Electric ENERGY T&D MAGAZINE

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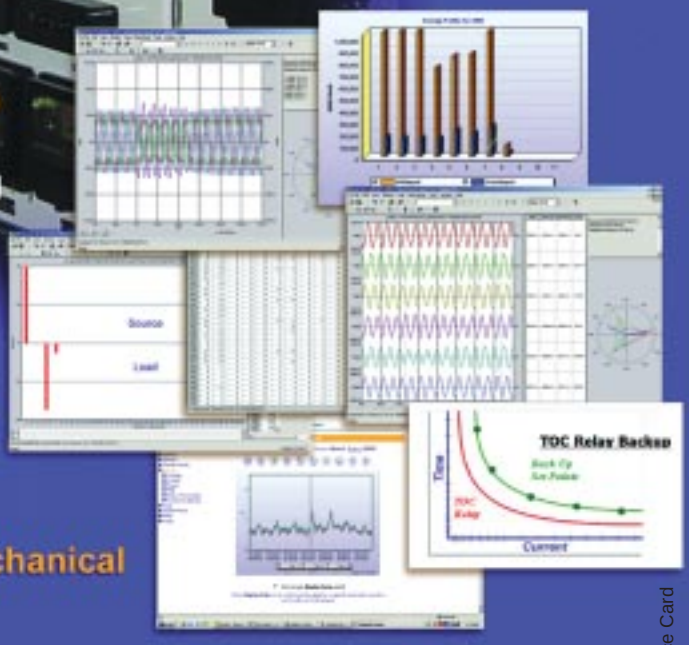

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Publisher
Jaguar Media Inc

Editor
Gordon McCormick: gordon@jaguarpublications.com

Contributing Editor
Francis Bradley: bradley@canelect.ca

Publication Manager
Steven Desrochers: steven@jaguarpublications.com

Account Executives
Joanna Mayoff: joanne@jaguarpublications.com
Ben Malek: ben@jaguarpublications.com

Production Assistant
Danielle Bernier: danielle@jaguarpublications.com

Art Designer
Linda Fleury: artwork@jaguarpublications.com

(MIS) Management Information System
Frederic Allard: fred@jaguarpublications.com

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Web: www.electricenergyonline.com

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Blackout Next Steps:

Mandatory Reliability Standards and Investment

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

Many months have passed since the historic blackout of August 14. With the release in November of the Canada-U.S. Power System Outage Task Force Interim Report, a number of next steps are clear. We need to move on the question of establishing mandatory reliability standards, and we need to put in place policies that will ensure the future investments required to safeguard long-term reliability are made.

The report places the outage in its appropriate historical perspective. For example, the outage that resulted in the establishment of the North American Electric Reliability Council (NERC), the infamous 1965 Northeast Blackout, resulted in the loss of 20,000 MW of load and affected 30 million people. The 1977 New York City Blackout resulted in the loss of 6,000 MW and affected 9 million people. The West Coast Blackout of 1996 saw the loss of more than 28,000 MW, impacting 7.5 million people. In this context, the outage last summer was indeed historic, with a loss of more than 61,000 MW affecting 50 million people.

CEA welcomes the release of the Interim Report of the Canada-U.S. Power System Outage Task Force. We believe it provides further arguments in favor of mandatory reliability standards. As the report demonstrates, the integrated grid was not the cause of the outage; rather, it was the failure to adhere fully to existing protocols and standards. The need for mandatory reliability standards, as identified in the report, is an issue CEA has supported for a number of years. We have actively promoted the creation of an international self-regulating electricity reliability organization able to implement mandatory reliability standards.

This is a view widely shared on both sides of the border. Reliability language in the draft Energy Bill which failed to pass before the U.S. Congress at the end of 2003 included the creation of an Electric Reliability Organization (ERO) that would have prepared and enforced reliability standards. Whether this legislation is re-introduced in the New Year or another method is found to move towards enforceability of standards, we need mandatory reliability standards that are international in design and operation, with regulatory backstop in Canada and the U.S. The present system of voluntary reliability standards must change, particularly as electricity markets continue to evolve. However, because the transmission grid is international in scope, the focus must be on solutions that are international as well. In order to ensure reliability of the international grid, any approach must be respectful of the jurisdictional sovereignty of both Canadian and U.S. regulators.

We must also be mindful of the importance of the trading relationship between Canada and the U.S. Any approach to reliability on the bulk-power system must be developed through close cooperation and agreement between both countries. Anything less could impede future cross-border trade and, more significantly, undermine the reliability of the continental bulk-power grid.

Establishing mandatory reliability standards for the North American electricity system addresses the day-to-day operations of the grid. To ensure long-term reliability and meet growing demand will require vast amounts of new capital investment. There is an emerging consensus that the transmission system needs substantial investment, as indeed do our distribution and generation assets.

The modernization of the electricity system will not be a cheap or easy process. Recently, the International Energy Agency produced a report on energy investment requirements over the next three decades. Globally, power generation, transmission and distribution will require investments in the order of $10 trillion. Transmission and distribution will account for more than half of global electricity-sector investment. From a North American standpoint, the IEA estimates that over the next 30 years, required investments in electricity will reach $1.6 trillion.

Creating a more favorable investment and tax climate for electricity, and boosting investor confidence in the sector will be vital. Investors have become wary of investing in an industry affected by the Enron debacle, the telecom market deflation, and the continued fallout from September 11. As a result, analysts and investors scrutinize energy companies with extra care. Some companies have seen their ratings downgraded, and many have restructured their finances. All this has contributed to a rise in capital costs. This lack of investor confidence places an additional hurdle in the path of raising the necessary capital for the construction of needed generation and transmission projects and could affect meeting the future needs of customers.

Legislators and regulators should be mindful of these realities. I hope that August 14 will indeed spur the kind of action required to address both the question of mandatory reliability standards and the need for investment to build the North American electricity system of the future. ◆

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ABB Signs 4+ Year Maintenance and Upgrade Agreement with CFE

Contract will keep utility's SCADA/EMS system on the cutting edge

Sugar Land, Texas, November 4, 2003 – ABB, the leading power and automation technology company, has been awarded a contract to maintain the SCADA/EMS systems at Mexico's national grid operator, CFE (Comisión Federal de Electricidad). The "Technological Upgrade and Maintenance Project" will ensure that CFE's installation of ABB's Network Manager system are kept up to date over a four and a half year period.

The multi-million dollar contract is the largest single order of its kind ever received by ABB, and will incorporate the following elements:

- Hardware replacement and expansion
- Software updates including new functional enhancements
- System upgrades
- Customer personnel training
- New software development and maintenance tools
- 24/7/365 telephone support
- Remote diagnostic capability
- Periodic on-site specialist visits to audit the systems and recommend preventive and corrective maintenance
- Periodic technical and executive meetings
- User group meeting attendance

The CFE installation is made up of 18 individual systems, originally installed in 1999, which are hierarchically configured in three levels (national control center, area controls centers and zone control centers). CFE recognized the importance of a systematic approach to system maintenance and upgrades in maintaining the systems in their optimum operational capability. This new comprehensive "evergreen" agreement will provide the company with the continued system maintenance and support needed for investment protection and reliable operations.

ABB (www.abb.com) is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 133,000 people. The company's U.S. operations employ about 10,000 in manufacturing and other facilities in 40 states. ✺

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New Utility Load Profiling Meter with Load Control, Alarming, Net Metering and Other Advanced Functions Installs Anywhere

— No Sockets, CT Cabinets or System Shut Down Required

ARLINGTON, TX——MeterSmart, a subsidiary of Hunt Power, L.P., and a leading provider of data collection, processing, web-enabled data applications and metering hardware for utilities, announces the immediate availability of the MeterSmart 5000 Load Profiling Meter. Manufactured to utility-grade billing and security specifications, the MS5000 is designed to help utilities cost-effectively obtain interval data for load research, revenue billing, outage detection, load management and energy information services for resale to their customers. The meter provides a number of features to benefit utility customers, including ANSI C-12 certification, security encryption, pulse synchronization, billing determinants, integration with MV-90 software, and more.

The MS5000's split-core current sensors may be non-invasively installed around the electrical feeds being measured, ensuring a safe meter installation every time without powering down the load. The meter requires neither CT cabinet nor socket for installation and may be located in any convenient location (not just the electrical room). Available in a broad selection of standard three-phase delta and wye voltage and current ranges, the MS5000 meter provides: kWh (usage); kW (demand) with peak date and time; real-time load in kW and kVAR; and per phase voltage, kW and amperage display. The meter can store up to 36 days of data collected in 15-minute intervals, or up to 12 days at five-minute intervals.

The MS5000's net metering option is ideal for facilities with self-generated power sources, allowing users to determine net power by measuring the amount of energy delivered by the power source (or utility), as well as the amount of excess power returning to the electrical grid. This is an especially valuable feature in areas where utilities give power credits. The MS5000 can even distinguish between delivered and received power when the two occur simultaneously on different phases. The meter also

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A MAJOR STEP TOWARDS WIDE AREA MONITORING

ABB's new RES 521 Phasor Measurement Terminal is a key component for gaining more efficiency out of your existing transmission lines and primary equipment. RES 521 phasor measurements are synchronized using GPS (Global Positioning Satellite system) to allow time tagging accuracy of one micro-second.

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RES 521 is based on the same proven technology used in ABB's 500 Series protection and control terminals, ensuring a reliable foundation for accurate phasor measurement. Meeting the stringent EMC requirements set on protective relays, it can be connected directly to CTs and VTs without any additional equipment.

Remote communication based on standard protocols

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provides a third data channel to store reactive (kVAR) data in its interval data readings, which may be viewed using Windows-based Automatic Meter Reading system software (sold separately), either on site or remotely via modem. Targeted at small-to-medium sized commercial and industrial users, the MS5000 provides programmable alarm and control functions that may be used to shut down selected equipment, or start a generator to supplant the utility supply in order to sustain demand at a lower level.

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US Energy Consumers Starting to View and Pay More

Utility Bills Online—Still Lag Well Behind Canada, According to Platts Studies

US consumers are slowly starting to view and pay their electricity and natural gas bills online, but Canadians are far more likely to use the Internet for that purpose, according to two recent studies conducted by Platts Research & Consulting. In North America over 2% of utility customers are now viewing and paying their utility bill using their local utility's Web site or consolidator Web sites such as Checkfree, Metavante or Yahoo. In the United States a further 1.7% of consumers are paying their utility bill directly at their bank's Web site. In Canada, 27.1% are going to their bank site to pay their utility bill.

For the purposes of the study, Platts Research & Consulting contacted a representative group of North American electric and gas companies, and completed a market survey of consumers. Andrew Heath, director of the E Business Service at Platts Research & Consulting noted that "the adoption rates varied widely within the group of utilities we contacted. Some still had adoption rates below 1% whereas some had over 4% of their customers regularly using their online billing services."

Tia Hensler, director of market research at Platts commented that "a further 5 to 10 percent of consumers not using these services are now saying they are very or somewhat interested." ✹
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Options allow easy climbing of CCA poles

The economy and ready availability of treated wood poles are widely recognized, and a 50-year limited warranty from some producers confirms the rot-resistance provided by CCA preservative. But what about climbability? Many poles must still be climbed, at least occasionally, and, despite their numerous desirable features, CCA poles have surfaces that may not allow as deep a gaff penetration as oil treatments do.

Now utilities do not have to give up climbability to gain the protection of CCA. In fact, three different systems have been devised to enhance climbing of CCA poles, and more utilities are choosing one of them for their distribution poles.

Wolmanized® ET® poles. After treatment with CCA, these poles undergo a second step in their processing. An oil emulsion is injected into the outer layer of the pole, serving as a lubricant and making the pole easier to climb. This option provides long-lasting climbing enhancement. In climbing trials, linemen rated ET poles as easy to climb as penta poles, even after 14 years of exposure.

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CCA-PA poles. Newest of the enhanced climbing treatments involves a patented polymer additive technology. The treatment was developed by Hydro-Quebec a major Canadian

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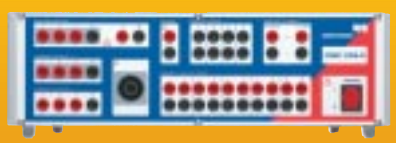

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utility, and Arch Wood Protection, a U.S. company and leader in wood preservation. The additive is forced into the pole along with the preservative, and then the pole is heated, which polymerizes the additive forming an insoluble network within the pole.

Each of these options retains the benefits of CCA preservation, including effective resistance to termites and fungal decay, clean-to-the-touch surface, no need to rotate stored poles, and no need for remedial treatment. In addition, they offer the benefits of wood – easy framing and on-site modification, low electrical conductivity, low thermal expansion, renewable resource, carbon storage, and low energy requirements for manufacture. ✺

More information on ET, Extra, and CCA-PA poles can be obtained from leading pole producers or by contacting Arch Wood Protection, Inc., 770-801-6600 www.wolmanizedwood.com.

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Telvent announces agreement with Echelon to expand worldwide market for Intelligent Electricity Metering

San Jose, CA, USA and Madrid, Spain – Telvent, the information technology subsidiary of Abengoa, (MCE:ABG.MC), one of Spain's largest applied engineering, process management and information technology companies, and Echelon Corporation (NASDAQ: ELON), creator of the LonWorks® device networking platform and the worldwide leader in interconnected and Internet connected networking devices, today announced that they have entered into a Value-Added Reseller (VAR) Agreement to allow Telvent to resell Echelon's Networked Energy Services (NES) system for intelligent electricity metering.

According to Manuel Sánchez, Telvent's Chief Executive, "We believe that Echelon's NES system will greatly expand the market for metering systems, and that is why we are adopting it as the basis of the metering systems that we will offer to our utility customers worldwide," He added "The NES system enables a broad set of services that bring cost savings, efficiency gains, and revenue enhancements by transforming the electrical infrastructure into a two-way communicating network with new intelligent meters. We gain a complete, reliable, cost-effective meter-to-operations center infrastructure through which we can extend our utility applications business by building our solutions on the NES system. The NES system provides a very compelling business case to our customers."

The NES Value-added Reseller (VAR) program enables companies providing products and services to the utility industry to adopt and adapt the NES infrastructure as the basis for their end-to-end metering solutions sold under the NES Powered by Echelon branding program. It creates an opportunity for companies to offer high-value project management and installation services, software applications, new services such as outsourced meter reading, and meters customized for local market needs—built upon a highly reliable, highly functional, field-proven network infrastructure consisting of enterprise software based on the Echelon's Panoramix™ enterprise software platform, powerful IP connected data concentrators, and a family of intelligent, communicating electricity meter boards that can be built into customized meters by the VAR.

"We are pleased to announce Telvent as our first NES value-added reseller partner," said Mr. Ken Oshman, Echelon's CEO. "Telvent brings several important attributes to the NES program. They have extensive expertise in large-scale project management, software applications development, and the coordination of large installation teams. They have existing relationships with many utilities, especially in Spanish speaking countries. Telvent also represents a potential second source of NES compatible solutions, which is important for many utilities as they look to adopt a new metering platform. The result, we believe, will be an increased adoption of our NES system infrastructure worldwide."

About Echelon

Echelon Corporation is the creator of the LonWorks platform, the world's most widely used standard for connecting everyday devices such as appliances, thermostats, air conditioners, electric meters, and lighting systems to each other and to the Internet. Echelon's hardware and software products enable manufacturers and integrators to create smart devices and systems that lower cost, increase convenience, improve service, and enhance productivity, quality, and safety. Thousands of companies have developed and installed LonWorks products and more than 30 million LonWorks enabled processors have been shipped for use in homes, buildings, factories, trains, utilities and other systems worldwide. (www.echelon.com.)

