resolution, asset management (loading on distribution and substation transformers and lines), load balancing studies, and advanced customer services. Browser-based applications port meter and power quantity data to those who need it throughout the organization, including outside resources that have permission to view read-only data, and optionally to consumers.

More Than Demand Response...

As the North American leader in demand response systems, Cannon provides software and intelligent hardware for managing customer-side loads ranging from large industrials to mass markets. On the mass market side, load management receivers use a variety of communication paths to reach wide areas at the lowest cost. The exclusive TrueCycle® algorithm maximizes curtailment. Remote access thermostats are made by Honeywell for maximum accuracy. Mass market demand response can be dispatched in seconds across an entire service area, or can be targeted to specific assets such as overloaded transformers or lines.

Interactive demand bidding with baseline calculation, internet feedback and meter aggregation are available for commercial/industrial customers. Monitor and control on-site generation; improve reliability using under-frequency control and cold load pickup; reduce load on specific assets automatically; and offer innovative rates.

More Than Power Factor Management...

Our combination of innovative, low cost capacitor bank control hardware and innovative software allow fine-tuning of power factor across your entire service area, using utility-owned and/or commercial communication systems. Clients use the system to reduce operation costs and flag bank malfunctions, improper bank location, low voltage.

More Than Substation Automation...

Our Substation Advisor® Data Gateway aggregates analog and digital equipment in the substation, processing it locally (in the gateway) through a series of predictive maintenance algorithms. The goal is to pre-empt outages and equipment failures. The Yukon Esubstation application collects and displays the processed information using a browser-based MMI; trending the data in useful combinations, and alerting operations via email and paging. Connect to power factor management for downline information and feeder monitoring, or demand response for targeted emergency reductions. Port real-time and historical data to planners for analysis without jumping through hoops.

About Cannon Technologies

Established in 1987, with a solid history of profitable growth, Cannon Technologies will be providing systems and integration services well into the future. Please visit us at NATD, Booth #413.

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For additionnal information, visit www.cannontech.com

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AREVA T&D areas of activity:

- **End to end solutions for electricity transmission and distribution through medium voltage and high voltage equipment**
- **Grid enhancement and power supply management systems (SVC, HVDC, etc...)**
- **Mission critical equipment through Energy Market Systems, SCADA, protection and metering equipment and substation automation solutions**
- **Electricity systems life cycle optimization through comprehensive service plans.**

The demand for a reliable energy supply continues to grow steadily in the USA and Canada, straining and outgrowing the capacity of transmission and distribution systems. To resolve these congestion issues, prevent future outages and ensure dependable and sufficient delivery of power, an experienced partner is needed to modernize and stabilize the grid.

AREVA T&D is a trusted partner helping clients meet this challenge. AREVA T&D North America is present at all stages of the power supply chain, from the generator to the large end-user, backed by a comprehensive services portfolio. Our customers include both the electric utilities and the industrial base: Oil, Mining and Metals, Renewable Energy, Paper and Glass, Transportation and Power Engineering.

AREVA T&D provides products, systems, services, and automation & information systems for the medium voltage and high voltage electricity markets. Our products ensure the reliability, quality and safety of energy flows, and operation of efficient networks through energy and information management.

As a solution provider, AREVA T&D optimizes key disciplines, and adds reliability and value to your business. We bring solutions that draw upon market segment expertise. Our company's international project experience allows us to provide the best local and global solutions for your needs.

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Meeting the Challenges of Managing Substation Equipment Assets

By Mr. Jack Shaver, P. Eng. CEA Technologies Inc.

As regulated monopolies evolve into competitive industries, utilities have had to change the way they conduct business. A central component of the marketplace is the need to provide the consumer with an available and reliable product at the lowest cost, placing great pressure on utilities to reduce variable expenses. The burden is thus to reduce the capital cost of equipment and its associated operating and maintenance costs.

Problematic is the fact that much of the equipment (breakers, transformers, switches) owned by utilities was installed a great number of years ago and may be reaching the end of its service life. Because of the risk of failures, this older equipment requires higher frequency maintenance and scheduled outages, which reduce system availability and reliability, decreasing the value of the delivered product. Although simply replacing the equipment may solve these problems, the carrying costs associated with such actions would, in turn, increase the cost to the consumer.

Asset management is without a doubt one of the most difficult occupations in the utility industry. In order to remain competitive, work must be performed at minimum cost and with little interruption to service, all without neglecting safety and environmental concerns.

This dilemma creates serious problems for those charged with the responsibility of maintaining utility assets especially as the list of factors they must consider grows longer. The focus is thus one of determining the best practices for the monitoring and assessment of station equipment.

The current state of the industry has challenged the time-honoured system of scheduled, or time-based, maintenance. This is the most expensive form of maintenance and it may not identify potential failures. Scheduled maintenance may identify the condition of the equipment at the time of assessment, but the estimation of remaining life is not necessarily addressed by current tests or practices. It is clear that the maintenance process must evolve with the industry.

MAINTENANCE INTERVALS

In the past, utilities generally followed the maintenance recommendations of manufacturers. These recommendations were justifiably conservative as, without detailed knowledge of the operating conditions, manufacturers must base their maintain/repair/replace guidelines on the most severe operating conditions and duty cycles. Transformers, for example, are typically expected to last well in excess of 20 years, with testing or maintenance planned at regular (annual or otherwise) intervals. Research, however, indicates that maintenance intervals can be extended beyond manufacturer guidelines based on the operating conditions of the equipment – many transformers currently in service are approaching 30 – 40 years of age. While improvements have been made in determining optimum maintenance intervals, further research will be needed to produce ideal timelines for varying conditions, minimizing both costs and associated outage requirements.

FAILURES

Maintenance tasks must identify two central factors: the condition of the existing equipment and potential equipment failures. Any abnormal conditions should be addressed before any equipment is returned to service as on-line failures constitute the most expensive maintenance task. These events also increase the risk to other equipment in the system and must be prevented. In the event that equipment is to be placed into service without corrective action, it must be done with full knowledge of when a failure may be expected, with remedial action scheduled before that time.

ASSESSMENT

An important factor to be addressed is how the condition of the equipment can be assessed without removing it from service. Oil/gas sampling has been the accepted on-line method to date, but other technologies are quickly emerging and/or being applied in non-traditional manners. New techniques, including the monitoring of parameters such as vibration and acoustics, temperature, discharge, and motion, offer utilities alternatives to the status quo. It is hoped that additional research in the development of new technologies may help to establish safe operating limits for the parameters being monitored and improve on utilities' capabilities to interpret and analyze the data in real-time.

TOOLS

It is essential that utilities know when equipment should be replaced or repaired. As many factors influence this decision, it is useful that the asset manager have access to both qualitative and quantitative tools. Developing decision-making tools that take into account obsolescence, reliability, safety and environmental issues, in addition to operating, repair and carrying costs, is necessary for consistent and intelligent decision-making.

REMAINING LIFE

One of the most pertinent topics in asset management is the estimation of remaining life. Based on a piece of equipment's at-present operating conditions, asset managers are tasked with determining how much of its expected life has expired and, considering future operating conditions, how much life is left. In order to do so, new technologies and methodologies for analysis and forecasting must be developed. Through forecasting and budgeting for replacement, surprises in capital cost expenditures can be avoided. While the hope is that maintenance planners will be able to schedule maintenance, repair, or replacement to coincide with the increased probability of failure based on the remaining life, more research and data collection will be needed before this can be considered an effortless assignment.

EXTENDING THE USEFUL LIFE

While the estimation of remaining life helps to predict failures, it can also be useful in helping to extend the life cycle of equipment. New developments in the use of inhibitors and in the maintenance of the original quality of the insulating medium will extend the life expectancy of both new and used equipment. Under older methods, these were allowed to deteriorate to a certain point before remedial action was to be taken. Keeping these mediums at peak operating condition will extend the equipment's life and reduce costs, especially if the process can be done while the equipment is on-line. Real-time detection and analysis of decomposition by-products will provide clues in the assessment of the current condition and the remaining life. The development of more real-time on-line analysis and diagnostic techniques will lead to courses of remedial action that will be of great benefit to the industry.

BEST PRACTICES

It is often quite difficult to determine the best operation and maintenance practices and methods. The management of assets can vary greatly between utilities, often under similar operating conditions. Opportunities do exist, however, to research, develop and document these "best practices." Such research will assist utilities in the development of their individual processes and methods. By identifying areas of risk (too little maintenance) and areas of overindulgence (too much maintenance), utilities can optimize their operations.

COLLABORATIVE EFFORTS

It is important to recognize that research related to asset management cannot be undertaken by one single utility; the cost of individual efforts is simply prohibitive. Through collaboration and by bringing together their resources (ideas, funding, personnel, skills, etc.) utilities can meet their objectives.

The Life Cycle Management of Substation Equipment and Apparatus (LCMSEA) Interest Group of CEA Technologies Inc. (CEATI) helps utilities facilitate their research and technology development endeavours. This group of 24 utilities provides a forum for the sharing of information and the development of new projects.

The group is currently focused on the development of equipment diagnostics (on- and off-line) and life optimization through the development of validation tools for predicting the remaining life and/or extending life. Safety and environmental concerns are a consideration in all endeavors of the group.

Many projects have been completed through the collaborative efforts of the Interest Group. Recently completed projects include:

Prediction of the Remaining Life (Life Left) as a First Indicator of Transformer Problems

The current trend in the utility industry is to utilize power transformers beyond their operating limit and/or normal operating life. The objective of this project was to find a simple test (through the monitoring of properties of oil) that might indicate the extent of deterioration and the remaining life of the transformer oil. Two methods were tested - Free Radical Scavenging Activity (FRSA) and the Rotary Bomb Oxidation Test (RBOT; ASTM D2112). A combination of the two tests was applied to estimate the remaining life of transformer oils. Further tests with field samples established a correlation between oil stability as measured by combining RBOT and the Free Radical Scavenging Activity.