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About Telvent

Telvent, Abengoa's Information Technology subsidiary, specializes in IT solutions with high technological added value for specific industrial sectors such as Energy, Environment, Traffic, Transport, Telecom and Public Administration. Telvent is a leading supplier to these industries in Spain, North America, Latin America and Asia.

With over 40 years experience in industrial supervisory control and business process management systems, Telvent executes projects and provides technical services in the field of mission-critical, realtime control and information management. With the most comprehensive portfolio of outsourcing and consulting services, and employing a technology-neutral philosophy, Telvent manages IT and telecommunications infrastructure for an extensive international client base. (www.telvent.com)

About Abengoa

Abengoa, an industrial and technology company with worldwide operations, provides solutions for Sustainable Development, the Information and Knowledge Society and the Creation of Infrastructures. The company is capitalized at over 500 million Euros (31/12/2002) and is listed on the Madrid Stock Exchange. Abengoa operates in four primary areas: Bioenergy, where it is the second largest worldwide producer of bioethanol; Environmental Services, where it is a European leader in various industrial waste market segments; Information Technology, where it has achieved global recognition and has operations in Europe, North America and Asia; and Industrial Engineering and Construction, where it is a leader in Spain and Latin America. (www.abengoa.com) ✺

For more information, please contact Don Buchanan, Manager Marketing Services; don.buchanan@telvent.abengoa.com

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Integrated Outage Management: Leveraging Utility System Assets Including GIS and AMR for Optimum Outage Response

Utilities today are adopting improved metrics for measuring network reliability that can best be achieved by integrating their outage management systems with other system assets

By: Edmund P. Finamore, P.E., President, ValuTech Solutions

It was not that long ago that utility companies' outage management systems consisted of a call center, trouble ticket system and radio dispatcher, all working in harmony to summon a trouble crew and restore service for the occasional "no light" service call. This system actually worked quite well in an era when computers didn't dominate our society, manufacturing processes were far less sophisticated and the public was in general much more tolerant of occasional power outages. In those days, customers were more forgiving of their dependable home town utilities, in part because there was less dependence on electric service in the workplace and less reliance on the comforts and convenience of electric appliances in the home.

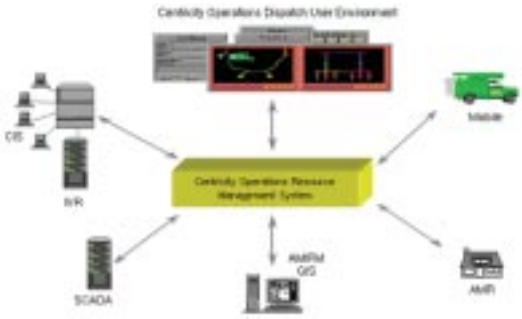
In today's world, however, demands for reliable electric service have grown to the point where a utility's primary goal is providing improved network reliability as measured through optimization of power delivery performance and reductions in the frequency and length of customer outages. This point was dramatically driven home recently, when a series of unexpected network transients and outages contributed to the August 14, 2003 blackout which placed a significant portion of the Northeastern U.S. and Canada into extended darkness.

While the key reliability measures are quite easy to monitor, identifying and implementing utility outage response process improvements is much more difficult to achieve. As utilities install outage management systems designed to improve performance in these areas, it has become increasingly apparent that stand alone outage systems cannot produce the more demanding results expected from top management and an increasingly more sophisticated customer base.

Organizational Changes Reflect Increased Public Scrutiny

Under the ever brightening light of increased public awareness including the growing dissatisfaction with "clock blinking" and other annoying symptoms of interrupted service, many utilities have begun taking some initial steps to address the problem, such as migrating to process based organizations that are better able to focus on the system oriented characteristics of outage analysis and response. Improving network reliability encompasses a significant number of variables that many believe are best addressed by adopting a system vs. departmental focus. While the key reliability metrics are easy to identify, relevant process inputs are less certain and may actually come from other processes located outside the outage management process organization.

A process based organization, for example, may have adopted an Enterprise Asset Management model as its corporate business strategy to manage overall utility assets and improve return on investment. The company's AM/FM/GIS systems, with their work management, supply chain and mapping capabilities, will typically fall under the EAM umbrella. Yet, the locational information of corporate assets provided via GIS can also make a valuable contribution to system reliability. Similarly, a utility's advanced metering (AMR) systems are typically found within its revenue cycle services business process. While traditionally held to be the utility's "cash register" with a primary purpose to support customer billing, many meter devices utilized in automated meter reading systems are also capable of providing outage alarms at the initial stage of a power outage. Frequently, these meters will eventually provide service restoration notification, which can be an invaluable benefit to system operators attempting to confirm that power has been restored without resorting to labor intensive site visits or customer callbacks.



Courtesy: CES International

Leveraging Multiple System Inputs

Together, a utility company's mapping and AMR systems can provide the additional customer status and locational information necessary to advance outage management capability beyond the standard system inputs of SCADA systems and call center telephone activity. While these traditional methods of obtaining outage information are certainly valuable, they cannot provide sufficient granularity or the geographic visibility necessary to deploy work crews in the most efficient manner. The addition of real time outage information originating from the customer's location can provide the missing ingredient for efficient outage response, particularly during the occurrence of major outage events when outage management systems are needed the most.

Of course, the downside of providing this additional data is that a sophisticated system is needed to manage the large amount of information generated from so many diverse sources. A well designed, fully functioning interactive outage management system will provide several operational layers that perform essential tasks related to outage detection, analysis, diagnosis and restoration. Sophisticated knowledge based outage systems are capable of identifying the various types of inputs, evaluating them by reconciling

Schlumberger/CellNet MicroCell Controller

the divergent system, subsystem and endpoint sources, diagnosing the most likely causes(s) and current status, and then transferring this knowledge in a manner that efficiently utilizes the utility's available restoration resources. Outage management systems are all about the efficient transfer of actionable information concerning changing network status from a wide range of data inputs.

The ultimate focus of this process is of course the customer who, in addition to wanting power restored immediately, must be constantly updated with system status. "When will my power be restored" is the customer mantra most often heard by call center personnel during storm conditions. Intelligent analysis of meter data including integration of meter status with other sources of outage information, when augmented with field and system supplied restoration progress, can bring about the improved restoration diagnosis and prediction capabilities that enhance customer images of utility efficiency and dependability and improve customer satisfaction.

Vendors Are Getting the Message

Outage management system suppliers are beginning to recognize this need and are responding with newly developed or acquired integrated solutions. General Electric, for example, has formed GE Network Solutions and has augmented its Smallworld Design Manager GIS system with its PowerOn software used for monitoring network status and providing remote workforce dispatch. Together, these applications can provide a holistic approach to network design, infrastructure location and efficient workforce management that should significantly improve outage response time. à

Similarly, Intergraph has announced the availability of its InService outage management system, which should function closely with its FRAMME geospatial mapping software. The ability to support outage reporting and analysis functions through use of geospatial information, and then integrate them with workforce management should provide a powerful integrated platform for effective and more timely outage response. Detroit Edison has implemented Intergraph's InService solution and also hopes to use the system data generated for network preventative maintenance to improve overall system reliability.

By some accounts, CES International has also achieved significant success in penetrating the outage management system market, with its Centricity software solution gaining increased acceptance among utilities installing outage systems. The Centricity product suite is designed to integrate a variety of distributed information based systems, such as SCADA, AMR, GIS, workforce management and CIS, and its ability to support outage event tracking for future network analysis and reporting purposes should provide added utility benefits.

This year, Baltimore Gas & Electric was added to the list of Centricity users who hope to reduce outage restoration time and improve customer satisfaction, particularly during large storm events, by making effective use of its system status monitoring and predictive capabilities. CES's Operations Resource Management System was created to handle a complex array of system inputs from a utility's enterprise applications, and to efficiently process this data to optimize outage response. "Centricity is a powerful, integrated outage management solution with real time information management capabilities that set it apart from other systems", claims Don McDonnell, Chief Marketing Officer for CES International. "The Baltimore Gas & Electric implementation again demonstrates the value that utilities place on having accurate real time outage information for predicting restoration time and providing efficient workforce response."

Increasing Value of AMR

Perhaps no utility application possesses as much upside potential for improving outage response time as automated meter reading (AMR). For utilities fortunate enough to have a fixed network AMR system, the benefits of near real time communication of meter originated outage alarms can be significant, and could eventually dwarf the value of call center notification as the primary method of customer initiated outage reporting. The automatic notification capabilities inherent in many network AMR systems can greatly accelerate the customer notification process that, even with the advent of sophisticated IVR systems, often experience significant delays during periods of heavy call volume.

PECO Energy has begun experimenting with use of their Schlumberger CellNet AMR system for outage detection purposes, for example. Hurricane Isabel recently provided them with a significant storm-related opportunity to pilot their new outage notification capabilities, and information provided from this study has demonstrated that use of network AMR data can be especially helpful to PECO in responding to storm-related events when efficient workforce management is of utmost importance.

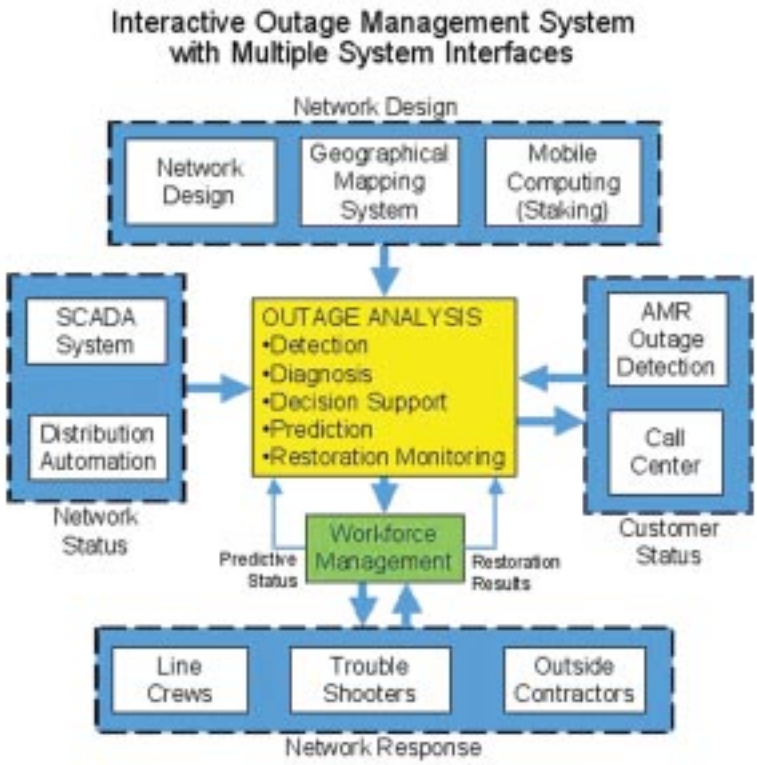
At Indianapolis Power & Light, The Schlumberger CellNet AMR system is already being used to augment their M3I outage system by processing incoming alarms initiated at the meter level for nearly 470,000 customers covered under their AMR fixed network. In addition to CellNet's Power Outage Application (POA) functionality that delivers timely meter initiated outage information to IPL's Operations Center, the network's Real Time Verification (RVA) application provides additional positive verification that power has been restored. Barry Feldman, IPL's Director of Distribution Operations, is pleased with the results so far. "We have just begun to tap the potential of AMR for expedited notification of customer service interruptions", claims Barry. "Clearly, the benefit of having near real time notification of power outages is huge when one considers the dramatic future impact meter outage alarms should have in shortening service restoration times."

As utilities continue to develop their AMR deployment strategies and prepare detailed business cases, it is appropriate to include outage detection as a key benefit of AMR. While admittedly the dollar saving benefits can be difficult to quantify, the overall contributions of AMR can be significant if a fixed network solution is implemented, both in terms of reducing outage related lost revenue and in improving customer satisfaction by shortening outage times. And the resulting improvements in CAIDI and SAIFI statistics, key metrics for measuring outage management performance, are the icing on the cake for operations managers striving to improve system performance.

Outage Management- The Ultimate Human-Machine Interface

Reorganizing the utility to better manage complicated processes such as outage management can be a good first step towards the goal of obtaining improved outage system performance, if an effective cross functional organization is created and the business processes and metrics are fully understood. No other system contains such a complicated mixture of human and equipment interfaces, that must function seamlessly at low levels (routine no light calls) while also being able to scale rapidly and efficiently to quickly redeploy utility assets in the event of storm conditions.

Successful outage management systems must be able to receive and manage large amounts of incoming data from multiple data sources, and then to translate this data into actionable work order information that is received at the front line by work crews, troubleshooters, line engineers and even outside contractors who are occasionally called on to provide additional support during periods of severe weather conditions. The results of their efforts must then be accurately reported back to the system operator to adjust and reschedule remaining work, and then to update the public on the changing status of utility restoration efforts. The ability to successfully manage many utility system inputs coming from other systems such as SCADA, GIS and AMR will ultimately determine the overall effectiveness of this virtual human-machine interface, and define its ability to produce the necessary outage management improvements required by company management.



Conclusion

As utilities come under increasing pressure to improve their outage response capabilities, it has become increasingly apparent that traditional stand alone methods of outage response will not get the job done. Organizational changes undertaken by some utilities are already beginning to reflect the commitment of top management to make significant improvements in this area, and sophisticated new interactive systems are being implemented to facilitate these improvements while at the same time protecting other key corporate financial metrics such as profitability and earnings per share.

The real way to accomplish these seemingly conflicting goals is, of course, through improvements in productivity. Optimization of utility assets and improvements in labor productivity can together bring about desired outage management performance gains without affecting performance in other areas if they are leveraged successfully and organized in a manner that produces synergies for the entire corporation. It is only in this manner that an optimum solution for outage response can be found that meets the high expectations of top management and satisfies the growing interests of state regulatory commissions reacting to increasing customer concerns. ◆

ABOUT THE AUTHOR

Edmund P. Finamore, P.E. is an industry consultant specializing in utility automation, deregulation and AMR. With nearly 30 years of utility related experience, he has participated in many utility automation projects, and has authored many articles on outage management and AMR. Mr. Finamore is founder and President of ValuTech Solutions, a management consulting firm specializing in utility industry deregulation and implementation of AMR systems, and is a licensed professional engineer in the Commonwealth of Pennsylvania. Donald L. Schlenger Ph.D., Managing Partner, Cognyst Consulting, also contributed to this article.

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Outsourcing Makes SCADA Affordable for EVERY Application

By: Donald Wallace, Chief Operating Officer, M2M Data Corporation

If any of the following are preventing you from getting your SCADA project off the ground, outsourcing to a SCADA service provider is worth consideration.

1. **Approval for a large capital budget**
   No capital investment required.
2. **Project risk**
   SCADA service providers offer a system that has already been tested, debugged, and proven through multiple deployments.
3. **Restricted schedule**
   SCADA service providers can deploy a system in weeks rather than months.
4. **High system reliability (uptime) requirement**
   The best SCADA service providers guarantee uptime through Service Level Agreement.
5. **Scalability requirement**
   SCADA service providers allow you to buy only what you need, so you can pay for 1 asset now, and add 1,000's incrementally over time.
6. **System maintenance resource limitations**
   Maintenance is the responsibility of the SCADA service provider.
7. **Project team resource limitations**
   No project to manage. The best SCADA service providers offer a turnkey solution.
8. **High network security requirement**
   The best SCADA service providers operate systems with the highest level of security
9. **Communications system expertise resource limitations**
   Communications system is the responsibility of the SCADA service provider.
10. **Technology obsolescence**
    SCADA service providers rely on proven best available technology to maximize quality of service.

Have you ever wanted to install a SCADA (supervisory control and data acquisition) system to monitor and control remote equipment or some other asset, but simply couldn't afford to? Well maybe you should take another look. New technologies have drastically changed the price/performance equation to a degree that makes it feasible to use SCADA in almost any application.

A unique combination of modern communications systems and Internet SCADA technology makes it feasible to monitor and control almost anything anywhere in the World from a single SCADA system--quickly, with no capital investment, and no risk.

Is it for you?

The cost-effectiveness of these new SCADA solutions makes it possible to implement remote monitoring and control of a wide range of equipment that has not been served by traditional SCADA. Application examples include:

- Reclosures
- Transformers
- Remote Meters

Although remote monitoring of these types of equipment has clear benefits (improved uptime, planned maintenance, reduced field technician costs, etc.) the value is often relatively low and simply cannot be achieved through the use of traditional SCADA. Outsourcing eliminates the traditional approach and its high resource requirements to plan, execute, and maintain the system.

New technologies and vendors who take advantage of new communications and Internet technologies offer the benefits described above without the demand on user resources. This is possible because the vendor takes responsibility for supplying a turnkey SCADA service that includes system planning (including technology selection), installation, and operation of the system. So users sign-up, collaborate on customization issues (if any), and then start using SCADA data to improve operations and the bottom line.

How's it done?

The advent of the public Internet, which uses open data communications protocols, services, and data formats, offered the promise of interconnectivity and interoperability for all data communication applications—and one of these applications was SCADA. As a result, many businesses have investigated the use of open standards as a way to integrate SCADA data into enterprise IT systems. Others developed Internet SCADA systems hardware and services to make SCADA data inherently compatible with enterprise systems. The result was the emergence of a new approach: outsourced turnkey SCADA services that are totally compatible with enterprise IT systems provided on a subscription basis.

Outsourced-SCADA vendors have a natural incentive-customer service-to minimize cost while maximizing security, integration, interoperability, and system availability. Without a high level of customer satisfaction, the opportunity to outsource doesn't exist.

Affordability

The low cost of outsourced SCADA services is one of the key benefits of the approach. The cost of software development, data center construction, operation, and maintenance is borne by the outsourcing vendor, and is therefore shared across the vendor's customer base, thus lowering the cost to each customer.

The same reasoning may be applied in other SCADA design and operational costs including software and data communications R&D, and data communications services.

Outsourcing eliminates SCADA software license costs. In an outsourced arrangement there are no software licenses to purchase, and no ongoing software maintenance fees to pay. Users access their data from secure web servers using a standard Internet browser from anywhere with Internet access.

The total cost of any SCADA system implementation is affected by a wide variety of factors. In cases where there are very large numbers of remote locations in single system, it is critical that all components of the solution be engineered to eliminate needless cost. Traditionally, one of the single largest costs has been remote

communications, a barrier that is being removed by new satellite services. These new services are engineered to provide cost-effective transportation of data using inexpensive terminals. There are even low-power (and self-powered) units available where power supply is limited or nonexistent.

Availability

Outsourcing SCADA vendors have made investments in data center equipment (servers, switches, router, redundant communications, backup power, physical security, etc.) that cannot generally be justified for a single SCADA project. The ultimate benefit to a user is higher system availability—a benefit that some vendors stand behind by offer service level guarantees.

Integration and Interoperability

The open architecture of an Internet-based SCADA system combined with appropriate field equipment makes it possible to develop integrated and interoperable SCADA systems. The keys to interoperability are data format and transmission protocol standardization, and existing Internet standards provide an ideal solution.

Extensible Markup Language (XML) is already the defacto standard for most ecommerce data transmission. XML was developed to bring greater flexibility and interoperability to web applications. It is a meta-language for describing markup languages and therefore does not specify semantics or a tag set. In other words, XML provides a facility to define tags and structure. XML provides flexibility not available from HTML because the programmer has the freedom to create tag sets and semantics.

The data transmission protocol used on every web site, Hyper Text Transfer Protocol (HTTP), is ideal for Internet SCADA because it is firewall friendly and allows web servers to be used to control data transmission. There is also a version called HTTPS, which provides authentication, and encryption, which are critical security components. The alternatives, TCP/IP or UDP, require the cooperation of the customer's IT department to open ports on servers and thereby introduce potential for cyber attack.

Security

The benefits of using an outsourced Internet-based SCADA service outlined can be achieved while increasing the level of security normally provided in a traditional SCADA system. Experienced outsourced SCADA vendors have implemented processes, procedures, and tools to address availability, integrity, confidentiality, and protection against unauthorized users.

Availability: System up time is maintained at the highest levels through use of redundant servers. Firewall protection is provided at all remote network nodes and servers, along with automated monitoring to detect DNS attacks.

Integrity: Systems ensure data is not modified or corrupted through use of encrypted data signatures, authentication to restrict access, etc.

Confidentiality: Systems ensure restricted access to data through use of encryption, and to the system by employing authentication such as Secure Socket Layer.

Protection against unauthorized users: Multi-layered password protection is generally provided at all levels in the system.

Should you consider outsourced SCADA?

Outsourcing simplifies the planning, funding, deployment, and maintenance of SCADA systems. Project risk may also be reduced to near zero by selecting a provider that includes service level agreements as art of its scope of supply.

So, if resources, human and capital, are limited, if the schedule is short, and you're risk-averse, outsourcing may be an ideal solution. Choosing an outsourcing vendor that offers an Internet-based service will provide an additional benefits: low cost, and the ability to integrate SCADA data into your enterprise IT system. ◆

ABOUT THE AUTHOR

Donald Wallace, a graduate of the University of East London, is a Professional Member of the British Computer Society (www.bcs.org). Heis a past Director of the HART Foundation (www.hartcomm.org), anindustry group formed to standardize sensor data communications, and beholds two patents for wide area telemetry (SCADA). He has over 30 years experience in the design, marketing, and sale of complex systems for industrial automation and data communications applications. He is currently Chief Operating Officer of M2M Data Corporation (www.m2mdatacorp.com), a Denver, Colorado company specializing in the provision of Internet-based SCADA services in oil and gas, power, and government markets.

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Since its inception in 1991, DistribuTECH (then known as "DA/DSM") has been the leading forum for professionals active in power delivery and related customer service technologies. From its humble beginnings as a small conference with a dozen table top exhibits, DistribuTECH is now a truly world-class conference attracting thousands of industry professionals, with hundreds of leading companies filling the exhibition hall.

The 2004 edition of DistribuTECH is being held January 20-22 in Orlando, FL USA at the Orange County Convention Center. In addition to the conference's traditional focus on utility IT and automation, the conference scope is expanding in 2004 to include T & D equipment and water utility IT and automation. Major technology and equipment areas covered include:

Utility Automation & IT

- AM/FM/GIS • AMR Systems
- Communications Systems
- Telecommunications
- Data Acquisition Systems
- Distribution Automation Systems
- Energy Management Systems
- Flexible ac Transmission Systems (FACTS)
- Load Management Systems
- Mobile Computing Hardware
- Mobile Work Force Management Systems
- Wireless Communication
- Outage Management Systems
- SCADA Systems/Equipment
- Security Systems
- Substation Automation Systems
- Line Design Software

T & D Equipment

- Breakers • Cable
- Capacitors
- Diagnostic/Monitoring Equipment
- Enclosures
- Insulators
- Metering Equipment
- PLCs • Poles
- Protective Relays
- RTUs
- Substation Equipment
- Switchgear
- Towers
- Transformers
- Vaults

Water Utility Automation & IT

- Meters & metering systems
- Automatic meter reading and related equipment and technologies
- Customer Information Systems, including hardware and software
- SCADA
- System Monitoring & Control
- Communications & Telemetry
- Software & Hardware
- Pump & Motor Control and Monitoring
- Flow, Level and Pressure Monitoring
- Security Systems
- Energy Management
- Geographical Information Systems (GIS): Mapping systems, hardware & software

DistribuTECH kicks off with the Keynote Address on Tuesday, January 20th. Featured Speakers are Nora Mead Brownell, Commissioner, Federal Energy Regulatory Commission; H. William (Bill) Habermeyer Jr., President & CEO of Progress Energy Florida; and Joe Weiss, Executive Consultant, KEMA, Inc. Also invited to speak is Senator Bob Graham (D-Florida) who may address the crowd in his capacity as chairman of the Senate Select Committee on Intelligence in the 107th Congress.

The conference includes nine concurrent tracks with sessions presented by leading industry professionals from the user, consultant, and supplier communities. The exhibition includes over 200 companies, from small niche solutions providers up to large, turnkey solution providers.

DistribuTECH also features the popular Utility University ("UU") preconference seminar series. While the UU sessions are not part of the DistribuTECH program, they are very popular as they give attendees an opportunity to explore leading edge topics with industry leaders in greater detail than what could normally be covered in a conference session. Topics covered in the various UU sessions include Cyber Security, AMR, Communications Technologies and Protocols, and Distribution Automation. UU's 21 sessions are being held in the Orange County Convention Center on January 18 - 19, 2004.

Additional information about DistribuTECH can be found at www.DistribuTECH.com.

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Elster Electricity's EnergyAxis® System with New Intelligent Two-Way Communications

In today's highly competitive global arena, the utility industry faces challenges and opportunities never seen before. Change has become constant, with innovation the standard rather than the exception. Reducing costs, enhancing customer service, and improving operational efficiencies are business strategies common to every company looking to remain competitive and operate profitably.

As a world-class provider of electricity metering products, communication solutions, and metering automation systems, Elster Electricity is a company aggressively pursuing those challenges. According to Ronald B. Via, vice president of sales and marketing, "Our goal is to increase customer revenues through innovative solutions and reduce costs through streamlined operational strategies. The introduction of our EnergyAxis System represents a major advance in network metering communications and extends beyond typical automated meter reading solutions. It reflects our continued commitment to these goals and enables our customers to compete effectively in a changing environment."

The Power of Two-Way Communications

Built on 900 MHz unlicensed radio communications technology, the EnergyAxis System's new, fully automated, intelligent two-way communications makes on-request meter reads and server-initiated commands a reality. Its powerful two-way communications, coupled with Elster's new electronic single phase REX™ meter, enables utilities not only to read meters, but to change energy, demand, or time-of-use rates as needed, as well as start or stop load profile interval recording, or initiate a service disconnect. To further enhance a utility's customer service capabilities, the system can automatically receive neighborhood power outage or restoration data, local voltage conditions, outage counts and other information.

Engineered for optimum flexibility and functionality, the EnergyAxis System supports targeted deployments of hundreds or thousands of meters, up to full-scale multi-million point installations. Its flexible two-way communications architecture assures greater wireless coverage through the implementation of a mesh network in which individual REX meters can function as repeaters. Since each meter can be designated to receive and transmit messages from other meters, the EnergyAxis System works in areas where obstacles may exist.

Meter Readings When and Where You Need Them

Locked gates, unleashed pets, or indoor meters all reduce operational efficiencies, drive up metering costs, and reduce revenues. With the EnergyAxis System, these barriers as well as associated problems of estimated bills or rescheduled meter reads are eliminated. High turnover areas, like apartment complexes, universities, and military housing, represent costly service areas, requiring repeated trips to obtain move-in and move-out meter reads, or to provide disconnect and reconnect services. The on-request reading function and the remote operation of Elster's optional disconnect switch improves the utility's ability to connect or disconnect service reducing operational costs and improving customer service.

Rapid Change Requires Intelligent Metering Products

"With the utility industry experiencing unprecedented change, market pressures have made sophisticated pricing methods for electricity a growing necessity. Our system has been built with advanced features that offer utilities optimum metering and billing flexibility for addressing these issues," says Garry January, Elster Electricity's residential meter product manager.

At the heart of the system is Elster's new single phase, residential electronic REX meter with built-in EnergyAxis System communications. Innovative in design and multi-tasking in function, the REX meter provides highly accurate kWh consumption, kW demand, time-of-use metering, critical tier pricing, and load profile interval data, all on command. These features reduce costly site visits and eliminate the need for new metering hardware. Utilities can adjust prices daily, a distinct advantage during peak energy demand periods.

The unique design of the REX meter and the intelligent two-way network architecture, enables meter self-registration within the network for true "plug-and go" capability. This feature eliminates the need for on-site programming, making installation and operation both easy and economical. Once installed, each meter automatically registers with the network. Should local conditions change, meters reregister via alternate network paths.

The communications network of the EnergyAxis System utilizes two-way spread spectrum frequency-hopping technology to provide secure, reliable communications between meters and collectors. This technology enables individual meters to be designated as repeaters, creating a dynamic path that optimizes signal strength and maximizes communication distances. Communication distances between meters and collectors are increased, and the number of collectors required is dramatically reduced, improving system economics. The system architecture uses Elster's A3 ALPHA® meter as the host for local data collection from the REX™ meter, making collector installations simple while reducing costs.

Discover the value of the diamond

For more information on Elster's new EnergyAxis System with intelligent two-way communications, call us today or visit our web site.

ELSTER

Elster Electricity, LLC
208 South Rogers Lane
Raleigh, North Carolina USA
+1 800.257.9754 (US toll free)
+1 919.212.4800 (US)
www.elsterelectricity.com

Circle 77 on Reader Service Card

EnergyAxis® System
Intelligent Two-Way Communications

For Capabilities That Increase Your Meter Reading Vocabulary

Elster Electricity's EnergyAxis® System offers a major advance in network communications and functionality for automated meter reading. Using 900 MHz unlicensed radio technology, it provides a new, intelligent, mesh network with two-way communications for scheduled or on-request reads and commands to all meters in the system.

This innovative architecture uses the A3 ALPHA® meter as the host for local data collection from Elster's new electronic REX™ meter. Within the network, REX meters function as two-way repeaters. By supporting multiple repeater levels, Elster's mesh network expands communication distances, reduces the number of collectors required, and lowers overall system costs.

Unlike systems that collect meter reads as data pulses, the EnergyAxis System utilizes advanced RF technology to read energy and other meter data directly from individual meters, thus unlocking the meter and all the valuable information it collects. The system's flexibility supports targeted deployments of hundreds or thousands of meters, up to full-scale installations.

REX meters are easily configured to provide remote reads of energy, demand, time-of-use, load profile, voltage, and more. When equipped with an internal switch, its two-way capability delivers connects and disconnects on command. The network and meter's unique self-registration feature provides plug-and-go installation making deployment easy and economical.

Contact us today to learn more!

Discover the value of the diamond

Elster Electricity, LLC
(Formerly ABB Electricity Metering)
800.257.9754 (US toll free) • 919.212.4800 (US) • 905.634.4895 (Canada)
www.elsterelectricity.com

ELSTER

An Agile Leader

Since 1980, Datamatic has been a leader in utility data collection and has enjoyed tremendous success providing solutions to municipal and investor-owned water, gas and electric utilities. Recent wins have generated increased demand for resources focused on integration of electronic handheld meter reading (EMR) and advanced automatic meter reading (AMR) technologies in the energy sector. In 2002, Datamatic sharpened its strategic direction with the formation of Datamatic Energy Systems (DES), a business unit focused on the electric and natural gas utility market.

Datamatic has seen a large jump in the number of energy utilities purchasing its integrated EMR and AMR solutions, thus justifying the launch of this dedicated division. DES has a very specific charter to focus on the unique needs of the energy sector and those areas where it can provide the greatest value. DES is also forging new strategic partnerships, integrating our technologies into more comprehensive solutions and always looking to improve the scope and quality of its offering.