Safety Protocol for Restoration of Substations Involved with Fires/Explosions

A natural consequence of maximizing the life of existing electrical utility substation assets is the further aging of electrical equipment. As equipment (and more specifically a transformer) ages, it is more prone to failure, which can occasionally result in fires and/or explosions. As materials typically found in electrical substations may form toxic by-products due to combustion, this report investigates the potential impact of their hazardous by-products. Included case studies illustrate the impact that these incidents have had on workers providing secondary response and cleanup, providing valuable lessons for future response. A safety protocol is presented for the sampling and clean-up of the atmosphere, equipment and debris following a fire or explosion in a substation. This safety protocol may be used by utilities to develop their own response plans and procedures.

Prediction of the Remaining Life (Life Left) of Power Connectors and Disconnect Switches

The primary aim of this work is to conduct a thorough engineering and failure mode analysis of power connectors and disconnect switches to identify maintenance issues and high frequency/high cost faults and failures. The work identifies sensors required to diagnose or predict the faults, including cost-benefit analysis. An essential part of the project involves the development of a prognostic algorithm for predicting the remaining life of a power connection. Included in the work is a survey of utilities which aims to collect field data on the failure sites, modes and mechanisms of power connectors and disconnect switches.

Instrument Transformer Condition Assessment and Diagnostics

Failures or faults on instrument transformers (ITs) may lead to the malfunction of system protection, controls or metering devices, and thereby jeopardize reliability and safety. There are many techniques for the condition assessment of oil-paper insulated equipment in general, and ITs in particular. However, no single technique seems to work all the time. In response, the LCMSEA Interest Group has sponsored a report which consists of a literature review and a worldwide survey of utilities to identify "best practices." Commercially available diagnostic instruments from different manufacturers were assessed based on their technology and operating experience. From this study, guidelines were developed for the implementation of the most appropriate and cost-effective condition monitoring methodologies.

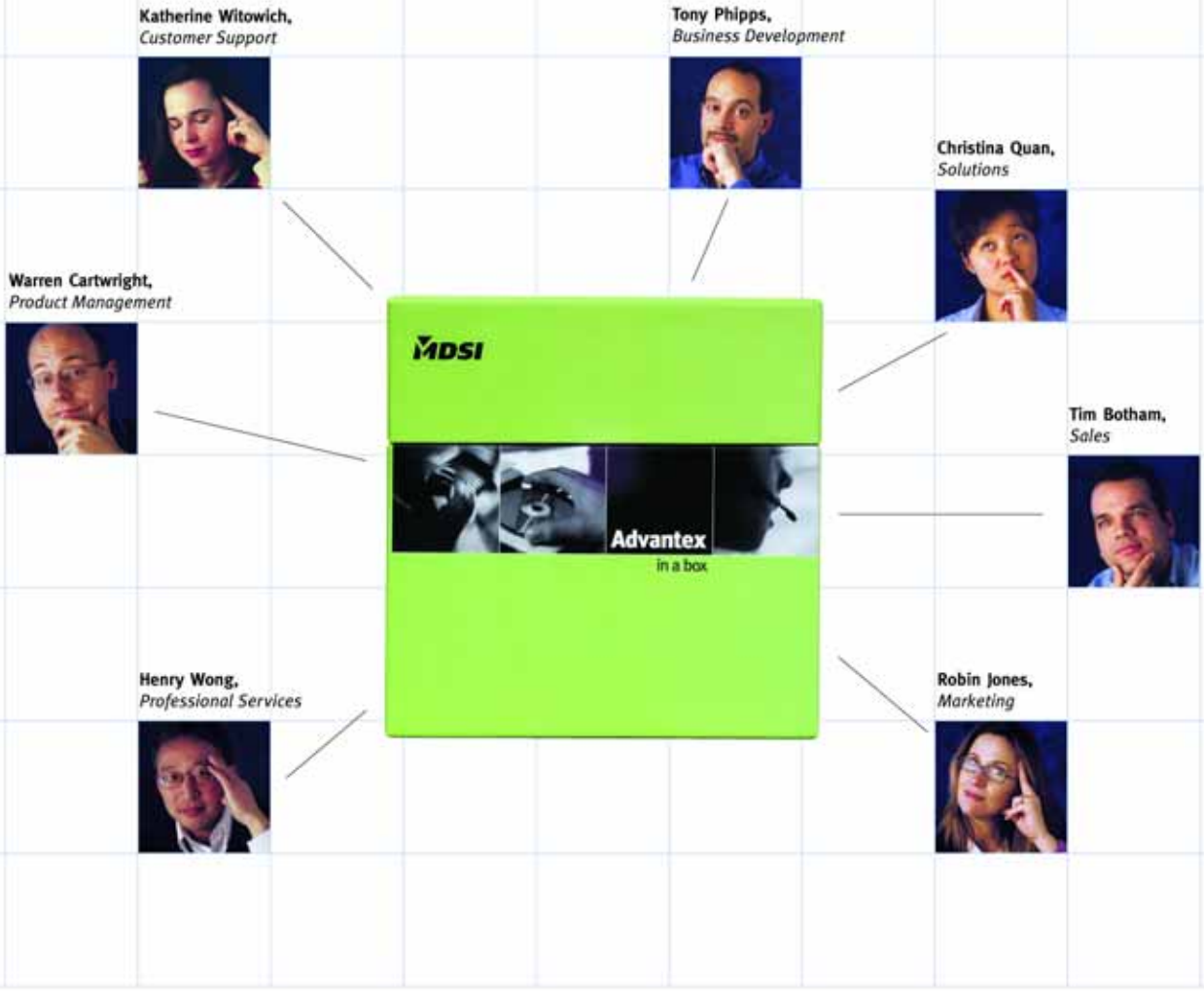
JOINING TOGETHER TO FUND SUBSTATION RESEARCH

The Life Cycle Management of Substation Equipment and Apparatus (LCMSEA) Interest Group is one of the many "interest groups" of CEA Technologies Inc. (CEATI). LCMSEA participants jointly sponsor studies and research projects in the area of substation equipment that will benefit them, the electrical utility industry and customers at large.

Participation is open to all electrical utilities that have an interest in substation-related issues. The group identifies areas of common concern and defines research objectives to solve those concerns. Individual group participants can then select to co-fund projects of interest that will be of benefit to their organizations. This flexible and collaborative approach provides substantial cost-benefit advantages to the participants. ■

About the Author

Mr. Jack Shaver, P. Eng. leads the Life Cycle Management of Substation Equipment and Apparatus (LCMSEA) Interest Group. Mr. Shaver has over 30 years of engineering experience with Manitoba Hydro in positions ranging from distribution design to apparatus maintenance. In his latest position as Senior Apparatus Maintenance Engineer, he was responsible for developing maintenance standards for substation equipment based on Reliability Centered Maintenance (RCM) in Transmission and Distribution Substations. A graduate of University of Manitoba, Mr. Shaver has also taken advanced courses in Project Management, Business Planning, Progress Improvement and the Fundamentals of Thermography. Over the years he has focused on many areas, including the planning of diesel generation facilities to meet load requirements in remote communities in Manitoba and the design of distribution substations, subtransmission and distribution lines and their protection systems. Jack served as a member and Chair of the Manitoba Hydro Professional Engineers Association Safety Committee and was also Manitoba Hydro's representative in LCMSEA from 1996 until his retirement in 2003.



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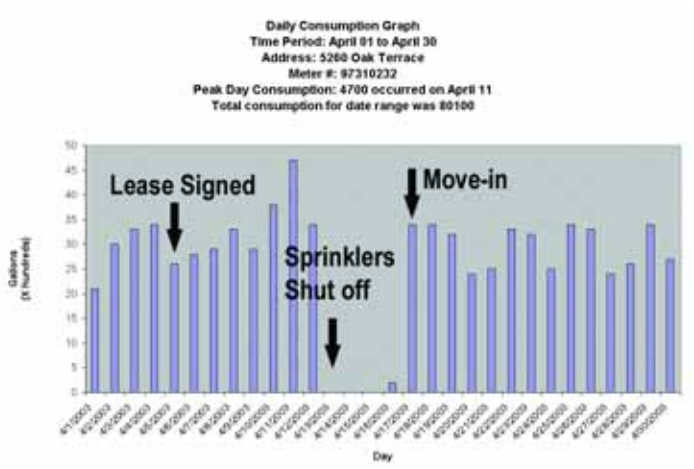
Integrating AMR with customer service and other utility operations.

By Michael Caranfa
Director of Business Development for Datamatic Energy Systems

Automatic Meter Reading has transformed the way today's utilities conduct business. Its benefits reach far beyond the meter reading shop into the customer service call center, the engineer's office and across the entire operation.

The degree of transformation is largely contingent on the amount of data provided by the system in question. AMR technologies which provide only reading and tamper information are undeniably beneficial to utilities in many ways. They address issues of reader safety, reduce reading personnel needs and expedite data collection. However, they cannot match the enterprise-wide benefits of more advanced AMR technologies.



Advanced Systems

"Advanced" AMR refers to those systems capable of providing various types of interval usage data along with the current reading. Many systems allow users to define the length of the intervals recorded, based on the application and utility being collected. Fifteen-minute intervals are generally regarded as both meaningful and sufficiently precise for most residential applications, however shorter (and longer) intervals can also be used.

Advanced AMR encompasses systems that deliver data over fixed networks (broadband, cellular, RF and WiFi) as well as systems in which the interval data is stored at the meter interface unit. The ability to provide such data allows the benefits of AMR to be felt beyond the meter reading operation and throughout the entire utility.

One of the first places the value of advanced AMR is experienced is on the utility's "front lines," customer service. Billing disputes and turn-on/turn-offs comprise a large portion of the calls in any given day, both of which can be significantly impacted by the information delivered by an advanced AMR system. AMR can also offer solutions to many of the unusual requests customer service is asked to handle.