While the FIREFLY Automatic Meter Reading System has been the headline-grabber for Datamatic during the last few years, it has also had a large increase in the number of customers using the latest generation RouteSTAR MVP route management and ROADRUNNER X7 handheld system. As a company, Datamatic has always tried to stay nimble and responsive to the changing needs of our customers. Customers are extremely receptive to this flexible, consultative approach and willingness to accommodate. Datamatic routinely gains audience with customers based on their previous vendor's unwillingness to work with them or "strong-arming" them into an upgrade before they were ready. It has always been Datamatic's policy to leave upgrade decisions to our customers - to not force the issue. Datamatic has never discontinued support on any generation of hardware or software. Customers appreciate being given back this measure of control. It's one less complication in an already-complex business environment.

AMR Plus

Rising energy costs have necessitated even closer care being paid to the cost-effectiveness of solutions. Datamatic has reengineered aspects of the FIREFLY AMR System, further increasing the value of an already-distinctive line.

The FIREFLY TWO makes use of two-way, unlicensed RF communications and low-cost mobile/handheld data acquisition. This approach to AMR is proven and extremely cost-effective, but it isn't new. The FIREFLY TWO, however, has added functionality that raises the mobile AMR concept to new levels of sophistication. No longer merely a reading tool, FIREFLY adds broad-based value that transcends the meter shop.

All FIREFLY Meter Interface Units (MIUs) archive usage data at user-definable intervals; a capability called ProfilePLUS™. Setting the profile interval of the new electric FIREFLY TWO to 15 minutes allows the MIU to store the previous 165 days of consumption profiles. Data can be retrieved quickly by field service personnel or meter readers. Once retrieved, ProfilePLUS data can be displayed on a graph or spreadsheet. Graphs can be printed, emailed or posted to secure portions of the utility's website.

A picture is worth a thousand words and being able to show a customer when they used the power they did adds credibility to your operation and can often jog customers' memories. For example, the additional power used during a brief and unexpected heat wave can easily be forgotten. ProfilePLUS data can be a helpful reminder to a puzzled customer.

Tighter competition drives the need for tighter controls and optimizing the efficiency of operational infrastructure. FIREFLY AMR can be used as a tool to support these efforts. For example, over/undersized transformers cost utilities money; either through outages or waste. ProfilePLUS data can be used to determine if transformers are properly sized for a given location.

Virtual turn-on/off is another often-requested function, owing to the rising cost of personnel and off-cycle reads. ProfilePLUS provides nearly a half-year of historical data at every meter plus the ability to gather it during normal reading operations, effectively eliminating the need to read the meter off-cycle.

Other popular applications include time-of-use/demand billing and detailed usage profiles for premium customers, load/peak studies and theft prevention. New applications for ProfilePLUS data are being discovered and utilized constantly.

A Market in Need

Datamatic also sees a market in need of alternatives. Utilities need choices - choices from proven leaders. C&I data collection systems are a prominent example. The most popular application is dated, difficult to use and doesn't fully harness the power available in the most current operating systems and databases. But it is popular largely due to the lack of viable alternatives. Q2 2004 will see a change to that landscape.

The rebounding economy is bringing with it a renewed optimism. Utilities are beginning to reengage in technology projects postponed during the downturn. Datamatic's devotion to R&D and listening to the needs of its customers has placed us in a position to play a key role in the recovery for many of our current and future utility customers.

Datamatic
3600 K Avenue
Plano TX 75074

Tel.: (214) 540-5037
Fax: (972) 234-1134
Web: www.damatic.com

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Creating Value.

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The Data

- -165+ days of 1/4-hourly usage profiles
- -Peak demand

The Value

- -Virtual Turn-on/off
- -Dispute Resolution
- -Load Studies
- -Transformer Sizing
- -TOU/Demand Billing
- -Theft Prevention

Check out FIREFLY AMR. Don't miss the opportunity to create more value for your utility and your customers.

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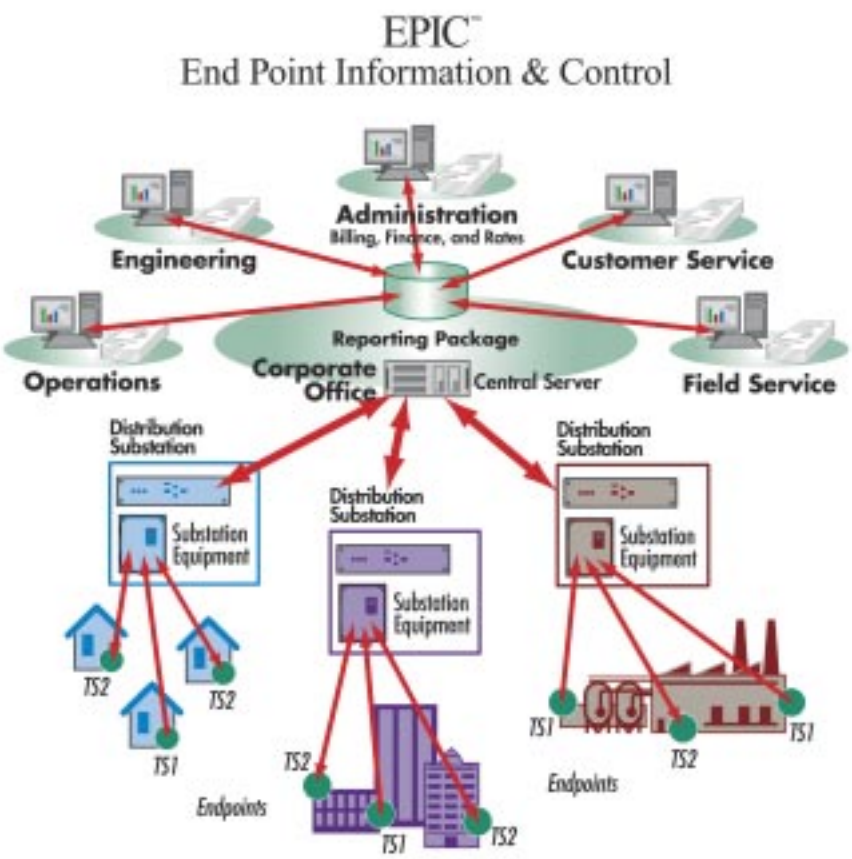

Hunt Technologies, Inc. is committed to providing the most reliable, cost-effective endpoint information system to utilities worldwide. Hunt's products are power line carrier based communication systems that deliver endpoint specific data necessary to conduct comprehensive customer analysis, as well as system wide information and command control.

Employing Hunt systems allows utilities to monitor and control their distribution system at the macro level, yet still enhances individual endpoint management to ensure the optimization of both the electrical system and customer service initiatives. EPIC™ — End Point Information & Control — provides utilities with a choice of a one-way Turtle® System, a bi-directional TS2 System, or a combination of the two. This allows utilities the flexibility to deploy the system that best meets their particular objectives.

Patented Technology — At the heart of the EPIC solution is patented Ultra Narrow Bandwidth power line carrier technology. Unique to this technology, is its ability to provide a constant and continuous connection to each and every endpoint. This Always Connected, Always On™ technology allows utilities to be connected to their customers all of the time.

Utilities can collect detailed usage data, receive automatic outage detection notification and gather system coincident data. In addition, this Always On connection facilitates the control of remote service disconnect/reconnect and load control operations.

The beauty of the system involves the use of the utility's existing infrastructure. There is no need to use additional line conditioning equipment. The system includes simple to install endpoint devices that transmit and receive data continuously over the power line. The substation equipment collects and stores the data transmitted by the endpoints. In addition, the substation also contains the coupling equipment needed to send messages downstream.

Enterprise-wide Power — All data collected in the system is available for enterprise wide use via its browser based Command Center™ software application. A dashboard based health monitor allows utility personnel to monitor the operation of the system. System anomalies are presented to the user in a format that is easy to identify and integrate into operations.

Customer friendly reports deliver information relevant to utilities day-to-day operations. The data collected at the substation is relayed to the utility and stored in an SQL database where it is available for use by all disciplines within an organization. Its standard format allows for its use in billing services, distribution system maintenance, customer services, and outage management.

EPIC has a proven reputation for quality, durability and reliability. It provides a sophisticated solution to meet the return on investment criteria established by utilities. To date, more than 2.5 million endpoints are deployed at over 400 utilities, collecting usage data, outage information and controlling energy flow. To find out more about Hunt Technologies, please visit www.turtletech.com.

Hunt Technologies, Inc.

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Always Connected,
Always On

Delivering an AMR solution that tracks customer contacts continuously and simultaneously.

This is not just one blip. Hunt Technologies' exclusive EPIC™ — End Point Information & Control — solution and Always On™ technology delivers constant communication with each and every endpoint in your distribution system. In addition to gathering precise meter reads, you can now do much more:

- Implement automatic real time outage detection and restoration notification
- Secure a comprehensive view of your distribution network with on-demand requests for coincident data, load profiling information and distribution performance indicators
- Execute and verify real time control operations with remote connect, remote disconnect and load control
- Deliver comprehensive customer service with access to detailed usage data, Time of Use provisions and reduced service outage time
- Energize your bottom line and your overall utility performance

It's simple; either you have the only solution that can provide a meter read and a continuous, detailed view of your entire distribution system simultaneously, or you're not even on the radar.

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By:

Jeffrey J. Hanft
Vice President
E.J. Brooks
Utility Products Group

New Brooks Utility Products Group offers one-stop shopping for meter-related products

Three UPG units will present an array of new products


1


2


3

E. J. Brooks Company and two subsidiaries-Ekstrom Industries and Meter Devices-have restructured their engineering, manufacturing, customer-service and marketing functions to become the Brooks Utility Products Group.

The Brooks UPG also set a principal goal-to become "The Premier Supplier of Metering Related Products" to investor-owned, REC and municipal electric-utilities.

The new UPG structure will 1) leverage all the resources of Brooks security seals, Ekstrom Industries and Meter Devices, 2) bring even more new and improved products to the marketplace, and 3) strengthen every function at the three operating units to be more efficient and competitive.

The Utility Products Group's management team, with over 175 years of utility experience, will guide the development of new and improved products and fill category voids in our current line-up of engineered solutions for the metering point.

We are eager to serve our electric-utility customers as we've been doing for more than 100 years, with the most complete line of metering-related products in the industry.

Listening to customers


Utility News

'Never a dull moment'

Northeast Utilities' Dave Scott reflects on the challenges of an 'invigorating' job

Putting Meter Devices' Lexan® Prewired Meter Socket to the test
4

Our Utility News reports on new products and services to allay metering and RP concerns. We listen to those needs. We make it our business to pay special attention to utility managers' needs. By listening to our customers, we create scores of products worthy of patent protection-products that evolve as our customers' needs do.

When the utility industry requires a solution to a meter-related problem, they come to us. Brooks UPG's engineering and marketing teams are eager to solve the problem in an expeditious manner.

Innovative design has been a hallmark of Ekstrom design engineers during that company's 48-year history. Founder Ken Ekstrom's initial effort, for Detroit Edison in 1955, was a simple adapter for single-phase, socket-type meters on bottom connected metal enclosures. From this first design, more than 4,000 models of meter-socket adapters have evolved. The all new-design Ekstrom Surge-Guard® surge arrester is fast becoming an industry favorite.

Brooks' Plastic Padlock Seal was improved 19 times in 30 years to provide indicative security from a simple wire/plastic combination with basic lettering to a special long-lasting plastic with bar-code ID or RFID-chip technology. The newest version is the Brooks Dual Channel Padlock Seal.

Meter Devices has designed hundreds of test switches, meter enclosures and prewired meter-sockets since its founding in 1918. It broadened its offerings in recent years, e.g., MD-5 meter-socket disconnect sleeves-a quick, safe, economical means of temporarily isolating a meter from electrical service while allowing the meter to stay in place.

Industry forecasts

Year after year, Utility News has been there, as metering pros face and forecast sweeping industry changes. In 1992, six metering executives shared ideas at an Ekstrom forum. Among their wish list, these now-familiar items appeared:

- Dead-front meter shield
- Solid-state electronic metering at remote locations
- More metering points as a result of deregulation
- Smarter multi-function electronic meters at residences
- Real-time pricing
- More outsourcing of meter-point products

Sound familiar? They were indeed prophetic in their picks for the future standards.

Keeping pace online

For the most current examples of metering problem-solvers, log on to our three web sites where you'll find more choices, more solutions.

Photo Captions:

I) The Dual Channel Padlock Seal provides the ultimate in tamper evidence.
2) Ekstrom's Low-Profile Surge Guard® meter-base surge arrester.
3) Meter Devices' new line of fused and non-fused potential test switches.
4) Read current and past issues of Utility News at www.brooksutility.com.

Enhance Security

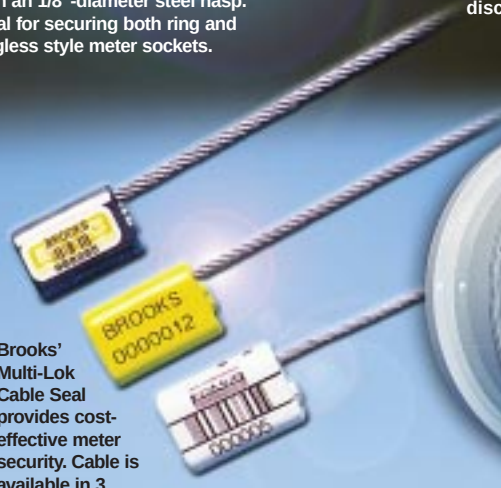
Solve Problems

Reduce Costs

E.J. Brooks High-Security Padlock Seal features an acrylic body with an 1/8"-diameter steel hasp. Ideal for securing both ring and ringless style meter sockets.

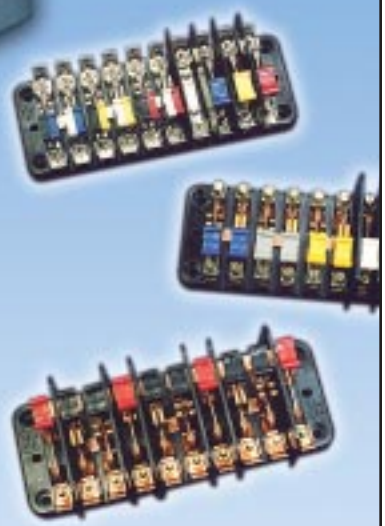
Ekstrom's low-profile adapter with potential contains line-side connections only in order to provide potential to meter electronics on a disconnected meter stored in the meter socket.

Meter Devices transformer-rated meter sockets are prewired to specs with provisions for test switch and wiring harness.



Brooks' Multi-Lok Cable Seal provides cost-effective meter security. Cable is available in 3 diameters. Has dozens of electric-utility applications.

EK Disconnect Device ensures safety, disconnects single-phase and polyphase lever-bypass sockets under load.



Meter Devices designs and manufactures the finest quality and most complete line of test switches in the industry.

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UTILITY PRODUCTS GROUP

The electricity meter stands at the core of your business, marking the place where investment turns into return. Our Utility Products Group is dedicated to creating security, safety and cost-effective solutions at the metering point. Please visit our web sites for 1,001 more solutions.

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E.J. BROOKS COMPANY
8 Microlab Road
Livingston, NJ 07039
1 800 458-SEAL
sales@ejbrooks.com
www.brooksutility.com

EKSTROM INDUSTRIES, INC.
23847 Industrial Park Drive
Farmington Hills, MI 48335
1 800 532-IDEA
marketing@ekstrom-metering.com
www.ekstrom-metering.com

METER DEVICES COMPANY, INC.
3359 Bruening Ave, SW
P.O. Box 6382, Station B
Canton, OH 44706
1 888 FOR-METER
marketing@meter-devices.com
www.meter-devices.com

E. J. BROOKS INDUSTRIES
412 High St. East
Strathroy, ON N7G 1H5
1 800 663-4292
dongeddy@ejbrooks.on.ca
www.ejbrooks.com

E.J.B. de MEXICO, S.A. de C.V.
Copenhague 2A, Desp.1,
Col. Juarez
Mexico, D.F. 06600
Tel: +55 5511-8560
Fax: +55 5511-8602
www.ejbrooks.com

Certified Meter Data Managers Provide Potent Tool

Utilities, Customers Benefit From Accurate Energy Data

By: Vance Hall, Vice President – Business Development, MeterSmart™

It's a potent tool for utilities.

It's one of their most powerful resources, yet remains underutilized. It's information about their customers' energy consumption and demand patterns.

Using customer energy information gives utilities the opportunity to build unprecedented business-to-business and business-to-consumer demographic profiles, an important driver in marketing to energy customers.

Readily available accurate, reliable and timely information about how and when customers use energy can enable utilities to help customers manage their energy consumption more efficiently. It can facilitate load shedding and suggest improvements in operational procedures. Ultimately, using energy information intelligently can help retain customers, especially in deregulated areas.

But that's not all.

Besides satisfying customers, energy information also can help utilities. Short- and long-term load management and planning, distribution planning, outage management and demand response programs all can benefit from analyzing customers' energy information. It can produce valuable insights that can help streamline billing and create revenue generating value-added services.

Utilities can create Time of Use and other rates to encourage customers to use energy when it's less expensive for utilities to provide it. Properly designed rates might generate less revenue, but they drive down cost of service, driving up profit.

The keystone to realizing all this potential is to frequently gather the energy data from meters, ensure its integrity and present it as actionable, customer-specific load profiles. The profiles need to be in an understandable and 'massageable' format that utilities and customers can use efficiently.

There's a hurdle to achieving this, however. It's a considerable investment in hardware, software and expertise in data management, system integration and project management. Many utilities are reluctant to risk creating such in-house capabilities when they may not realize adequate return on investment from their customer base.

Enter MDMAs

Enter meter data management agents, or MDMAs. Agents are companies that have created infrastructures to manage tremendous volumes of energy data. They're banking on economies of scale to make their investments pay off by offering data management to utilities as a cost-effective turnkey service. Agents, or data managers, generally are independent of utilities, and to ensure their services provide accurate data, they must meet rigorous qualifications to be certified—a benchmark recognizing their meter data management expertise. Knowing certification requirements is in the best interests of energy providers, users and others in the energy distribution channel.

That begs the question. What exactly is good data management? It involves gathering, validating, editing and estimating energy data to ensure its accuracy.

Gathering data requires a process that is compatible with a multiplicity of meters and metering technologies ranging across geographic areas, from utility to utility and even within a single utility. The process must accommodate a variety of automated meter reading configurations, including a host of communications platforms spanning landline telephones, radio frequency collectors, cell phones and communications satellites.

The ABCs of Accuracy

Validating data compares actual meter dial readings to pulses or previous energy usage patterns to current profile information. Meter data managers ensure that the pulse data is consistent with metered measurements. They confirm that metered information is time synchronized.

One MDMA, MeterSmart™, of Arlington, Texas, uses National Observatory time as its benchmark. It can identify when meter time clocks begin drifting and correct the problem. Utilities set their own thresholds for error that data managers follow, but up to two minutes is fairly typical.

Some of the checks that data managers make include looking for high and low energy spikes as potential indicators of error. The managers compare the data by interval, whether it's 5, 15, 30 or 60 minutes, and to historical records for other like time frames, usually the previous week, previous month and the same month a year ago. Unusual readings flag the data for closer inspection.

Editing data entails scanning it for pulse values that may have been introduced into the data record by testing or other activity. The objective is to ensure the data reflects customer's actual energy use.

Estimating data, similar to validating it, requires comparing records to those of previous time frames.

Throughout the data management process, the goal is to ensure data accuracy and reliability. Accuracy is making sure that what the meter reads are translated properly into values that are sent to the data management center for processing. Quality data processing procedures to accomplish this are critical since a decimal error can mean thousands of dollars in unnecessary extra charges to utility customers, or thousands of dollars in lost revenue to utilities.

Reliability depends on proper operation of system components, such as the meter that measures energy use and the communications platform that transmits the data. A wireless communications failure, for example, hampers data reliability. An example might be where a meter is installed in an exposed open space, such as loading dock. If the meter happens to be hit in the process of the everyday business, it would be rendered it inoperable. This would make data delivery unreliable indeed.

The entire data management process is regulated by each state. Rules may vary, but by and large they are similar from state to state. The goal is a common one, however: make sure the data that the data manager submits to the utility and customer for review conforms to state rules, or province if in Canada.

The Path to Certification

Getting certified as an MDMA means following a different path for the most part in each state, but typical requirements include demonstrated ability to validate, edit and transmit data, a strong disaster recovery system, and straightforward training procedures.

In California, for example, the California Public Utility Commission exercises oversight responsibility for what is considered one of the nation's most rigorous MDMA certification processes. Each of the Utility Distribution Companies in California participate in the certification process. They are responsible for stringently testing data management practices and procedures. Each utility conducts its tests separately and provides its seal of approval.

One utility provides data managers with meter data from the late 1990's. Another requires data managers to create their own data and the third provides current data. The tests include overlaying the data sets with weather data (temperature) for the respective time frames. In Illinois, the process is similar, but is managed by the state's Commerce Commission. In Canada, an organization called Measurement Canada sets the minimum requirements for MDMA certification. Utilities may include their own requirements as part of the evaluation process.

Beyond evaluating data management expertise, the states examine data managers' overall capabilities. Business location, depth and breadth of business systems that support MDMA functions, satellite offices and detailed information on staffing are some of the information required for review.

Managing Disasters

The certification process pays particular attention to how data managers have organized themselves to manage disasters. They must identify personnel in their organization who are contacts in the event of a disaster and describe their recovery systems, including equipment spares, internal and external communications links, telecommunications links, WAN/LAN, etc. Data managers must provide the location of such "hot site" or redundant systems as security, power, remote access, backup polices, system replicating and mirroring.

They also must explain how they would handle "worst case" situations. Bottom line, data managers must show that no matter the extent of disaster, they would be able to secure meter data and provide ready access to it. A typical MDMA Disaster Recovery Plan should include the items listed in Table 1 to be considered complete.

Table 1: Disaster Recovery

- Temporary power failure
- Extended power outage
- Minor network issues
- Major network failure
- Server shutdown
- Low-, medium- and high-level general emergencies
- Major equipment failures
- Software failure due to virus or system bug
- Regional disasters
- Fire
- Major storms
- Events that would hamper physical access to the primary site

A complete MDMA Disaster Recovery Plan should include procedures for managing items like those listed in the table.

Typical minimum standards of availability and security include providing the past 12 months of historical consumption data within five days of a request. Hardware and software platforms must be scalable to meet any through-put and connectivity performance requirements. Data managers must have Secure-Socket Layer (SSL) or other security mechanism to protect data when it's transmitted from their MDMA servers to utilities or customers via common carrier. Data must be protected from unauthorized access by a firewall, encryption or other security measures. Security measures also must prevent unauthorized physical access to the data processing center.

Deregulation and Data Management

Not surprisingly, energy market dynamics can affect meter data management. One dynamic in particular, deregulation, had a dramatic impact. Market deregulation heightened the need to manage meter data better because the promise of lower utility bills raised customer expectations. Unfortunately, customers in many cases didn't have comprehensive load profiles of their energy consumption and demand.

The value of load profiles is considerable. They allow customers to compare current energy consumption and demand patterns to historical energy and weather data, which can identify trends or anomalies. Customers can conduct "what if" scenarios that aggregate loads of a number of facilities in an effort to qualify for better volume discounts on their energy rates.

Load profiles also enable customers to identify and correct operational problems. By establishing energy consumption benchmarks for major equipment, such as chillers, customers can quickly identify when equipment needs maintenance, or is about to fail, based on its changing energy consumption profile.

Power-intensive commercial and industrial firms like pharmaceutical manufacturers, hotels and food processing plants are learning that lesson well. They're finding that staggering start times for energy-intensive equipment or gradually "soft starting" the equipment can avert setting new energy demand peaks. Setting new peaks can boost energy bills for up to a year, regardless of how effectively a company reduces its consumption. Demand charges can represent 40 percent or more of a company's energy bill so managing demand is good business.

It's clear that the upside of meter data management for customers is huge. So valuable are the benefits that utilities can sell meter data management as a service or offer it at no charge to large customers as a customer retention tool.

Data Management Elements

To be accepted by both utilities and their customers, experience shows that energy data management needs to encompass:

- Easily accessible Web-based "dashboards" that display and help customers analyze their energy data,
- E-mail alerts, including a wireless option, that signal customers when their energy consumption or demand is about to exceed threshold levels,
- Robust connections to the Internet for transferring data,
- Fully redundant, "hot" backup servers to ensure seamless operating efficiency in the event of a disaster; and
- Distributed communications systems so that if servers in one location fail, data transfer can continue from other locations.

Besides helping customers, load profiles that are established and maintained by accurate meter data management also benefit utilities. Energy providers have more pricing options when they know whether or not they will need to purchase high-priced energy to meet demand during hot summer months.

Another benefit is monitoring meter operation. Collecting interval data every 15 minutes or even every day quickly identifies meter malfunctions and minimizes the time frames that energy use would need to be estimated. Estimating use for some part of a 24-hour time frame is far preferable to estimating use for some part of a month or more as is the case when meter data is read manually.

Sharyland Utilities in southern Texas is a good example of a utility applying interval data management to its entire customer base. One commercial customer used the information to identify a spike in demand at an office building during a day when demand should have been low. An investigation showed that a cleaning crew that had been shampooing carpets turned down the air conditioning temperature for comfort and boosted the hot water temperature for carpet cleaning.

Working with certified meter data managers offers a measure of comfort to utilities and their customers. It assures a level of expertise and professionalism, a good procedural process and, ultimately, accurate meter data management. But that's only the beginning.

As customers learn its full benefits and how they can make the data work for them, they develop insights into their energy consumption and demand patterns. Their knowledge becomes 'energy intelligence,' a sustainable competitive edge that minimizes their operational costs. That's what makes meter data management a potent tool for utilities and customers alike. ◆

ABOUT THE AUTHOR

Vance Hall - Vice Pr*esident*
– Business Development

Previous to working for MeterSmart, Mr. Hall founded Utility Data Resource Inc. (UDRI) in 1995 and sold UDRI to MeterSmart in 2001. Before starting UDRI Mr. Hall worked as Manager of Load Research and Demand Side Management for Utility Translation Systems (UTS), now part of Itron, in Raleigh, North Carolina. Before joining UTS, Mr. Hall was Load Research Manager at Texas Utilities (now TXU) in Dallas, Texas for 6 years, and in executive management at Iowa Electric Power and Light (now part of Alliant Utilities) in Cedar Rapids, Iowa for 22 years.

Mr. Hall is an expert in interval data retrieval systems and load research/load profiling program design and analysis. He also has significant industry experience in automated meter reading systems (AMR), utility billing administration, load control and real-time pricing systems, generation and transmission planning and load forecasting. Mr. Hall provides senior level management and guidance to MeterSmart. Mr. Hall has presented numerous papers at conferences and served as an instructor on various training courses.

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2004 TechAdvantage Conference

Proposed Session Schedule – as of December 9, 2003

Note: The TechAdvantage Conference will be held at the Hilton New Orleans Riverside Hotel Tuesday, February 10 through Friday, February 13. Saturday, February 14 General Session will be held at the Ernest N. Morial Convention Center

Tuesday, February 10

— Preconference Workshops

1:00 - 5:00 p.m.
RUS Electric Engineering Seminar

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

Wednesday, February 11

— Preconference Workshops

8:00 a.m. - 5:00 p.m.
RUS Electric Engineering Seminar, con't.

8:00 a.m. - 5:00 p.m.
Materials Mgmt Certificate Program, Unit III

8:00 a.m. - 5:00 p.m.
Certified Purchasing Manager Review, Modules 3, 4

7:30 a.m. – 4:30 p.m.
Howard Industries
Distribution Transformer Facility Tour

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2004 TechAdvantage Conference

Proposed Session Schedule – as of December 9, 2003

Thursday, February 12

- Conference Program

8:30 - 9:45 a.m.
— General Session

EO / IT / SCM Morning Schedule:

10:00 - 11:30
Breakout Sessions

- EO 1A —Accident Investigation — Just the Facts and How to Get Them
- EO 1B — Managing the Balance — Growing Systems and Aging Plant
- EO 1C — Aging Plant and LimitedResources
- EO 1D — Right-of-Way Maintenance and Management
- IT 1A — General Session —Technology Trends and Emerging Solutions in IP Networks
- SCM 1A — General Session —The Value of Education in Supply Chain Management

11:30 a.m. – 1:00 p.m.
Networking Luncheon

Silo Busters! Building Stronger Working Relationships

For registered conference atten dees only. Advance registration required,no charge.

EO / IT / SCM Afternoon Schedule:

1:15 - 2:30 p.m.
Breakout Sessions

- EO 2A — Joint Use Tools You Can Use
- EO 2B — Planning for Succession and Managing Knowledge Transfer
- EO 2C — Distributed Generation — Ready, Set, Go!
- EO 2D/IT 2B — Facility Security — EO/IT Joint
- IT 2A — Disaster Recovery Workshop, Basics Part I
- IT 2C — Practical Solutions to Today s IP Issues with IP Networks
- SCM 2A — Speak Up to Avoid the Supply Chain Blues
- SCM 2B — Effective Facilities Management and Contracting
- SCM 2C — Quantitative Fleet Management

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Thursday, February 12, 2004 (continued)

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

- EO 3A — Outsourcing —A Dirty Word or Secret to Success?
- EO 3B — New DOT Regulations — Ideas for Managing the Workforce
- EO 3C — Power Quality — Designing Reliability in Your System
- EO 3D/IT 3C — Mobile Technology — EO/IT Joint
- IT 3A — Disaster Recovery Workshop, Basics Part II
- IT 3B — Seven Cooperative Principles of Internet Security
- SCM 3A — Peer-to-Peer Forum Less than 20K Members
- SCM 3B — Peer-to-Peer Forum 20 - 40K Members
- SCM 3C — Peer-to-Peer Forum 40K + Members
- SCM 3D — Peer-to-Peer Forum G&T Issues

Friday, February 13, 2004

EO / IT Morning Schedule:

8:30 - 10:00 a.m.
EO & IT Breakout Sessions

- EO 4A — General Session — Technology Pipeline: What s in it for You?
- IT 4A —IT Strategic Planning —The Basics
- IT 4B— Advanced Information Security — Today s Best Practices
- IT 4C— The Ins and Outs of Moving to a Thin Client Environment

10:15 - 11:45 a.m.
EO & IT Breakout Sessions

- EO 5A/IT 5C —The Why and How of Application Integration — EO/IT Joint
- EO 5B — Raptors — Soaring Toward Acceptable Solutions
- EO 5C — Up, Up and Away — Power Quality Expectations Are on the Rise
- EO 5D — Prioritizing Your Operating Activities
- IT 5A — Merging IT and Telecom: 411 or 911?
- IT 5B — Security Threats and Vulnerabilities

2004 TechAdvantage Conference

Proposed Session Schedule – as of December 9, 2003

Friday, February 13, 2004 (continued)

SCM Morning Schedule:

8:30 – 9:45 a.m.
SCM Breakout Sessions

- SCM 4A — Putting Your Cost Center in the Black!
- SCM 4B — Cooperative Supply Management — the BIG Picture
- SCM 4C — Establishing and Streamlining Your Purchasing/Contracting Process

10:00 – 11:15 a.m.
SCM Breakout Sessions

- SCM 5A —Three Keys to a Winning Supply Strategy
- SCM 5B — Warehousing Essentials
- SCM 5C — Strategic Initiatives for Prevailing Supply Personnel

11:20 - Noon
SCM 6A – ISM-CU Annual Meeting

EO / IT / SCM Afternoon Schedule:

1:15 - 2:45 p.m.
Breakout Sessions

- EO 6A —AMR — Are We There Yet?
- EO 6B — Power Quality - Improved Functionality
- EO 6C — Broadband Over Power lines
- IT 6A — Disaster Recovery Planning: Objectives, Practices, Procedures, and Testing
- IT 6B — NERC Cyber Security Standards and Guidelines
- IT 6C — Online Billing and Payments
- SCM 7A — Fleet Management Questions You Can t Outrun
- SCM 7B — Guidelines for Supply-Accounting Communication
- SCM 7C — Fine Tuning Purchasing Practices and Vendor Evaluations

3:00 - 4:30 p.m.
Breakout Sessions

- EO 7A — Peer-to-Peer Forum: Spill Prevention, Control and Countermeasures

EO 7B — Peer-to-Peer Forum: AMR

- EO 7C — Peer-to-Peer Forum: Contribution in Aid to Construction
- EO 7D — Peer-to-Peer Forum: Shared Services (CIS, Engineering, Maintenance, Construction)
- EO 7E — Peer-to-Peer Forum: Pole Attachments
- EO 7F — Peer-to-Peer Forum: Reliability/Power
- EO 7G — Peer-to-Peer Forum: G&T Issues
- IT 7A — General Session -- Customer Service with Sizzle!
- SCM 8A — Building a Better Fuel Management Program
- SCM 8B — Successful Intermediary Supply Management Communication
- SCM 8C — A Paced Approach to Supply-Practice Improvement

4:30 – 7:30 p.m.
TechAdvantage® Expo Opens

Saturday, February 14, 2004

9:00 - 10:30 a.m.
General Session/Wrap-Up
Bridging the Generational Divide at Work

10:30 a.m. – 5:00 p.m.
TechAdvantage Expo Open

10:30 a.m. – Noon --
Special expo session for co-op managers and staff ONLY. This is your opportunity for exclusive conversation and networking with exhibitors.

1:30 – 4:30 p.m.
Tech Day

Sunday, February 15, 2004

11:00 a.m. – 3:00 p.m.
TechAdvantage® Expo Open

Monday, February 16, 2004

11:30 a.m. – 2:30 p.m.
TechAdvantage® Expo Open

NOTE:

TechAdvantage Expo and Tech Day will be held at the Ernest N. Morial Convention Center approximately 2-1/2 blocks from the Hilton New Orleans Riverside Hotel.

TechAdvantage 2004 Expo Exhibitors

As of December 9, 2003

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3M	1304
4DataLink	1351
ABB Power T&D Company	730
ACES Power Marketing	1232
Advanced AMR Technologies	309
Advanced Control Systems	532
Advanced Utility Systems Corporation	652
Almetek Industries	956
Alstom T&D Inc.	150
Altec Industries, Inc.	604
Alvarion Inc.	132
American Iron and Steel Institute	625
American Polywater	555
American Safety Utility Corporation	1152
Amistad Fiberglass Co., Inc.	130
AON - Rural Electric Utilities Underwriting Managers	904
Applied Technology Solutions, Inc.	340
Arch Wood Protection	1146
Arista Information Systems	845
Arkansas Electric Cooperatives, Inc.	208
Art Advertising Inc. (AA Labels & Decals)	1245
Asplundh Tree Expert Company	509
AXIOM Corporation	1052
Bermex, Inc.	310
Beta Engineering	409
Bombardier Utility Vehicles	311
Bridges Electric, Inc.	1121
BRK Brands/Coleman Powermate	116
Broadband Energy Networks Inc.	1247
C.H. Guernsey & Company	307
C3-Ilex	843
Calpine Corp.	750
Cannon Technologies Inc.	1114
Caremark Inc.	1046
Carhartt	1256
Cass County Electric Cooperative	1022
Caterpillar Inc.	522
Cayenta, Inc.	1331
Central Service Association	404
Centurion, Inc.	650
CEVA Energy	515
Chapel Mapping	640
CIS Conference, Inc.	110
Clough Harbour & Assoc. LLP	841
Cogsdale Corporation	138
Colorado Energy Management, LLC	556
Comsquared Systems	536
Comverge, Inc.	1404
Conduit Repair Systems, Inc.	551
Connector Products Inc.	1513
Convectair	747
Cooperative Response Center	304
Cummins Power Generation	1338
Currin Energy Page	1336
Daffron & Associates, Inc.	910
Data Comm for Business, Inc.	215
Datamatic	837
DATAMATX	735
dataVoice International, Inc.	721
Davey Resource Group	346
Dicke Safety Products	951
Digital Inspections, a KEMA Company	1150
DIS-TRAN	1431
Doble Engineering Company	1214
Document Imaging Solutions, Inc.	511
Donning Company Publishers, The	852
Dufresne Henry Consulting	1249
DuPont Vegetation Management	322
ECO Technology Solutions, LLC	222
ei Bottled Water	548
Electrical Consultants, Inc.	1151
Electro Industries, Inc.	1309
Electric Energy Publications	955
EMS Technologies	848
Energy Alternatives	627
Energy Providers Coalition for Education (EPCE)	552
EnerVision, Inc.	324
Enspiria Solutions, Inc. - an Osmose Company	1252
Environmental Protection Services	1428
Envision Utility Software Corporation	207
Equipment Technology, Inc.	230
ERMCO	714
ESRI	330
EUDA/GRESCO	108
Eye Lighting International of North America	813
FKI Energy Technology	850
FLIR Systems	632
FPL Energy	639
Franklin Equipment Company	448
G&W Electric Company	312
GDS Associates, Inc. /HiLine Engineering, LLC	1403
GE Industrial Systems	1326
Genics, Inc.	1010
Geotek, Inc., PUPI Division	1325
Gillette Generators	528
Global Utility Equipment Connection	657
Hall's Safety Equipment Corporation	445
HDW Electronics	746
High Cotton	1329
Hitachi Software Global Technology	451
Homac Companies, The	246
Howard Industries, Inc.	840
Hubbell Power Systems	738
Hughes Brothers, Inc.	1203
Hunt Technologies, Inc.	1122
IFD Corporation	1310
Immediate Response Spill Technologies	1155
Infrared Solutions	647
Innovative Utility Products	712
International Utility Structures, Inc.	944
Invensys Metering Systems	628
Itron	938
JCMB Technology Inc.	1015
Joslyn Hi-Voltage	622
Kaddas Enterprises, Inc.	742
Katolight Corporation	1123
Kershaw Manufacturing	134
Kozy Heat	751
LabOne	1145
Laminated Wood Systems, Inc.	1147
Landis+Gyr	1314
Larson Cable Trailers Inc.	1414
Layton Graphics, Inc.	352
Lewis Manufacturing Company	1432
Manheim Auctions Government Services, Inc.	1321
Marathon Water Heaters	112
MarKi Industries	547
MasTec, Inc.	212
Mauell Corporation	950
McFarland Cascade	343
Megger	947
Meteorlogix	744
Milsoft Utility Solutions, Inc.	1129
Milspec	250
Miner & Miner	447
MiniMax	504
Moloney Electric Inc.	1308

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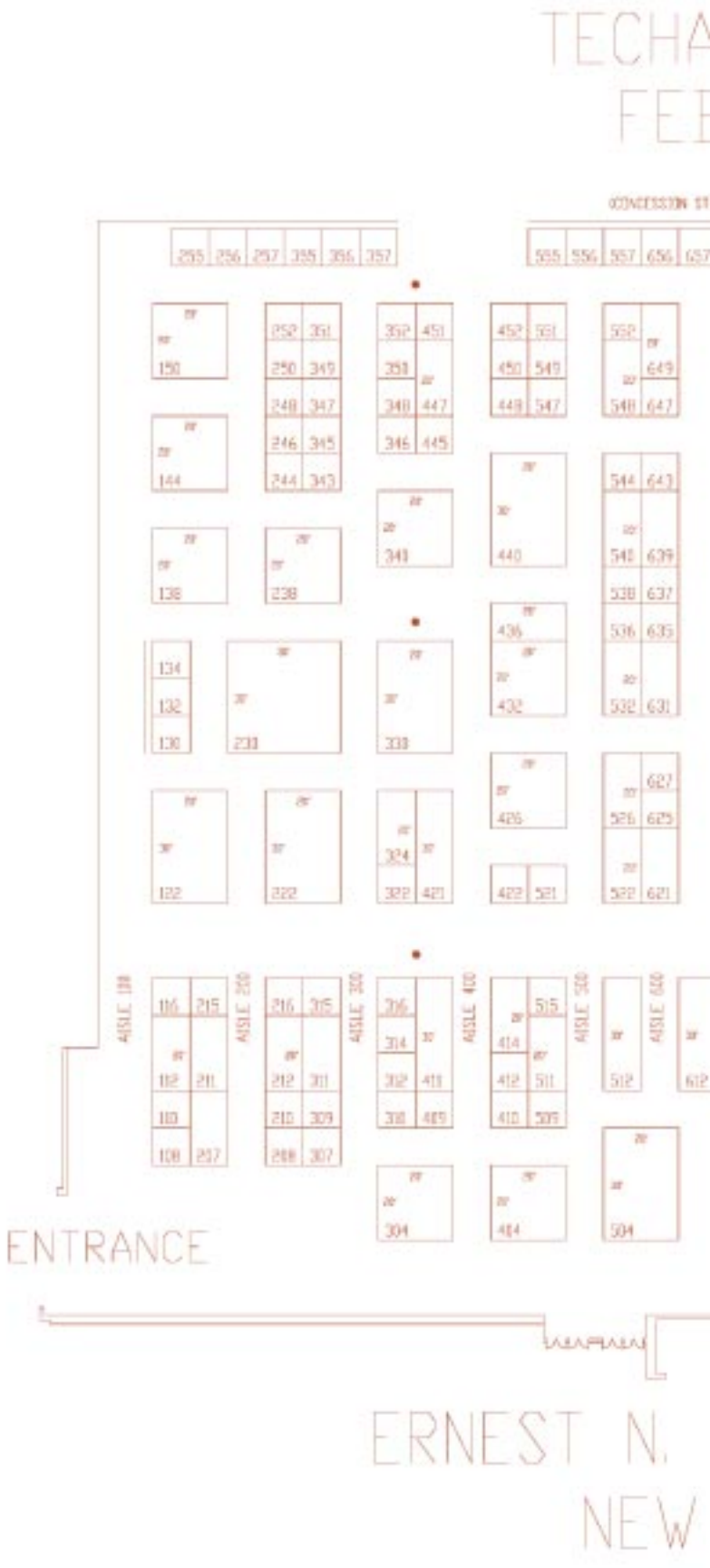
TechAdvantage 2004 Expo Exhibitors

As of December 9, 2003

Company	Booth
MSE Power Systems, Inc.	526
National Renewable Energy Laboratory	1349
National Rural Electric Cooperative Association - NRECA	1038
Nationwide Utility Pole & Supply, Inc.	315
NERTEC Design Inc.	1109
NISC	920
North American Wood Pole Coalition c/o WWPI	1104
Northrop Grumman	626
NRECA - Multi Speak	1107
NRTC	122
Okonite Company, The	316
Omega Systems	314
ONLINE Utility Exchange	755
Osmose Utilities Services, Inc.	1244
Ozark Technologies	422
Panasonic Computer Solutions Company	351
Patterson & Dewar Engineers	1430
Pike Electric, Inc.	1303
Pirelli Power Cables & Systems	646
Postal Pros dba Documents Southwest	410
Power Delivery Associates, Inc.	432
Power Quality Systems	421
Pratt & Whitney Power Systems	1209
Precise Power Corporation	1110
Preformed Line Products	649
ProCore Solutions	144
Professional Computer Systems	512
PSG Enterprises, Inc.	740
QEI, Inc.	414
Radius Radio Network Technology	815
Rainbow Treecare Scientific Advancements	1008
Red Simpson, Inc.	1004
Reef Industries, Inc.	743
Renfroe Collection of Fine Art, The	1251
Ripley Company	637
S.D. Myers Inc.	811
Schlumberger	1410
Schlumberger Electricity, Inc.	1014
Schweitzer Engineering Laboratories, Inc.	631
SecureWorks	544
SensorLink Corporation	244
SePRO Corporation	1149
Service Concepts	1342
Sherman & Reilly Inc.	1502
Siemens PT&D	238
Solomon Corporation	216
Southeastern Data Cooperative, Inc.	426
Southeastern Reprographics, Inc. (SRI)	436
Statewide Editors Association	1250
Steffes Corporation	621
Stratos VSAT, Inc.	916
Stuart C. Irby Co.	635
SunGard Mailing Services	452
Survalent Technology Corporation	741
T&R Service Company	634
Tantalus Systems Corp.	1322
Terex Telelect	804
Thomas & Betts/Elastimold	856
Time Manufacturing Company	440
Touchstone Energy	1238
Townsend Tree Service Co., Inc.	521
Transmission and Distribution World Magazine	1230
Transworld Network Corp.	932
TSE International	411
TVD Inc.	1332
TWACS by DCSI	720
Twenty First Century Communications	1026
United Services Group	345
Uticom Systems, Inc.	210
UTILCO	644
Utility Automation Integrators, Inc.	812
Utility Equipment Leasing Corp.	1006
Utility Solutions Inc.	540
UTILX	538
VA Tech Ferranti-Packard Transformers Ltd.	1108
Vaughn Manufacturing Corporation	412
VON Corporation, The	1103
W.A. Kendall & Co., Inc.	211
Waukesha Electric Systems	1420
WeatherTAP.com	357
Wilson Bohannan Padlock Company	1226
Wood Quality Control, Inc.	1222
Zemar Inc.	643