"By implementing a comprehensive advanced AMR system to collect readings from our electric, gas and water meters, we can maximize our resources, streamline processes and enhance customer service," said Bill Gaguski, IS Director for the City of Lawrenceville, Georgia. "Interval data is a feature that is taking our customer service and system management to the next level. For the first time, we'll have detailed usage information available from every meter. We can resolve customer billing disputes, detect theft, find leaks and undersized meters, study peak demand and a hundred other things now that we have the data."

Settling Billing Disputes

The first step in settling a billing dispute is generally to re-read the meter; in order to determine if an inaccurate manual reading was the source of the high bill. However, this rarely provides satisfying closure for the customer. This is because most handheld computers immediately alert the reader when readings fall outside expected ranges and allow them to be checked and reentered. If it is discovered that a reading was correct after all, the utility and customer are at a stalemate: the usage is correct and no one has the story behind it. The utility often grants the customer a one-time credit as a measure of good faith, even though the entire bill may be completely legitimate. Enter advanced AMR.

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1986 – Developed the Commander 6000 Series

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1992 – Developed the Commander 7000 Series

1995 – Introduced the Commander 4000 Series

1997 – Introduced the latest Generation of Radio Controls

1998 – Develop the L4000 Series

1999 – Introduce the XL4000 Series

2000-Present

2002 – Introduced the Captain 3039 Digger Derrick

2003 – Redesigned the Commander 5000 & Commander 6000 Series
- Introduced the New Generation of the the Telecon Digger Derrick

2004 – Introduced the RC Series Radio Controlled Digger Derrick

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The same scenario plays out quite differently if the utility is using an advanced AMR system. When the complaint is registered, the utility will be able to consult the usage profile for that customer's meter during the period in question. Periods of high usage are quickly identified when viewing daily/hourly bar charts. When one considers times, dates and amounts, it is quite easy for the trained professional to see the difference between a general pattern of wasteful energy use and an electric furnace working overtime during a bitter cold snap. Walking a customer through an analysis of their usage normally leads to a more satisfying resolution that can also save the utility from losing money to an unnecessary service credit.

Eliminating Off-cycle Reads

Move-in/move-out reads are inherently inefficient and, in college towns and other heavily transient areas, incredibly time-consuming. Advanced AMR makes it possible to leave normal reading operations undisturbed. Instead of sending a reader on a specific day, to read the meter before the next tenant or homeowner arrives, customer service can simply consult the historical usage profile and quickly determine the usage as of that particular day. This can be done long after new tenants have moved in and started using the utilities. It also ensures a customer's consumption history is captured and not be affected by anything that happens after their move. Thus, meter reading retains the efficiency of uninterrupted normal operations and the customer gets an accurate final bill.

The Good, the Bad and the "Other"

Customer service personnel are often called to deal with "special" situations. An advanced AMR system can equip them with the tools to address these issues, which can run the gamut - from the typical to the outrageous. One recent example involved a utility that was able to submit

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a customer profile as an evidentiary exhibit for a lawsuit between a homeowner and a contractor. It proved compelling enough that the contractor chose to settle out of court.

Catching utility thieves is difficult at best. But any law enforcement professional will tell you that historical data showing past behaviors is a great place to start. Profile data can often make it possible to establish a pattern of theft which can make it much easier for utility and law enforcement personnel to catch or prevent. A fairly common scenario has discovered and stopped construction crews from using live but unbilled utilities in areas of new construction.

Another unusual instance involved environmental abuse and illegal dumping by a food processing company in North Texas. An observant worker at the utility noted from the usage profile that the company was using a tremendous amount of water around 3 a.m. several times per week. The utility discovered that the company was flushing its grease traps into the municipal water system, a violation of both local and federal environmental regulations. The company was warned and has complied with the law ever since.

"Our advanced AMR system is a great processing tool for providing detailed information for our customer base," added Gaguski. It also helps us resolve specific metering problems, and analyze utility usage whether it be gas, electric, or water."

Meter and Infrastructure Resizing and Planning

Operational efficiency can be greatly compromised by improperly-sized infrastructure and meters. Advanced AMR turns even the simplest residential electric, gas and water meters into sophisticated data recorders capable of delivering demand and interval usage data, which in turn can be used to perform load studies over any portion of the distribution system.

Meter right-sizing involves examining usage and determining if it approaches the rated capacity of the meter. In cases where it does, replacement with the next larger size often will show that customer's usage was higher than with the old meter. This is because undersized meters often cannot capture usage in excess of their rated capacities. One city began this kind of analysis and found a large portion of their meters to be undersized. Replacing the undersized meters with larger ones netted the utility nearly $2.5 million per year of previously lost revenues.

Transformers can be similarly evaluated by analyzing the aggregated usage patterns for all services attached to them. By noting these aggregated totals, peak loads can be accurately determined along with estimates as to the unit's probability of failure. Transformers found to be close to, or routinely exceeding their rated capacities can be replaced. This kind of proactive resizing can prevent outages, unhappy customers and can save utilities money. Analyses of this kind can also be of great help in infrastructure planning and maintenance.

"Having an advanced AMR endpoint that is meter independent, that is, compatible with virtually any meter, adds another dimension of value to the equation," commented Scott Durham, Vice President of Sales for Datamatic Energy Systems. "As undersized meters are discovered, it gives the utility unlimited replacement options. Without the constraints of proprietary AMR and able to choose any meter to replace those that need it, utilities are placed in a much more powerful position."

Summary

The advent and widespread proliferation of automatic meter reading has proved to be one of the most significant technological advances for utilities in the last 20 years. As AMR technologies have matured, so have the diversity and depth of its applications across utility operations. Technologies able to provide detailed interval usage profiles such as advanced AMR, are undoubtedly leading the way delivering the broadest value to today's utility operations.■▲

About the Author

With over 15 years business and sales management experience, Michael Caranfa has successfully managed and run sales, marketing and business development groups within technology, telecommunications, engineering and outsourcing organizations.

As Director of Business Development for sDatamatic Energy Systems, Michael is responsible for providing focus and guidance for Datamatic's gas and electric strategies as well as increasing the Company's revenue and strengthening its customer base.

The former United States Army Airborne Ranger served in the Persian Gulf War and was awarded the Bronze Star Medal for actions in combat. Currently a captain with the Texas Army National Guard, he is a company commander with the 3rd Battalion, 144th Infantry.

Michael can be reached for comments or questions via email at mikec@datamatic.com.

Driving Operational Efficiency and Productivity with Mobile Workforce Management Solutions

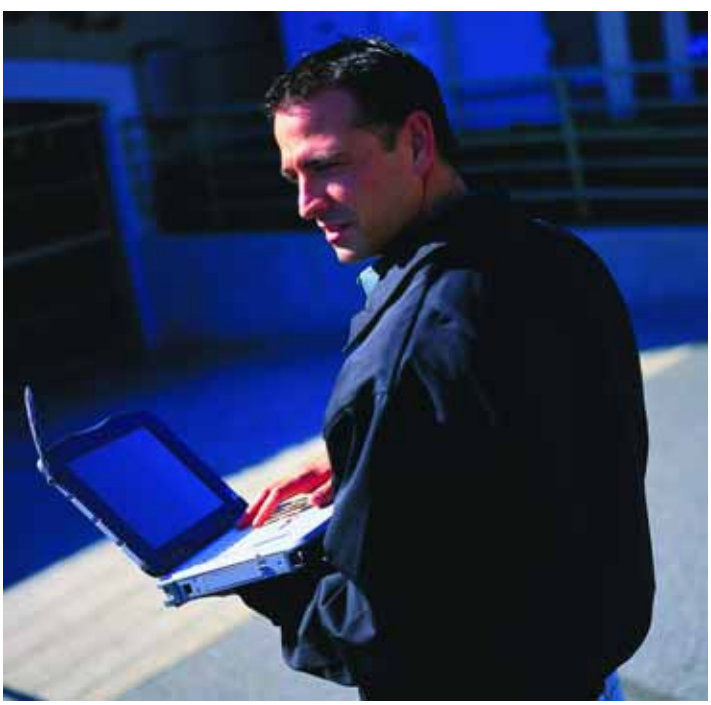
By Simon Jacobs, Director, Product Management for MDSI Mobile Data Solutions

Mobile computing is fast becoming a mainstream requirement as society shifts toward a decentralized and more mobile workforce. For many field service companies, business factors including customer demand for superior service, and business process reengineering efforts, are necessitating significant investment in mobile computing technologies.

As field service organizations search for solutions to maximize efficiencies across the enterprise, momentum towards mobile workforce management solutions is building. Industry driving forces are changing the way in which companies compete, work with suppliers, and offer services to customers. Deregulation, globalization, rising customer expectations, decreasing operational budgets, reduced workforces and technological changes are rapidly increasing competition in the marketplace. Pressures from every side are driving companies to do more with less—to increase customer satisfaction while reducing operating costs.

More than any other enterprise application, a Mobile Workforce Management (MWFM) solution can help companies do just that. But which solution is best? The wrong one may solve only a subset of your problems and force you to pour money into a never-ending project in an attempt to get it right. The right solution can give you an immediate and measurable return on your investment and directly affect your bottom line

A MWFM solution is critical to achieving corporate objectives of increased market share and improved profitability. It will help you (i) retain existing customers and attract new customers by improving customer service, and (ii) reduce operating costs by improving the efficiency and effectiveness of service delivery. MWFM provides you with the tool you need to respond to competitive pressures and to achieve a competitive advantage in your industry.



Understanding the Mobile Workforce Advantage

Service providers are confronted daily with the difficult task of optimally assigning work requests to their field force, dispatching work from the office to the field, monitoring the progress of the work, and responding to changing conditions. In addition, field service organizations must measure workforce performance in order to improve the quality of strategic forecasting and planning efforts. In contrast with time-consuming and inefficient paper-based systems, mobile workforce management systems manage, schedule, and dispatch work for mobile engineers and technicians – all wirelessly and in real-time. Work assigned to technicians is delivered wirelessly to the workforce in the field using laptops or hand-held mobile devices like Pocket PCs; as work progresses, technicians send completed information wirelessly back to the enterprise.

Specific workforce challenges that impact daily field service operations include:

- Making and keeping customer commitments
- Completing planned work without overtime
- Responding quickly to emergency situations
- Making the most productive use of the mobile workforce
- Providing technicians easy access to the information they need
- Automating the collection and validation of field data
- Reducing travel times

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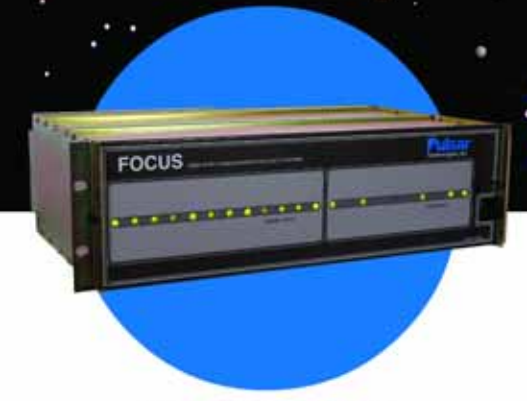

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Faced with these business challenges, many field service operations are choosing to implement a MWFM solution to achieve a number of strategic business goals including:

- Improvements in the immediate accessibility of customer information to field representatives during the workday.
- Real-time status updates of customer work orders and account histories.
- Improved distribution of customer work orders to field representatives according to representative location, availability and skill set for optimized efficiency.
- Consolidated data and improved visibility into field operations to provide insight into how to maximize work force efficiency.

Two Canadian companies, ATCO Gas and FortisAlberta, have implemented MWFM solutions and have realized significant return on their investment as a result through improved operational efficiency, productivity and customer satisfaction.

ATCO Gas

Part of the ATCO Group of companies, ATCO Gas provides safe, reliable delivery of natural gas to more than 2.4 million customers in almost 300 communities in the province of Alberta Canada. The ATCO Group is one of Canada's premier corporations, and is actively engaged in Power Generation, Utilities, Logistics and Energy Services, Technologies and Industrials.

The company has more than 90 years of experience providing natural gas service to homes, farms and businesses. Headquartered in Edmonton Alberta, ATCO Gas has approximately 1,600 employees and 57 district offices across the province. ATCO owns and operates a safe, reliable natural gas distribution system comprised of 34,000 kilometers of pipeline throughout Alberta.

ATCO Gas' MWFM solution is owned and operated by ATCO I-Tek, a separate division of the ATCO Group, which provides call center, information technology, network infrastructure, applications software development and integration services.

At ATCO, fifty dispatchers and 370 mobile technicians use their enterprise workforce management solution to manage a variety of gas service work, including inspection, meter reading, customer complaints, and appliance repair. On average, their system dispatches 1700 work orders to the field each day, with approximately 100 orders per day on the weekends.

Orders generated in ATCO's proprietary customer information system (CIS) are sent to their MWFM system for dissemination to the field force. Mobile technicians communicate with the enterprise wirelessly and in real-time, using HP iPAQ Pocket PC's over a CDMA 1XRTT network by Telus Mobility.

Investing in Next-Generation WFM technologies

An MDSI customer since implementing Advantex r4 in 1989, ATCO made the strategic decision to upgrade its system from r7.4 to r7.6 in June 2004 to address their evolving mobile workforce management needs.

And the results of the upgrade project were impressive.

Traditionally, upgrading enterprise-level software has taken months, sometimes as long as the initial implementation, and has required the help of the software vendor or IT consultants. No more. ATCO Gas demonstrated how easy it could be to upgrade an enterprise workforce management system. They successfully upgraded their system in

just a weekend with a minimum of technical support and no unplanned system downtime.

"As this was our first time through a baseline system upgrade, we wanted the comfort of having MDSI engineers on-site, in case something went wrong. We were pleased to find that our team was able to do most of the work themselves. It was a very easy upgrade," says Errol Seim, Work Management Project Team Lead for Atco I-Tek

After having invested significant time in configuring their mobile workforce management solution to meet their unique business needs, ATCO was very pleased to find that all configuration changes they had made came through the upgrade and performed as expected. ATCO's WFM solution also incorporates the use of an advanced configuration tool set, enabling ATCO to make configuration changes themselves without the need for technical support staff.

As a result of the upgrade, ATCO Gas users were quickly able to appreciate the changes. Dispatchers were thankful for the improved text messaging. Field technicians noticed enhancements in the mobile application, like better drop down menus and greater overall application performance. And because all of the configuration work that ATCO Gas had done was carried forward to the new version, users didn't have to relearn a thing. Given the success of this upgrade project and in support of its continued growth, ATCO successfully automated the work of an additional 170 service staff in December 2004.

ROI Benefits Achieved

ATCO has achieved benefits beyond its expectations with its initial implementation of a MWFM solution, including widespread operational efficiencies, productivity improvements, and cost savings.

To date, specific tangible benefits include:

- Reduction in the number of employees
- Increase in volume of work
- Reduction in amount of paperwork
- Heightened customer safety, service and satisfaction
- Improved customer and asset data quality through reduced data entry errors
- Increased number of completed appointments
- Reduced support costs with the ability to configure the system themselves

FortisAlberta

FortisAlberta is an electric utility with more than 407,000 rural and urban customers located in Alberta, Canada. It is a wholly owned subsidiary of Fortis Inc. – a diversified, international electric utility company with 4000 employees operating utilities in 5 provinces of Canada, Belize and Cayman Islands. FortisAlberta owns and operates approximately 96,000 KM of low voltage distribution lines in Alberta and serves its customers with a workforce of construction and operations technicians. There are 180 operations technicians that deal with the bulk of the customer service orders including such things as new service connections, power outage calls, and streetlight repairs.

Drivers for Change: Service and Billing Delays Impact the Bottom Line

In the late nineties, the operations workflow at FortisAlberta's 53 small local area offices was primarily paper-based and fraught with delays. The existing workflow lacked the ability to provide field technicians with up-to-the-minute customer information and was not well suited to ensure effective utilization of resources over such a large service territory as Alberta. The company realized that it had to change the service delivery model to better meet the needs of customers.

In 1998, the company committed to implementing a MWFM solution across the organization to improve customer service and to optimize operational efficiencies. The strategic business goals for the implementation project were to:

- Reduce the number of people involved in coordinating daily work.
- Create better visibility of the total work and resources available to more effectively meet the priority needs of our customers
- Automate the order completion process and the delivery of information back to the Customer Information system
- Reduce manual data entry time and increase data accuracy.
- Automate the time entry process.
- Improve customer response time and troubleshooting ability.
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In 1998, as part of several business process improvements the company centralized the work dispatch process by implementing MDSI's Advantex r5.3 MWFM solution and automating the maintenance, construction and emergency work of 180 Power Line technicians. Fortis Alberta's MWFM solution is integrated with a SAP CCI customer information system and R3 systems for maintenance and construction work.

"Our MWFM solution has given us greater visibility of the workload and has enabled us to more effectively deploy our resources to meet the priority needs of our customers. As a result, we have the right resource assigned to the right job at a significant cost savings to the customer," comments Craig Taylor, Supervisor, Resources and Scheduling for FortisAlberta.

ROI Benefits Achieved

FortisAlberta has achieved many significant benefits as a result of its initial implementation of a MWFM solution, including the following:

- A reduction in staff required for the efficient planning and organizing of work.
- A 30% increase in the volume of service orders completed from 2001 to 2004 with minimal increase of field technicians.
- Improved response time and fewer repeat visits to a customer's site.
- Improved accuracy of customer information enabling more timely feedback to customers.

Thus, the implementation of MWFM solutions at both ATCO Gas and FortisAlberta has yielded significant benefits for both companies including improved operational efficiency for field service representatives and dispatchers. The MWFM solution in each case has allowed for better asset management and resource deployment decisions as well as improved visibility into the status of customer service orders. Furthermore, the MWFM solutions have proved to be a cost effective replacement of older legacy systems that were becoming increasingly expensive to maintain. Most importantly, the operational benefits achieved by both ATCO Gas and FortisAlberta have yielded significant improvements in service levels that have been passed on to customers. ■

About the Author

Simon Jacobs, Director, Product Management for MDSI, has 18 years of experience in software development, requirements analysis, and product management. Mr. Jacobs holds a Bachelors of Mathematics from the University of Waterloo and a Masters of Science in mathematics and computer science from the University of British Columbia

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SCADA/Business Network Separation: Securing an Integrated SCADA System

By Scott Wooldridge , Vice President of Sales, Citect.

In recent years, utility companies have undergone great changes in the way they run their businesses. The pressure to increase profits and reduce expenses has them integrating their SCADA systems with their business networks to streamline operations. The popularity of the Internet has customers requesting online access to their accounts as well as online bill payment, further increasing network exposure. In addition, utility companies have reduced costs by leveraging the Internet to facilitate core business operations such as outage management and procurement.

The August 2003 mass power outage heightened public concern about the possibility of an intentional outage. As a result North American Electric Reliability Council (NERC) created the Urgent Action Standard 1200. The purpose of this action was to ensure all entities responsible for the reliability of the bulk electric systems in North America identify and protect critical cyber assets that control or could impact the reliability of bulk electric systems. In 2004, NERC issued a continuation and update of Standard 1200 that remains mandatory for control areas and reliability coordinators. All control areas and reliability coordinators must complete and submit the appropriate regional self-certification renewal form(s) indicating their degree of compliance or non-compliance with the cyber security standard requirements during the first quarter of 2005.

In addition, global terrorism has the public and media concerned about the security of public utility companies' critical infrastructure and their SCADA systems. Despite the public fears, there is no reason for utility companies to shun the immense benefits resulting from the integration of SCADA systems and the advantages of the Internet. The threat may be real, but the measures to protect SCADA systems are, fortunately, relatively easy.

Perhaps the greatest danger to utility companies is the lack of awareness of the need for greater security. Many public and private companies controlling vital public utilities like gas, power and water, never thought they would be the target of cyber attacks and now must implement measures to improve network security. While many utility companies perform regular risk assessments of their SCADA systems, too many do not. They have become dependent on their tightly integrated digital information systems without fully understanding the potential impact of a cyber attack.