TechAdvantage 2004 Expo

As of December 9, 2003



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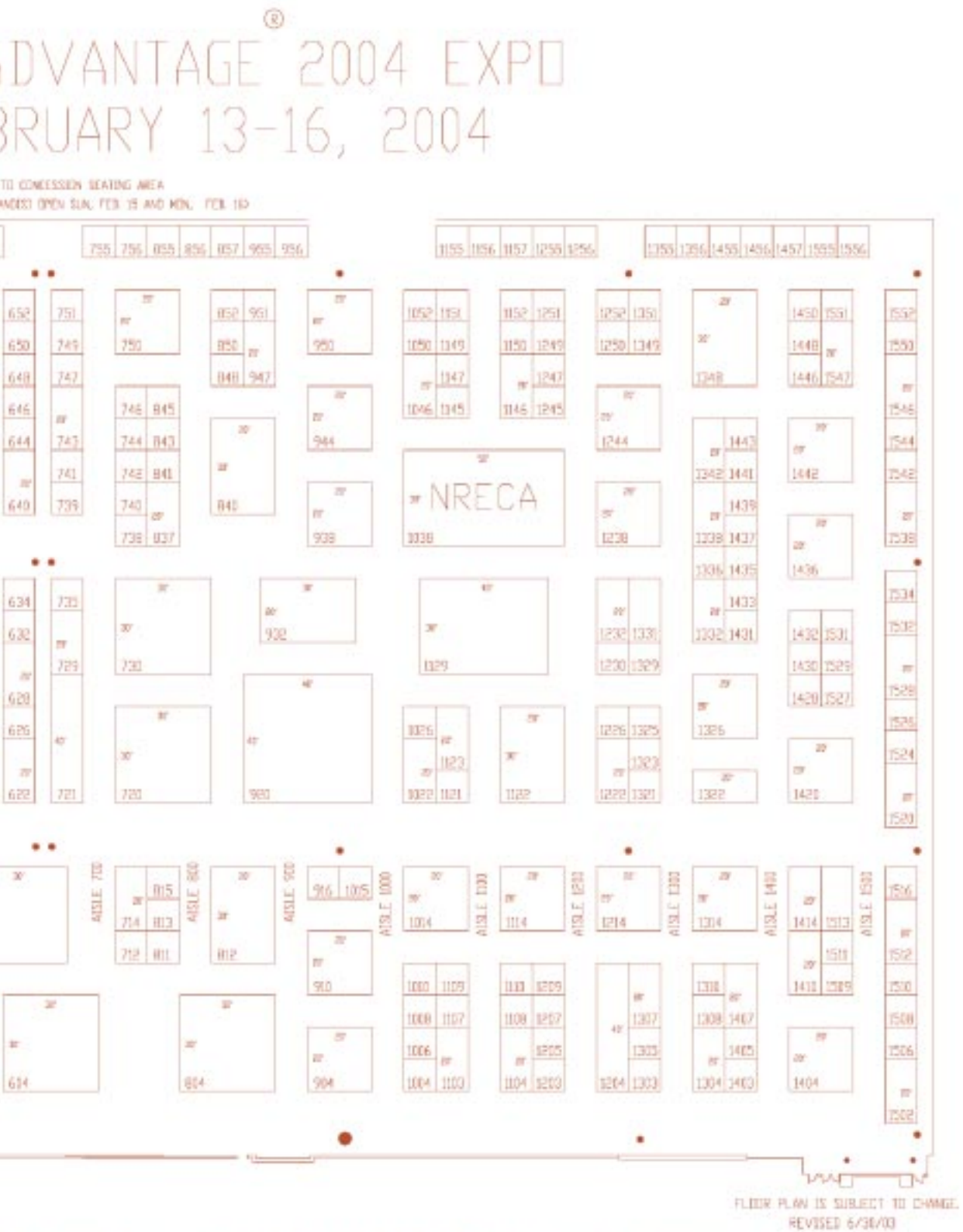
As of December 9, 2003

FLOOR PLAN



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Thermal anomalies are revealed by IR images (left to right) of a disconnect, a failed lightning arrestor, and a damaged transformer (center photo: R. Strmiska, Sumter Electric Cooperative)

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An Overview of ANSI C12.22

By: Edward Beroset, manager of the software and test group, Elster Electricity, LLC

Using the Internet to send and receive meter data is a topic of discussion at many utilities. A number of proprietary protocols are available today, but soon, a new ANSI standard protocol will be published to cover this application. This article describes the new protocol, including its impact on both Internet and radio networks.

Imagine that you're surfing the web and you see a web link that looks interesting to you. If you're like most people, you probably don't think about how that mouse click results in displaying the requested web page. When you click on a link with the mouse, the web browser issues a Hypertext Transfer Protocol (HTTP) GET request for that specific page. This request makes its way through the Internet network to a web server, which could be anywhere in the world. In response, the web server delivers the web page content through the Internet network to the web browser, which displays the web page. Regardless of how your computer is connected to the web, through a modem dial-up connection or an Ethernet connection to a local area network (LAN), the request issued by the web browser is the same.

This characteristic of Internet network design has significant advantages over other possible designs. One advantage is that only one web browser is needed that sits on top of the underlying transport protocols (for example, TCP/IP over PPP over dial-up, or TCP/IP over Ethernet). This design characteristic also helps the programmers who develop the applications that make the Internet work. The browser programmers can concentrate on browser functions without having to worry about underlying protocols, and the protocol developers can do their job without needing to know what applications are using the protocol.

To explain this characteristic of Internet network design in simple terms, consider this analogy. If you send a letter to Moscow by traditional post, you are the application writing the letter and the postal carrier is implementing the underlying transport protocol. You don't need to know any of the details of how the Russian postal system works, and the letter carrier doesn't need to know the contents of your letter.

ANSI C12.22 is the designation of a new standard that is being developed to allow the transport of ANSI C12.19 table data over networked connections. It is part of a group of related ANSI protocols but has some fundamental differences from the other protocols within the group. This article discusses the ANSI C12.22 protocol and how it works, but to fully understand the C12.22 protocol, it is helpful to consider a brief history of ANSI meter communications standards.

A Brief History of ANSI Meter Communications Standards

Years ago, data formats, data structures and communications protocols for electricity meters were all proprietary. But, utility companies wanted a compatible communication protocol between ANSI meters so they were not restricted to a single electricity meter vendor. To meet this requirement, ANSI standards were created that describe meter data formats and structures (C12.19), and provide a simple optical point-to-point communications protocol (C12.18) that allowed them to communicate with ANSI standard meters.

While this was a huge step forward in making a standard communication protocol for electricity meters, it wasn't long before users wanted to be able to send and receive ANSI tables remotely. To address that need, C12.18 was adapted to create C12.21. ANSI Standard C12.21-1999 specified a new version of C12.18 that was modified for telephone modems. This protocol was still strictly point-to-point communication and session oriented. Minor modifications were made to account for longer communication timeouts and for security since it could no longer be assumed that a person would be standing directly in front of the meter.

How and Why is C12.22 Different?

C12.18 described every detail of the physical attributes for optical communication ports (dimensions, LED wavelength, etc.). This standard was needed to build meters with a compatible communication interface. When C12.21 was created to implement point-to-point communication between meters, the intent was to use it with already existing modems. For this ANSI communication standard it did not make any sense for the ANSI subcommittee to describe particular modulation techniques and the physical connector used in modems because these aspects were already specified by other standards.

Although C12.21 is a meter communications standard and not a modem standard, some general attributes regarding modems were incorporated into the C12.21 standard. For example, initialization and dial strings were specified, but connector specification and electrical characteristics were not. The format and structure of the communications packets that carry C12.21 requests and responses are described in detail in the standard, but below a certain point, the detail stops. In the language of communications standards, the C12.21 protocol is more abstract than C12.18 because it deliberately omits the lower layer details. C12.22 is different from C12.21 in the same way that C12.21 is different from C12.18. C12.22 is more abstract because it omits even more of the underlying protocol details. The reason for these differences is also related. C12.22 is intended for use over already existing communication networks just as C12.21 is intended to for use with already existing modems. Examples of such communication networks covered by C12.22 include TCP/IP over Ethernet, SMS over GSM, or UDP/IP over PPP over serial port. Just as HTTP provides a common application layer that all web browsers can use, C12.22 provides a common application layer that all meters can use.

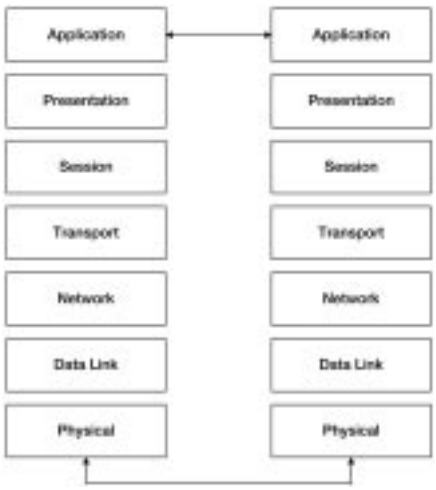
OSI Reference Model

The ISO (International Organization for Standardization) OSI (Open Systems Interconnections) is a set of international standards that describe how computer systems may be interconnected to support the exchange of information in a consistent fashion. It is commonly referred to as the OSI Reference Model, or the "seven layer model." It provides a standard for layering communication protocols, which makes it easier to understand and implement in product design.

Seven Layer Model

While many people are familiar with the OSI Reference Model, Figure 1 provides an overview of the communication protocols contained in each layer.

Figure 1



Layer 7 - Application

The Application Layer describes network applications from the user's point of view. It includes things like HTTP, File Transport Protocol (FTP), and email protocols. ANSI table reads and writes belong to this layer.

Layer 6 - Presentation

The Presentation Layer describes the syntax of data being transferred, and formats and unwraps the data for application layer processing. Data encryption, data compression and protocol translations would be in this layer.

Layer 5 - Session

The Session Layer describes the organization of data sequences larger than the packets handled by lower layers. An example of this is a single request for load profile data that is handled by multiple packets containing the actual load profile log data.

Layer 4 - Transport

The Transport Layer describes the quality and nature of the data delivery. This layer is responsible for data reliability and integrity. If the underlying network layer fails to deliver a packet, it is the transport layer that issues a request for retransmission. This layer is also the lowest one at which an end-to-end connection exists.

Layer 3 - Network

The Network Layer describes how a series of exchanges over various data links can deliver data between any two nodes in a network. Routing and forwarding, addressing, congestion control and packet sequencing are functions of this layer.

Layer 2 - Data Link

The Data Link Layer describes the logical organization of data bits transmitted on a particular medium. The calculation of packet Cyclic Redundancy Codes (CRC) in C12.18 and handling of packet level ACK and NAK responses are examples of Data Link Layer functions.

Layer 1 - Physical

The Physical Layer describes the physical properties of the various communications media, and the encoding of information on the physical media. An example from C12.18 would be light levels, wavelengths, and physical dimensions of the optical port.

C12.22 Scope

The scope of work for C12.22 was defined early in the process to explain the document and to serve as a guide to help the committee members stay on track.One key point is that there are two different models of implementation addressed by the standard:

- Meters with an integrated network connection
- Meters with a separate communications module (CM)

The model for meters with an integrated network connection only specifies the application layer protocol. It may implement any kind of lower layer protocols.

The model for meters with a separate CM has the meter on one side and the target network on the other side of the CM. The interface between the CM and the meter is explicitly and completely defined down to the physical layer (Layer 1). The interface on the network side of the CM is only defined at the application layer (Layer 7) since the underlying network is not dictated by the standard. This allows for communication modules to be interchangeable without dictating the network on which the module is used.

Unlike C12.18 or C12.21 that only provide session-oriented communications, C12.22 provides for both session and sessionless communications. In a session, both ends keep track of what they have done so far in the connection. For example, after providing a password, subsequent read requests are granted or denied based on that password. In sessionless communications, neither side needs to keep this kind of information because each transaction is independent of the previous ones. In a sessionless communication, for example, a read request also includes the encrypted password. Sessionless communication has the advantage of requiring less complex handling on both sides of the communication link and fewer packets exchanged if communications sessions tend to be short.

C12.22 Application Layer Services

C12.22 also describes a number of Application Layer Services. All of the functions of the C12.22 protocol are handled through combinations of these services. The Application Layer Services provided in C12.22 are:

Identification request (ident)

Like the identification request of C12.18 or C12.21, this identification request allows the meter to send basic protocol identification, including which protocol is being used and a feature list that includes things like encryption parameters in C12.21. Added to C12.22 are session control information and the ability to indicate compression support. Encryption parameters were generalized to become security mechanism.

Read request (read)

Identical to a read request in C12.18, this service allows reading a full table, a partial table or the curiously undefined "default table."

Write request (write)

Identical to a write request in C12.18, this service allows writing a full table or a partial table.

Logon request (logon)

Identical to a logon request in C12.18, this service establishes a session without establishing access permissions.

Security request (security)

Identical to a security request in C12.18, this service establishes access permissions by a simple unencrypted password.

Logoff request (logoff)

Identical to a logoff request in C12.18, this service provides for an orderly shutdown of the session established by the logon service.

Wait request (wait)

Wait request is used to maintain an established connection during idle periods to avoid automatic termination from a traffic timeout.

Registration request (register)

Registration request is used to add and maintain routing tables of C12.22 relays. This is covered later in the description of routing.

De-registration request (de-register)

De-registration request is used to remove a routing table entry of a C12.22 relay. This is also covered later in the description of routing.

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Resolve request (resolve)

Resolve request is used to retrieve the native network address of the C12.22 node. This native address can be used to communicate with other nodes on the same network segment.

Trace request (trace)

Trace request is used to get a list of relays capable of forwarding messages to a target node. This is intended mostly for diagnostics.

The Impact of C12.22 on Internet Metering

There are alternative methods to C12.22 by which meter data is transported over a network. Instead of wrapping C12.18 or C12.21 protocol transactions in an existing network transport protocol such as TCP, the committee decided to use C12.22 for three main reasons: improved security, reliability, and speed.

Improved Security

The first reason is improved security. In C12.18 the password is sent unencrypted. This is not a problem for a point-to-point connection from a handheld device to an optical port on a meter, but when data is transmitted over the Internet, it's a serious security problem. A hacker with a computer loaded with freely available packet sniffing software can look at the packet and see the password. C12.21 has an alternative authentication mechanism, which provides for encrypted authentication, but the encryption is only used for authentication and all subsequent data reads and writes are done unencrypted. With a point-to-point connection via dialup telephone lines, this is not a problem because intercepting such communications is very difficult, but if the data is transmitted over the Internet, we once again have a problem because hackers can easily intercept the data. In both of these cases, the problem created is that a hacker, having successfully monitored the login, can now freely interfere with the meter and the automated meter reading (AMR) system. C12.22 enables data encryption without requiring it, so no additional communications resources are used until encryption is actually used.

Reliability

Reliability is the second reason C12.22 is preferred over wrapping C12.18 transactions in TCP. Remember that C12.18 was intended for use over a point-to-point connection via an optical connection with very low error rates. In a typical network, errors and retransmissions are common and the data frames may arrive out of sequence. You might get the second half of the message before you get the first half. TCP takes care of these details and hides their effect to a point, but there is a cost. First, every TCP connection requires a three-way handshake to open the connection. Then, every application layer request that gets transmitted over TCP must be delivered completely before it is passed to the receiving point application layer. If the second half of the message arrives first, it is not available to the application layer until the first half also arrives. This is a useful property of the TCP transport service, but it has consequences. C12.18 and C12.21 both say that if an expected reply is not received before the traffic timeout period expires; the request should be retransmitted. If this happens, then the second response is also blocked until the first transmission is satisfied (by receiving the missing first half of the message) or the session times out at the TCP layer.

Speed

The third reason is speed. C12.22 provides for messages that do not require a session. This means a single transaction (see Figure 2) can support an authentication and read billing data request without the usual overhead of a table read transaction (see Figure 3). It's important to note that this applies whether or not the data is transmitted over any Internet segments. Because of this overhead, a radio network built using C12.21 or C12.18 may be more expensive to operate because radio networks are often billed by the amount of airtime used.