SCADA systems were traditionally "walled off" from other systems operating independently from the network. Prior to the awareness of

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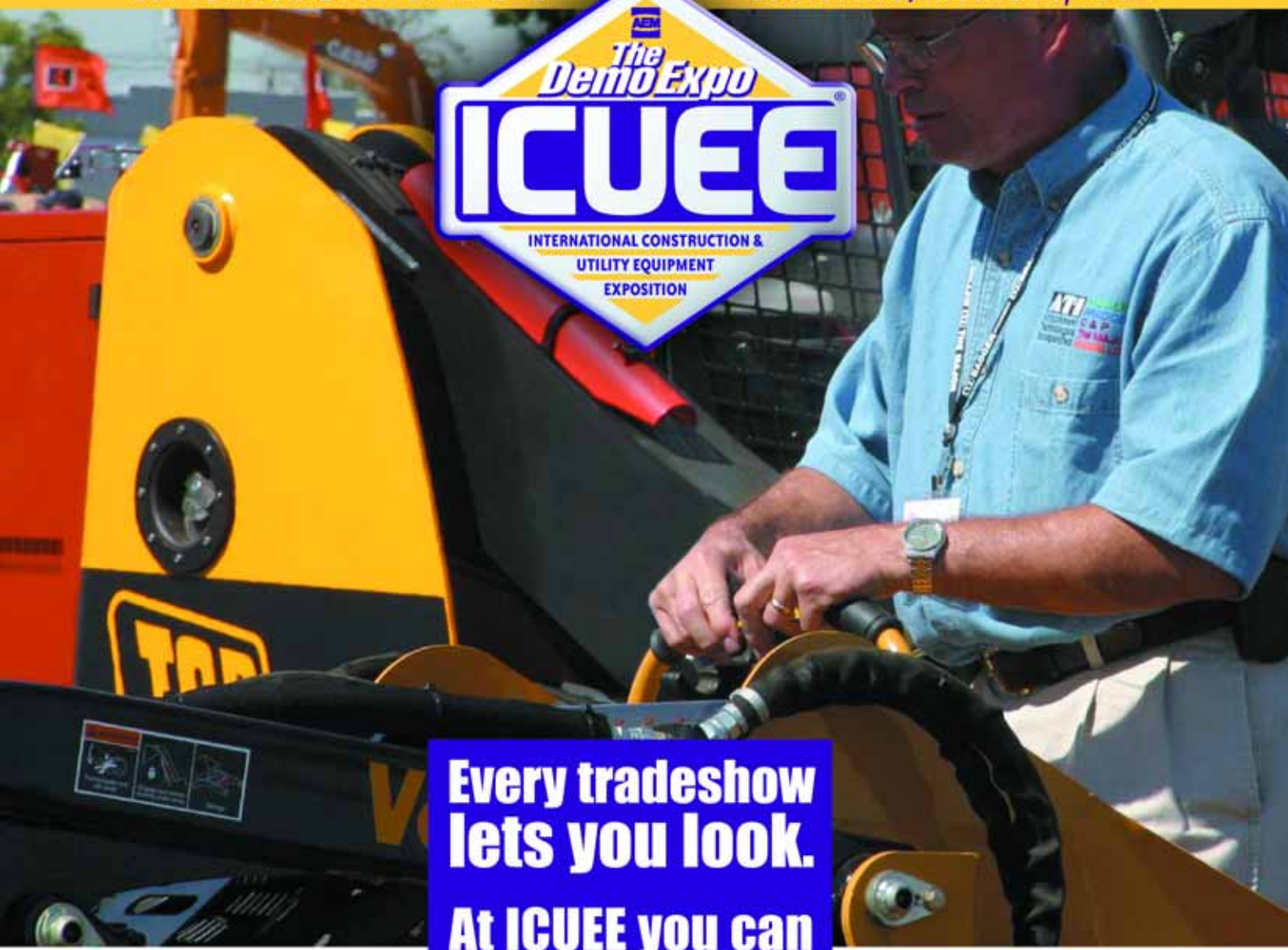

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possible attacks, this seemed to provide all the protection the SCADA system needed. They were largely proprietary systems with such limited access and esoteric coding that very few people would have the ability to access them to launch an attack. Over time, however, they became integrated into the larger company network as a means to leverage their valuable data and increase plant efficiency. Therefore, the reality is their security is now often only as strong as the security of the network.

Protecting Your SCADA Network

The first step

The first step towards securing SCADA systems is creating a written security policy, an essential component in protecting the corporate network. Failure to have a policy in place exposes the company to attacks, revenue loss and legal action. A security policy should also be a living document, not a static policy created once and shelved. The management team needs to draw very clear and understandable objectives, goals, rules and formal procedures to define the overall position and architecture of the plan.

Key personnel such as senior management, IT department, human resources and the legal department all should be included in the plan. It should also cover the following key components:

- Roles and responsibilities of those affected by the policy
- Actions, activities and processes that are allowed and those that are not allowed
- Consequences of non-compliance

Vulnerability Assessment

A key aspect of preparing a written security policy is to perform a vulnerability assessment prior to completing the written policy. A vulnerability assessment is designed to identify both the potential risks associated with the different aspects of the SCADA-related IT infrastructure and the priority of the different aspects of the infrastructure. This would typically be presented in a hierarchical manner, which in turn sets the priority to address security concerns and the level of related funding associated with each area of vulnerability.

For example, within a typical SCADA environment, key items and the related hierarchy could be as follows:

- Operational Availability of Operator Stations
- Accuracy of Real Time Data
- Protection of System Configuration Data
- Interconnection to Business Networks
- Availability of Historical Data
- Availability of Casual User Stations

A vulnerability assessment also acts as a mechanism to identify holes or flaws in the understanding of how a system is architected and where threats against the system may originate.

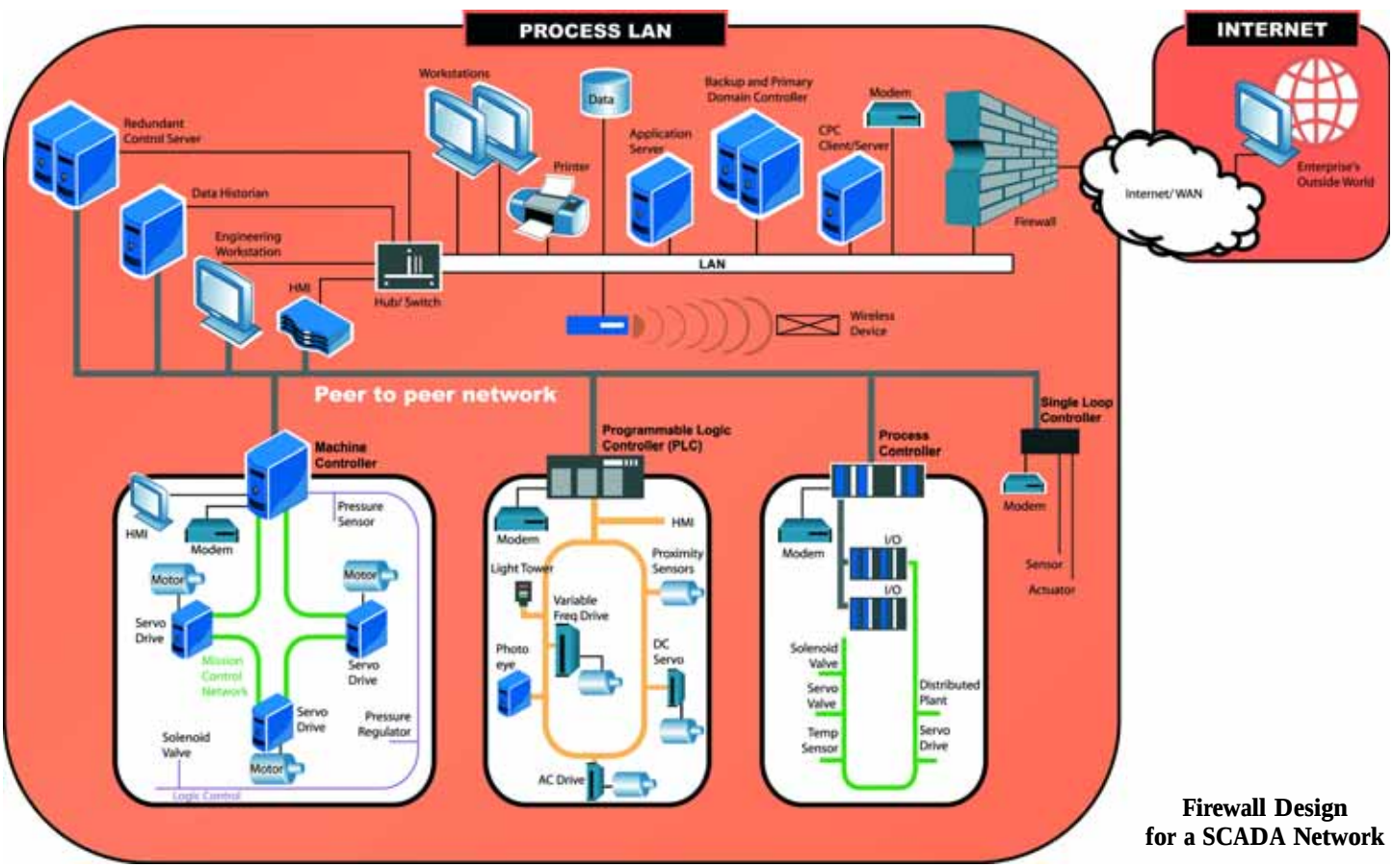
To successfully complete a vulnerability assessment, a physical audit of all the computer and networking equipment, associated software and network routings needs to be performed. A clear and accurate network diagram should be used to present a detailed depiction of the infrastructure following the audit.

After defining the hierarchy and auditing the different system components, the following areas of vulnerability need to be addressed, as they relate to each component, as part of the assessment process:

Network and operating environment security

- Application security
- Intrusion detection
- Regulation of physical access to the SCADA network

It should also be understood when dealing with the SCADA infrastructure that there are commonalities and differences between



Firewall Design for a SCADA Network

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SCADA-related IT security and IT security focused on typical business systems. For example, in a business systems environment, access to the server is typically the key focus. Whereas in a SCADA environment, the access focus is at the operator console level. This difference produces both alternate network topologies to provide the necessary availability as well as a different focus on what elements of the SCADA system would be of highest priority to safeguard against security breaches.

Further Security Measures

As previously mentioned, SCADA networks were once separate from other networks and physical penetration of the system was needed to perpetuate an attack. As corporate networks became electronically linked via the Internet or wireless technology, physical access was no longer necessary for a cyber attack. One solution is to isolate the SCADA network; however, this is not a practical solution for budget-minded operations that require monitoring plants and remote terminal units (RTU) from distant locations. Therefore, security measures need to be taken to protect the network, and some common security mechanisms apply to virtually all SCADA networks, which have any form of wide area (WAN) or Internet-based access requirements. The core elements of each method are discussed in the following:

Network Design – Keep It Simple

Simple networks are at less risk than more complex, interconnected networks. Keep the network simple and, more importantly, well documented from the beginning.

A key factor in ensuring a secure network is the number of contact points. These should be limited as far as possible. While firewalls have secured access from the Internet, many existing control system have modems installed to allow remote users access to the system for debugging. These modems are often connected directly to controllers in the substations. The access point, if required, should be through a single point that is password protected and where user action logging can be achieved.

Firewalls

A firewall is a set of related programs, located at a network gateway server that protects the resources of a private network from outside users. A firewall, working closely with a router program, examines each network packet to determine whether to forward it toward its destination. A firewall also includes or works with a proxy server that makes network requests on behalf of workstation users. A firewall is often installed in a specially designated computer separate from the rest of the network, so that no incoming request can get directly at private network resources.

In packet switched networks such as the Internet, a router is a device or, in some cases, software in a computer, that determines the next network point to which a packet should be forwarded toward its destination. The router is connected to at least two networks and decides which way to send each information packet based on its current understanding of the state of the networks to which it is connected. A router is located at any gateway (where one network meets another), including each point of presence on the Internet. A router is often included as part of a network switch.

It is imperative to utilize a secured firewall between the corporate network and the Internet. As the single point of traffic into and out of a corporate network, a firewall can be effectively monitored and secured. It is important to have at least one firewall and router separating the network from external networks not in the company's dominion.

On larger sites the control system needs to be protected from attack within the SCADA network. Implementing an additional firewall between the corporate and SCADA network can achieve this aim and is highly recommended.

Virtual Private Network (VPN)

One of the main security issues facing more complex networks today is remote access. VPN is a secured way of connecting to remote SCADA networks. With a Virtual Private Network (VPN), all data paths are secret to a certain extent, yet open to a limited group of persons, such as employees of a supplier company. A VPN is a network constructed by using public wires to connect nodes. For example, there are a number of systems that allow the creation of networks using the Internet as the medium for transporting data. These systems use encryption and other security measures to ensure only authorized users access the network and data cannot be intercepted. Based on the existing public network infrastructure and incorporating data encryption and tunneling techniques, it provides a high level of data security. Typically a VPN server will be installed either as part of the firewall or as a separate machine to which external users will authenticate before gaining access to the SCADA networks.

IP Security (IPsec)

IP Security (IPsec) is a set of protocols developed by the Internet Engineering Task Force (IETF) to support the secure exchange of packets at the IP layer. IPsec has been deployed widely to implement VPNs

IPsec can be deployed within a network to provide computer-level authentication, as well as data encryption. IPsec can be used to create a VPN connection between the two remote networks using the highly secured Layer Two Tunneling Protocol with Internet Protocol security (L2TP/IPSec).

IPsec supports two encryption modes: Transport and Tunnel. The Transport mode encrypts only the data portion (payload) of each packet, but leaves the header untouched. The

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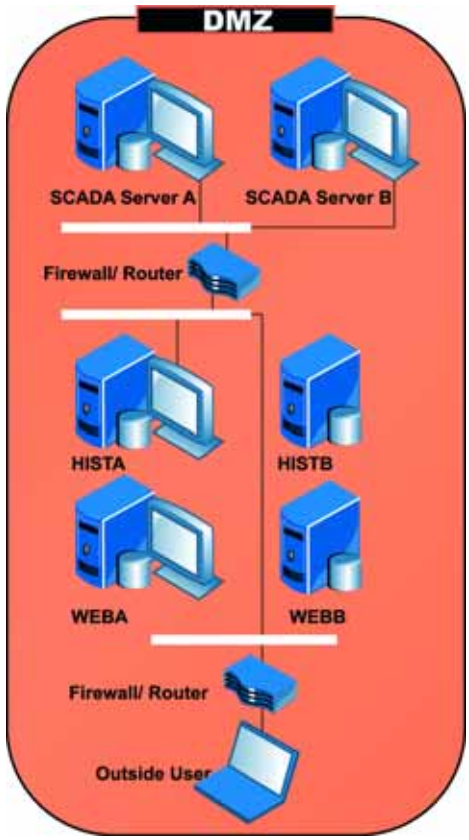
more secure Tunnel mode encrypts both the header and the payload. On the receiving side, an IPSec-compliant device decrypts each packet.

For IPsec to work, the sending and receiving devices must share a public key. This is accomplished through a protocol known as Internet Security Association and Key Management Protocol/Oakley (ISAKMP/Oakley), which allows the receiver to obtain a public key and authenticate the sender using digital certificates.

It is important during the selection process of network hardware such as routers, switches and gateways to consider the inclusion of support for IPSec security as part of the devices to enable the support of secure VPN connections.

Demilitarized Zones (DMZ)

Demilitarized Zones (DMZ) are a buffer between a trusted network (SCADA network) and the corporate network or Internet, separated through additional firewalls and routers, which provide an extra layer of security against cyber attacks. Utilizing DMZ buffers is becoming an increasingly common method to segregate business applications from the SCADA network and is a highly recommended additional security measure. ■

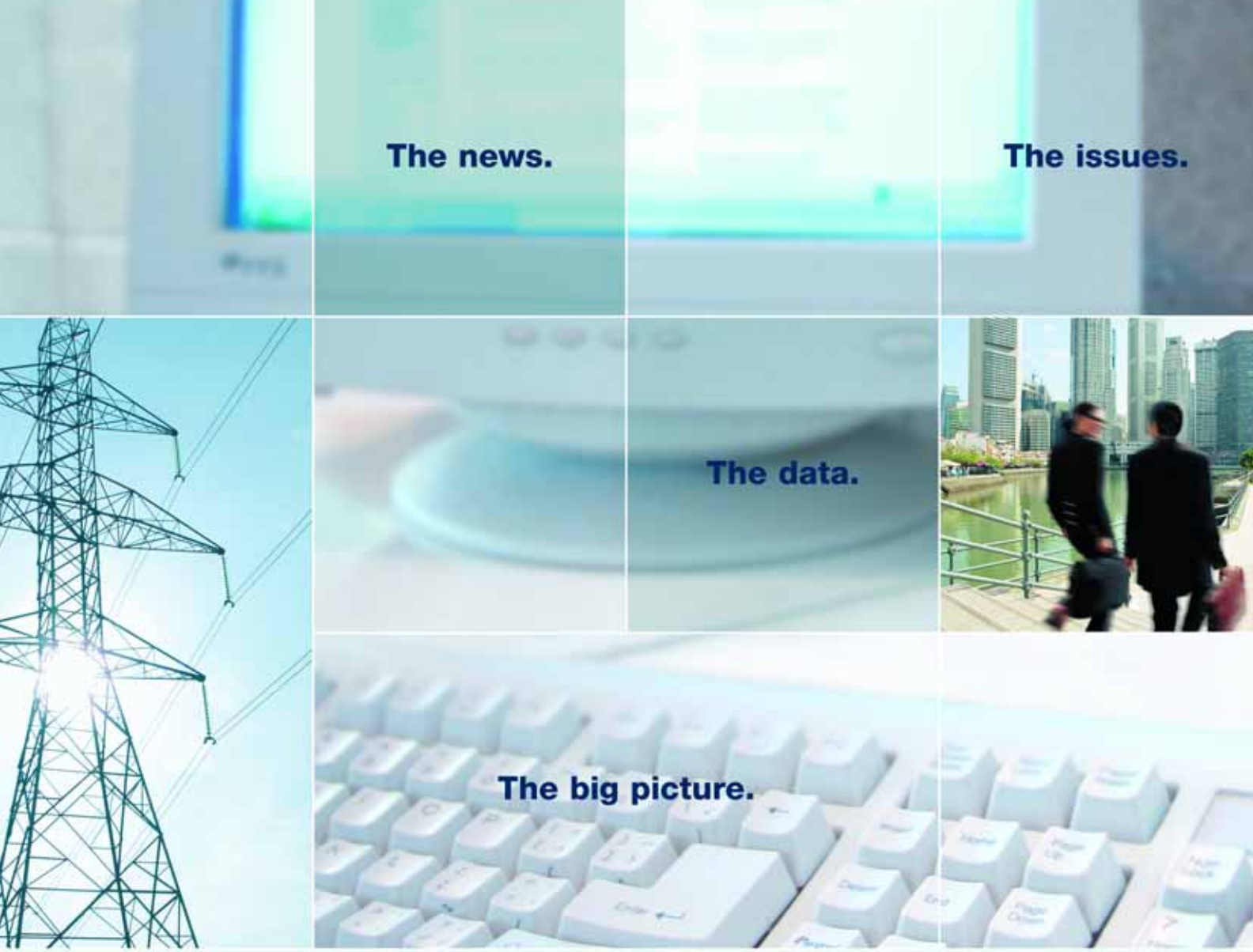


Demilitarized Zones (DMZ)

About the Author

Scott Wooldridge holds an MBA degree in addition to degrees in electrical engineering and mechanical engineering. He has over 15 years experience providing production improvement engineering, IT, Project Management and Consultancy services to a variety of industrial, process, food and mining customers including: Rio Tinto, BHP Billiton, ALCOA, PG & E, Mitsubishi, Caterpillar and GM.

Scott now serves as Citect Americas Vice President of Sales and previously acted as the Vice President of Citect's Professional Services organization, leading a team of engineering and IT personnel providing services throughout North and Latin America.



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"Iowa Utility Migrates Wireless SCADA Network from Analog to Digital, adds Data Ports"

By Russ Straayer, Data Comm for Business, Inc.

Background

Dennis Hill, Telecom Manager at Northwest Iowa Power Cooperative (NIPCO) in LeMars, Iowa had a networking problem that was perplexing him. The SCADA system he is responsible for managing had analog radios and switches, but Dennis needed to migrate to a digital network. The MDS (Microwave Data Systems) analog 900 MHz radios are no longer manufactured. The pool of spare radios is very small. There are not enough analog radios around to count on for system expansion. The replacement for the analog radio is the MDS digital 9700 series.

Dennis needed to upgrade the network to run faster and with greater reliability. Digital networking is the key to more speed and greater reliability. As newer RTUs are migrated into the NIPCO SCADA network, more information can be gathered and higher transport speeds are desired on the SCADA network.

Existing Analog Switching is not Digital Compatible

The Northwest Iowa Power Cooperative (NIPCO) Iowa, had analog multidrop (MAS) MDS radios in operation for many years. NIPCO shares the radio network between SCADA and meter data collection. Dennis had developed a clever analog switching system for NIPCO. A switch at the substation is activated to select either the SCADA RTUs or the meters, using a 2800 Hz signal tone. The tone is recognized by the switch and the data path is switched from the SCADA equipment to the meter equipment. The 2800 Hz tone is sent through the analog MAS radio system. The 2800 Hz tone was selected because it was out of the frequency range of the FSK modems running over the analog radios.

When the 2800 Hz tone is active, the SCADA RTUs are switched offline, the meters are switched online. The SCADA host system is unable to collect RTU data while the meter data is collected, but the interruption lasts only a few minutes per day. After collecting the meter data, the SCADA system is switched back online by turning off the 2800 Hz switching tone.

The SCADA downtime and digital path problem

NIPCO needed to move away from this analog switching system for several reasons. First, while meter information is being collected, load management data is unavailable. Downloading meter information takes the SCADA system down for 30 minutes to an hour. During high load conditions, such as hot weather and the fall grain drying season, losing the SCADA system information for just half an hour can lead to system problems. Second, as noted earlier, NIPCO must make the transition from analog to digital radios, as the analog radios are not available for purchase in any quantity. Once the digital radios are deployed in the system, it is impossible to send a 2800 Hz tone. The 2800 Hz analog tone cannot be transmitted through the digital radio path.

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SMD and DSU used to link the host site to a master radio

The SCADA and meter equipment

The NIPCO uses the LANDIS & GYR 8979 (L&G) protocol for SCADA. The meter application uses Scientific Columbus meters running at 1200 bps, using JR1 meters and JR1F protocol. Some of the sub-stations have already been upgraded to newer Jemstar meters, and all substations will, at some point in the future, be upgraded. The SCADA host and the new meters are capable of running at 9600 and 19,200 bps. NIPCO wants to take advantage of the higher speed capabilities when they switch from analog to digital radios.

The Radios

NIPCO chose to stay with Microwave Data Systems for their radios. They upgraded to the model 9710 digital radios, operating in the 900 MHz licensed band. The digital radios operate at 9600 or 19,200 bps. They have tried both speeds, and find the system operates well at either rate.

To replace the analog switches, Dennis looked at several other options. One option was to gather the meter information using the SCADA RTUs. Some SCADA equipment manufacturers use store and forward techniques to deliver the remote meter information back to the host site through the RTUs. The RTU buffers up the meter information and pass it to the host computer. The data is then passed from the SCADA host to the host computer that processes the meter data. Dennis evaluated this approach, looking at its implementation at another electric cooperative.

The Solutions

The RTU relay approach that Dennis Hill analyzed was not a solution he wanted to deploy. He found that if the remote RTU had gathered the meter data but had not yet transmitted that data to the host, and there was a power glitch, the meter data was gone. Missing meter data leads to estimated billing, rather than exact usage billing. Dennis wanted a more reliable solution. He wanted to communicate with the meters directly, not through an intermediary RTU. Dennis looked for a solution that would either allow him to switch between SCADA RTU communications and meter data collection, or would allow both SCADA and meter collection to occur simultaneously. Simultaneous operation was his preference.

Dennis looked at code activated switches. There were none on the market that did exactly what he wanted. He would have to find someone to build a custom switch or build his own. This was not the preferred solution either. With a custom switch, future repair and replacements are a problem. A third party built custom switch was an expensive solution. A switch of his own design tied the unit to him personally. If he were on vacation, or in the future, retires or is not around for some other reason, his support for the device would be gone. A standard commercial product was the preferred solution.

Dennis found a standard commercial product from Data Comm for Business, Inc. It is the DCB SCADA Multidrop Multiplexer (SMD). This device claimed to allow up to 4 channels to operate at the same time, even at different speeds and with different protocols. Dennis is a capable, but cautious engineer. He liked what he heard, but "show me" is his motto. He procured several of the units and deployed them in a test system for several months before blessing this approach.

Dennis assigned the task of testing to Tim Hansen. Tim installed the new MDS 9710 digital radios and the SMD multiplexers. The main radio tower is several miles from the host computer, requiring a link from the host computer to the host SMD multiplexer and radio. This link is provided over DSUs and a T1 link.

Multiplexed system performance

Error rates

Tim Hansen tested the system on the bench and in the first small field test for several months prior to full in-the-field implementation. Both on the bench and in the field, the SMDs worked as expected. There are virtually no errors on the system now. Initially there was a problem over the link from the host computer to the SMD/radio head end. This turned out to be an easy problem to solve. Tim discovered that while the radio and the SMDs were sending asynchronous data, the DSU was set for synchronous operation. With asynchronous data going into synchronous DSU channel, the SMDs had about a 10% error rate. No problem really, just an incorrect setup. Now with the DSU channel set to asynchronous operation, matching the radios and the SMD, the error rate through the DSUs is almost zero. As for the rest of the system, the SMDs and the digital radios, the error rate is also nearly zero. When the digital system is compared to the old analog radio system, the error rate has dropped from a percent or two to near zero.

Comparing analog versus digital error rates

To determine how many transmission errors were encountered when collecting meter data, Dennis built a special monitor box. The monitor box checks the host/meter data stream for ACKs and NAKs. The meter data is error free when the host sends an ACK back to the meter. When the data block is corrupted and needs to be sent again, the host sends a NAK to the meter. The box Dennis built consists of a digital comparator circuit, an LED display and a speaker. Whenever there is an ACK or a NAK, the display shows the hex character that corresponds to the ACK or the NAK. Whenever there is a NAK, the speaker beeps so you can hear when there is corrupted data.

Dennis employs this monitor box on the new digital radio links as well as the old analog links that have not yet been converted to digital. The results are striking. By a wide margin, the digital circuits have fewer errors than the analog modem circuits. The analog system beeps often, the digital system is silent. The SMD multiplexers and the digital radios provide more reliable communications (fewer data errors) and allow the SCADA system and the meter data collection to exist side by side, simultaneously.

Tim Hansen and equipment rack at the host site

Timeouts

The timeout parameter on the NIPCO SCADA system has been changed from about a half second to 2 seconds. With the addition of the SMD, Tim Hansen found he had best performance when he set the polling timeout to two seconds. The timeout issue, if not properly handled, may present some problems that can be difficult to troubleshoot. Older protocols, or most SCADA protocols other than DNP3, do

not include the source and destination addresses or poll numbers in the poll and response. NIPCO is not using DNP3, so the SCADA polling protocol does not include source addresses or poll numbers.

The lack of addresses on the polls and responses and lack of poll numbers leads to the following potential problem if time outs are not considered. The SMD multiplexer may buffer a poll or response due to primary (radio) channel outage or heavy traffic on other channels of the multiplexer. This buffering might exceed the time of the SCADA system timeout. Suppose the SCADA system polled RTU #1, but the RTU response is buffered and delayed. The SCADA system then times out the RTU #1 poll, assumes the RTU did not respond, and goes on to poll RTU #2. If the RTU #1 response is delayed, not lost, then the next response seen by the SCADA host is from RTU #1. With older SCADA protocols, the host does not know the response came from RTU #1. The host thinks the response is from RTU #2. Now the polls and responses are out of sequence.

This out of sequence problem results in SCADA information being shifted from one location to another. Suddenly, substation data seems to shift down one location for all the substations. If the user is not aware that this is the result of timeouts and buffered data, this is a very difficult problem to diagnose and cure. Even if one knows the source of the problem, the data is reported for the wrong location. Once the source of the problem is understood, it is easy to correct.

In the case of the SMD, each drop (remote) SMD has a timer for purging old, stale data. This timer is set to match the SCADA or meter system poll timeout. When the timeouts are matched, data that is too old is purged, letting the SCADA host computer do its normal poll/response/timeout routine without the confusion of receiving old, unexpected data. As mentioned earlier, DNP3 protocol is not subject to this problem because the polls and responses have source and destination addresses and the polls and responses are consecutively numbered. Polls and responses with incorrect source and destination addresses or bad poll sequence numbers are discarded.

Converting from a single channel to multiple channels is accomplished using the DCB 4-port SCADA Multidrop Multiplexers (SMD). A four port SMD is deployed at the host site, another SMD is deployed at each remote site. With four channels, NIPCO operates the LANDIS & GYR 8979 protocol on the first channel. The meter reading application uses another channel of the SMD.

Simultaneous operation on up to 4 ports

The SMD now allows NIPCO to have simultaneous, independent operation on up to four ports. The channels do not interfere with each other. The SMD divides the MAS system channel into 4 ports by digitally sharing the radio bandwidth. One might assume that this process will greatly slow down the collection of SCADA information, but it does not. The SMD divides up the data channel without any noticeable slowing down of the SCADA system polling.

SMD polling is faster than SCADA polling

A typical SCADA system polls RTUs at a rate much below the capability of the MAS radios. In the case of NIPCO, the L&G 8979 RTUs are polled at a rate of 2 polls per second. Each RTU in a polling group of the RTUs is polled about

once every 5 seconds. The SMD installed at the NIPCO host site polls up to 30 remote drop SMDs every second. This faster polling by the SMD results in a four to five time increase in the data transmission capacity of the MAS radios. This fast polling makes it possible to create additional data channels over the MAS radio links.

Rate conversion

The SMD at NIPCO also performs data rate conversion which is used to further speed up the polling process. The NIPCO MAS radios can operate at either 9600 bps or 19,200 bps, the RTUs and the host computer operate at 9600 bps, the meter system at 1200 bps. The conversion to higher speeds increases the polling rate of each channel and is transparent to both the radios and the RTUs. The SCADA or AMR system may momentarily send data to the SMD faster than the SMD sends the data over the radio system. The SMD buffers up the excess data until it can be sent through the radio system.

Migrating to the SMD System

NIPCO is migrating to their new SMD system on a systematic basis, installing the SMDs on one MAS multidrop group at a time. The first group has 11 remote sites. An SMD is installed between the SCADA host computer and master radio at the host site. At each remote site the SMD is installed between the remote radio port and the RTU. Once the SMDs are in place, they are transparent to the L&G 8979 protocol and the load management protocol.

The remote SMDs can be installed at remote drop sites before the host SMD is installed. The drop SMD is in a transparent mode until host SMD protocol is detected. This transparent mode for the drop SMD makes installation less stressful for the installers. They don't have to take the whole system down while they rush around to all the sites and install the SMD drops and host. The 10 or 11 drops on the SCADA system remain in service as the drops are installed. Only when the host SMD is installed do the drop SMDs become active. Until then, the drop SMDs act as just a "bump-in-the-cable".

At a few sites, NIPCO does not have the need for both and RTU port and a meter port. For these sites, NIPCO deploys a single channel SMD. The remote single channel SMDs are needed because the host SMD bundles the L&G 8979 protocol in its own SMD protocol. When the data gets to the remote site, and SMD is required to un-bundle the L&G 8979 protocol.

The SMD Protocol

An SMD host unit polls each drop in numerical sequence and expects a response from the drop polled. During SMD host polling, any port data in an SMD host port buffer is also sent from the host to all drops, regardless of which drop is being polled at the time. The drops send the data out the appropriate port. The SMD drop being polled responds to the poll and includes any data pending in its transmit buffers.

When a host SMD port is defined as an Access Port, the data from the host SMD is handled a little differently. The data from the SMD host goes out the port at only one SMD drop location. This special case allows 1 to 1 SMD host to SMD drop connections. Normally, when a port is not set as an Access Port, data from a host SMD port is broadcast to all the same SMD drop ports for a 1 to many connection.

Access Switch function

With only 2 of the 4 ports used for polling communications, NIPCO has two more ports available on the SMD. Any SMD port can be configured as an Access Port. When an SMD port is set to the Access Port function, a point-to-point link is established from the host to any one of the drops. NIPCO can use the Access Port function to access and control an RTU RS232 setup port, the radio the management port, or any other equipment at the substation that has a serial management port.

Other devices may be plugged into the ports of the SMD, non-polled meters for example. The non-polled devices can be used on any of the 4 ports of the SMD. NIPCO can attach a terminal or PC to the host end SMD, then select a specific remote port to communicate with. By selecting a specific remote port, non-addressed devices can be managed while other ports are carrying polling traffic.

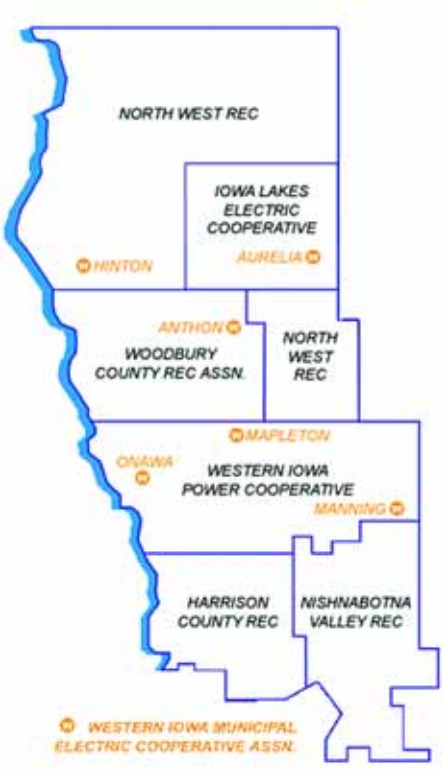
Ethernet/LAN/IP in the future?

With the extra ports available in the SMD, NIPCO will be able to add Ethernet bridging to the system if required. There are many new devices coming onto the market for electric utilities that utilize Ethernet ports, in lieu of, or in addition to serial ports. These devices, whether SCADA, AMR or other data collection and monitoring equipment, are typically very low data volume. These low data volume devices are an ideal fit with the SMD multiplexers.

Adding Ethernet is accomplished using an external box, a "SCADA Bridge". The SCADA Bridge connects to the SMD through a serial port. The SCADA Bridge Ethernet port connects to the LAN equipment at the host and remote ends. Bridging (versus routing) involves just plugging in the units after setting the serial port speeds, a process that avoids the more complex setup used by routers. Bridging puts the remote devices on the same LAN subnet as the host site LAN.

Conclusion

NIPCO has eliminated the periodic lack of load management data and they are able to implement the digital MAS radios. NIPCO has added 3 channels to their single channel radio system. Considering the alternatives of a parallel radio system or phone lines, the SMD multiplexer approach has saved months in time and in excess of $1,500 per remote location. Add in installation and maintenance costs and the savings are even greater. The multiplexed system has no negative impact on the SCADA and AMR systems, provides remote access, builds in room for future expansion, and is economical. ■



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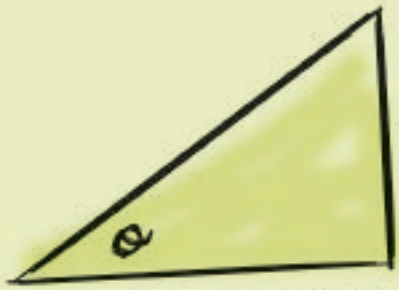

SoHCAH to A

$$\tan\theta = \frac{47.8968\ \text{kVAR}}{98.6972\ \text{kW}}$$

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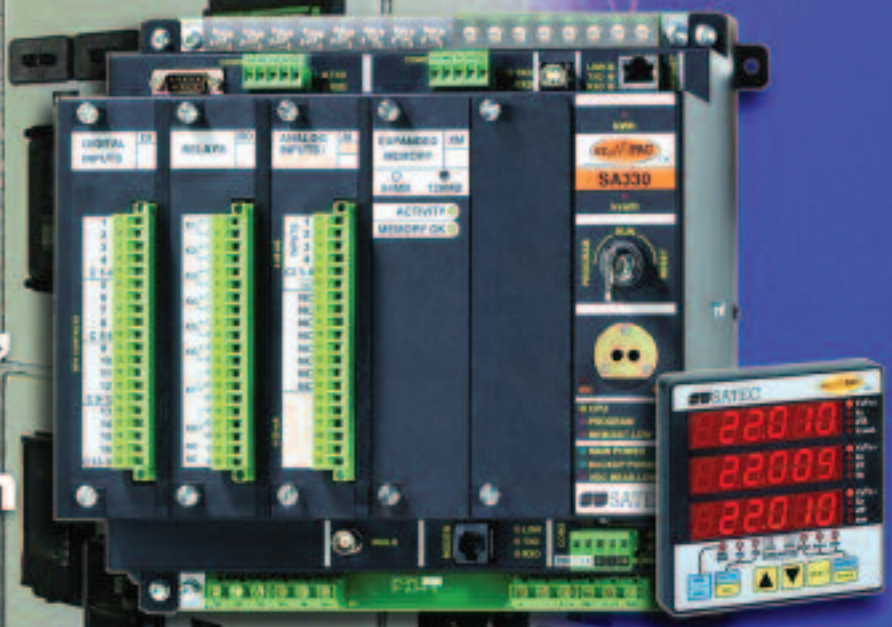

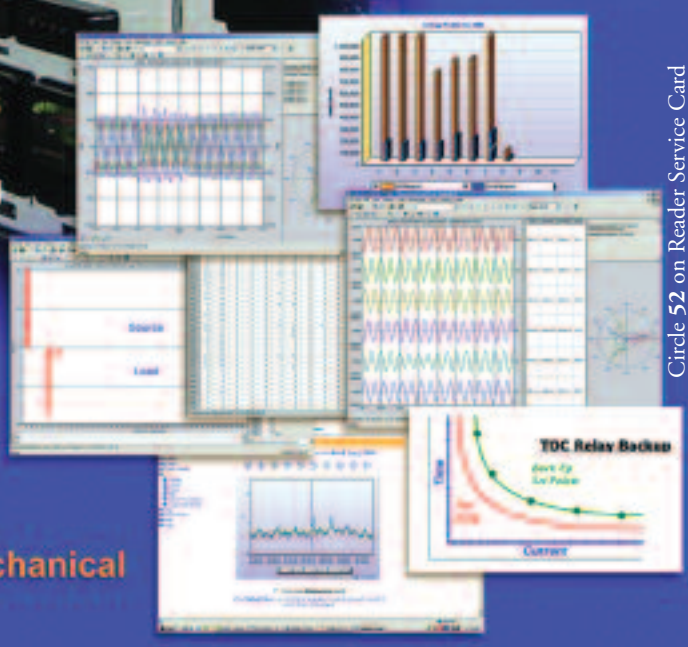

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