Conclusion

The utility industry trend is to read increasing numbers of meters remotely using various types of networks. As communications options diversify, some kind of packet-based network is more frequently used for this purpose. The C12.22 standard accommodates this diversity without becoming a nightmare for manufacturers, utilities, and regulators. This article covered just a few of the many facets of C12.22. If you would like to learn more, the entire draft standard is available on the web at: www.nertec.com/standards/ansic1222/index.htm and also at www.forums.nema.org/~ansi_c12-17. Our meetings are open, and we welcome your participation and comments. ◆

About the Author

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

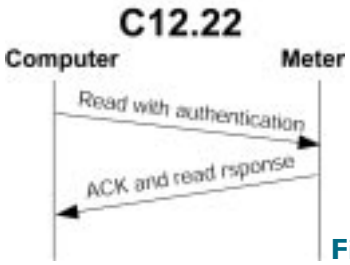

Figure 2

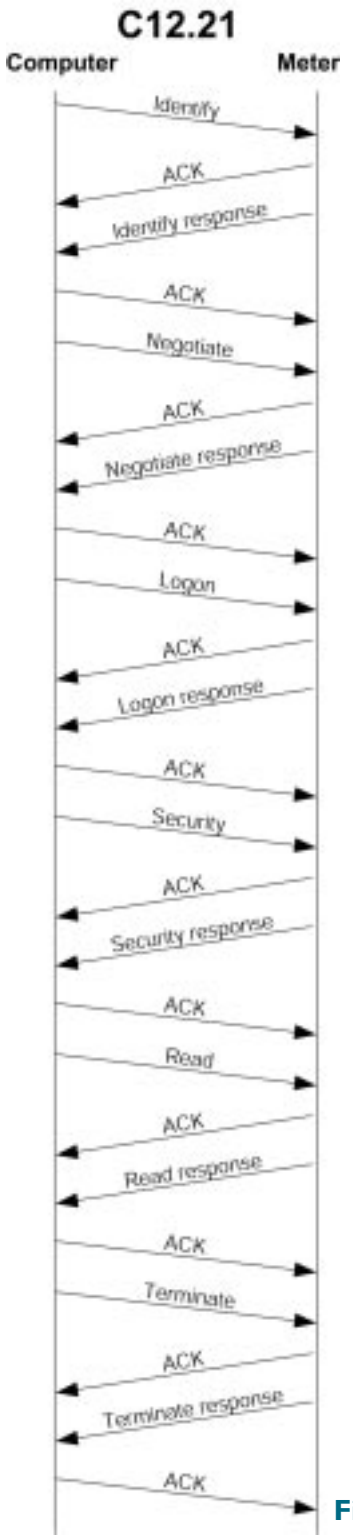

Figure 3

Experience with On-line Diagnostics *for Bushings and Current Transformers*

By: *Robert Brusetti, P.E., Product Manager, Doble Engineering Company*

The industry has always sought better tools to assess the general condition of high voltage equipment and identify potential problems. Today's microprocessor technology provides a sophisticated means to capture information. While much of this technology has already been integrated into off-line techniques for over a decade, it also adapts well to on-line measurement. One of the primary challenges to the on-line approach is the management of a tremendous amount of data. Fundamentally, the desired result of the diagnostic test is to determine the status of the apparatus, and if an anomaly is detected, how critical is it, and how soon will it require attention? This level of information analysis cannot be achieved with a simple monitoring system; it requires an expert system, which can digest all of the data being generated. It is this expert system, which differentiates an on-line monitoring system from an on-line diagnostic approach. The intent of this article is to outline how on-line diagnostics can be applied to evaluating bushings and also to share some applications experiences.

Off-line diagnostics have served the industry well and they continue to play an important role in the reliability of the power system. The off-line application has some inherent flaws - the obvious one being the need to remove the apparatus from service -and the other flaw being the inability to identify serious changes taking place between test intervals. If the gestation period (time from normal condition to failure) is shorter than the test interval, then the test result will never exhibit the problem. The frequency of the on-line measurements provides the ability to determine the rate of change, knowing if the change was gradual, over a long period of time or sudden, as well as when the change took place. This is all information that can be used to determine the appropriate course of action. An apparatus owner may decide to tolerate an abnormality that has stabilized and let the expert system determine when the situation becomes more critical or plan corrective action at a more optimal time. To achieve this level of confidence, one must place a great deal of trust in the expert system. The expert system must distinguish between noise and actual change, identify a wide array of problems at the incipient state, and provide evidence why an alarm is being issued, as well as some type of traceability. An expert system should not rely solely on thresholds set from conventional off-line methods, which traditionally have been conservative due to the limitations of the approach. The diagnostics should be capable of learning the specific characteristics of the individual apparatus and not rely solely on user limits or average values from other similar apparatus. The expert system should be capable of learning normal behavior of the apparatus being evaluated and apply this to the analysis.

Why apply on-line diagnostics to bushings? Bushings are certainly not the most expensive piece of equipment in a substation, so the financial loss of a bushing failure is not the driving force. However, the damage that a failed bushing can inflict on its affiliated apparatus could indeed be catastrophic. Specifically, bushing failures leading to a damaged power transformer have been well documented. The role of the bushing subjects them to high dielectric, thermal, and mechanical stresses, which tends to make bushings one of the most vulnerable components of major apparatus. Most bushing failures can be attributed to internal deterioration or contamination and being able to detect these irregularities is essential to maintaining a stable system. Many of the same dynamics affect the performance of current transformers. For stand-alone current transformers the insulation system is very similar to bushings making it feasible to apply the same diagnostic tools.

The industry has accepted the conventional off-line power factor/capacitance test as the most reliable tool for identifying problem bushings and current transformers. It is the success of the power factor/ capacitance measurement in bushing diagnostics and the awareness of the catastrophic results of bushing failure that have lead industry experts and insurance providers to recommend more frequent testing of bushings. These guidelines are in conflict with the current philosophy of the industry, which is to minimize down time. The concept of bushing/current transformer on-line diagnostics combines the advantage of the power factor/capacitance test with the ability to perform the measurements on-line, without interruption of service.

One approach to determining in-service condition of bushings is to calculate the imbalance current measured at their tap for a three-phase set, Figure 1A. The sum current method is based on the principal that in a symmetrical three phase system, the sum of the voltage and current vectors is zero, Figure 1B. This allows the condition of bushings to be determined by vectorially adding the currents measured at the bushing taps. If the bushings are identical and system voltages are perfectly balanced, then the sum current will equal zero. In this situation, the expert system would only need to rely on the most recent recordings to determine the condition of the bushings. Since bushings/current transformers are never identical and system voltages are never perfectly balanced, the sum current is a non-zero value, which is unique to the bushing/current transformer set. As a result, the sum current is a vector unique to that bushing set, Figure 1C. The expert system establishes a benchmark sum current during an initial learning period, which is then compared to the configuration data, which consists of the last off-line measurement and/or nameplate data. This configuration is also used in the analysis to determine the present power factor and capacitance of the problem bushing/current transformer.

This benchmark value of sum current is compared to subsequent measurements. Subtracting the benchmark from the latest measured sum current provides a third phasor, which is referred to as the 'change in sum current', Figure 1D. The angle of this third vector with respect to the reference bushing is used to identify which bushing is causing the change. Once the deteriorated

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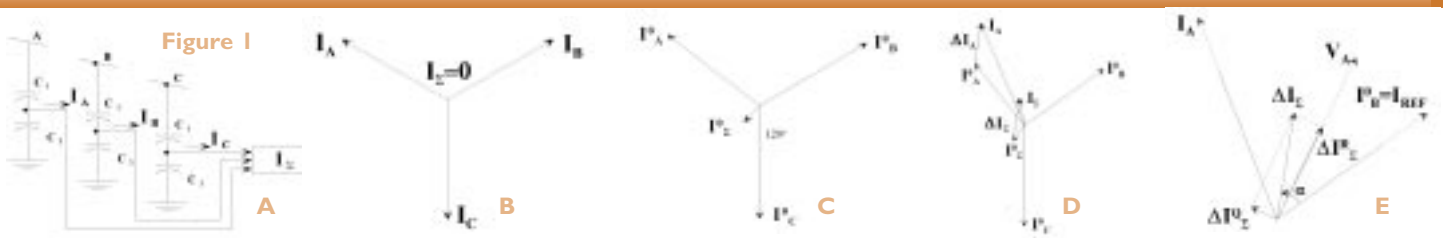

Figure 1

bushing is known, the magnitude and phase of the change in sum current vector is used to calculate the change in capacitance and power/dissipation factor of this bushing. The quadrature component of the change in sum current is used to calculate the change in capacitance while the in-phase element can be attributed to a change power/dissipation, Figure 1E.

This exercise calculates the absolute values of the power factor and capacitance of the dominant bushing (the bushing experiencing the greatest degree of degradation). This essentially replicates the off-line tests, provided the test conditions are the same. The advantage of the on-line approach is the frequency of data points, which provides the means to determine the rate of change. The expert system arrives at this information by performing a least-squared fitting on a subset of consecutive power factor and capacitance values accumulated over a specified period of time. This exercise will produce a quadratic polynomial equation that, if plotted, would generate a curve that provides a "best fit" through a series of points, in this case power factor and capacitance. By representing a series of power factor and capacitance values as a polynomial, the analysis can use applied mathematical tools to determine the stability of the situation. From this information, the expert system can reach a more informed conclusion on the criticality of the incident.

This technique can also be applied to stand-alone current transformers with and without taps. If the current transformers are equipped with taps the imbalance current is calculated using the tap current, similar to bushings. To apply the sum current approach to current transformers without taps typically requires electrically isolating the current transformer from the ground grid with the exception of one grounding point. The current measured at the grounding point is used in place of the tap current to calculate the imbalance current.

In the last discussion, it was suggested that the absolute power factor measurement using the on-line sum current approach duplicates the off-line measurements, provided the test condition were similar. The key point in this statement is the test condition. The experience from off-line diagnostics indicates that bushing problems effecting power factor measurements are accentuated at elevated voltage and temperature. The influences of voltage and temperature on good and deteriorated insulation are illustrated in Figure 2A and 2B. The plots track the power factor using the conventional off-line C1 (center conductor to tapped layer) insulation of two bushings as test conditions (voltage and temperature) are varied. The two specimens are both115KV bushings of the same manufacturer, type, and vintage - one is

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considered to have good, low power factor while the other has deteriorated high power factor. Figure 2A shows no change in power factor for the good bushing as the voltage is ramped up to rated voltage, while the deteriorated bushing exhibited an increase. A similar behavior is observed, Figure 2B, when the power factor of the two bushings was measured at increasing temperatures. This phenomenon was realized in an on-line situation when two sets of three bushings, one set containing a degraded bushing, were correlated to the top oil temperature of the transformer they were installed on. Figure 3 shows seven days of top oil temperature plotted with sum current data from two sets of Type U bushings in the same transformer. The middle plot is for the high-side (230-kV) bushings demonstrated "good": 0.3%, 0.32%, and 0.29%. The top plot is for the low-side (138-kV) bushings with elevated power factor values: 0.73%, 0.9%, and 1.08% (phase A, B and C respectively). The influence of temperature (lower plot) on the sum current is clearly evident, providing on-line confirmation that deteriorated bushings experience greater fluctuations caused by change in the operating environment.

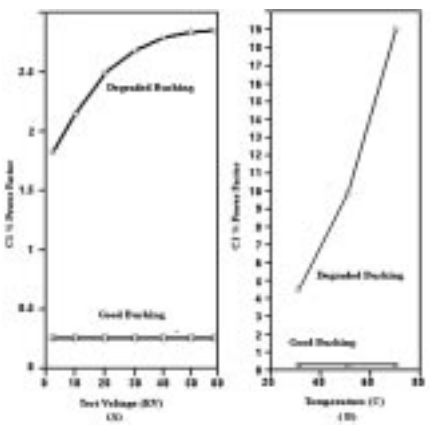

Figure 2

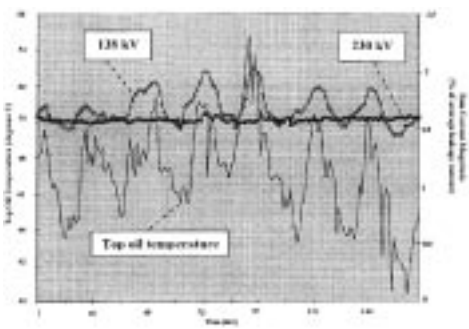

Figure 3

Case Story

The high power factor associated with the 138-KV bushings was realized during the commissioning of the on-line diagnostic system. The bushings were General Electric, Type U, manufactured in 1972, installed on a 224 MVA transformer. Bushings that exhibited this level of power factor would typically be removed from service, especially the phase C bushing, which registered a power factor greater than three times the nameplate. In this situation, spare bushings were not available; thus, it was decided to rely on the expert system to monitor the situation. This would provide an opportunity to prove that this technology was not only capable of detecting a problem, but also would permit the user to continue operating with a known problem. As long as the situation remained stable, a high power factor bushing could remain in service. In order to be successful, the expert system would have to overcome the thermal fluctuation to be able to track the rate of change. The on-line diagnostic system was installed in April '97, and the system continued to monitor the bushing for more than a year without issuing any alerts. In May the following year, the transformer began running hotter than usually; this triggering the expert system to issue an alert based on a significant change in sum current. The expert system identified the power factor on the phase C bushing to be the cause; it also noted there was no significant change in the bushing capacitance. This suggested that the problem with the phase C bushing was contamination. With spare bushings available, the utility elected to replace the bushing. The plan is for removed phase C bushing to be energized again in a protected environment with an on-line diagnostic system installed and run to failure, in order to learn more about the behavior of bushings just prior to failing.

This example provides an opportunity to point out the importance of the rate of change. If the expert system relied solely on a limit, it is very likely that it would have triggered alarms soon after installation, requiring the asset owner to make a decision based solely on absolute values. In order to arrive at an intelligent conclusion about the bushing's condition, the power factor and capacitance values along with rate of change needed to be available.

The intent of this discussion is not to lobby for the exclusion of the traditional method of apparatus testing, but to show that in certain applications on-line diagnostics can be a better alternative. The conventional off-line power factor test for bushings and current transformers continues to be an excellent tool to evaluate their condition, however there are situations where its inherent constraints cannot be tolerated. Bushings which are tied to critical system apparatus or which cannot be readily removed from service are candidates for on-line diagnostics. The on-line diagnostics should offer the possibility of duplicating the traditional tests, as well as taking advantage of the large sample size to perform trending and projection of potential problems.

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About the Author

Robert Brusetti, P.E., received his BS degree from the University of Vermont in 1984 and a Masters in Business Administration from Boston College in 1988. He has been employed at Doble Engineering Company for the past twelve years and is currently Product Manager. Prior to his present position he worked as a field engineer and assisted in the development of the expert system for the Insite on-line diagnostic system. Mr. Brusetti is a licensed Professional Engineer in the state of Massachusetts.

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Underground Cable Fault Locating
Using the Arc Reflection Method

Use of the arc reflection method combined with a high capacitance surge generator and state-of-the-art pinpointing devices for underground cable fault locating will find faults in less time and with less risk of damaging good cable than classical techniques.

By: *Mike Scott, Product Manager, Megger*

Time Domain Reflectometry

The pulse reflection method, pulse echo method or time domain reflectometry are several terms applied to what is referred to as cable radar or a TDR. The technique, developed in the late 1940's, makes it possible to connect to one end of a cable, actually see into the cable and measure distance to changes in the cable. The original acronym Radar (**Ra**dio **D**etection **A**nd **R**anging) was applied to the method of detecting distant aircraft and determining their range and velocity by analyzing reflections of radio waves. This technique is used by airport radar systems and police radar guns where a portion of the transmitted radio waves are reflected from an aircraft or ground vehicle back to a receiving antenna. For cable radar, when applied to underground cable, short time duration pulses are transmitted at a high repetition rate into the cable between the phase conductor and shield (neutral). A liquid crystal or CRT display shows reflections of the transmitted pulses. Reflections are caused by changes in the characteristic impedance of the cable. Any reflections are displayed on the screen with elapsed time along the horizontal axis and amplitude of the reflection on the vertical axis. Since we can now measure elapsed time and if we know the pulse velocity as it travels down the cable, distance to the reflection point can be calculated. For airport radar and police radar guns the velocity of propagation (Vp) of the radio waves through air is very nearly the speed of light or 984 ft/ms. Pulses transmitted through the insulation of our underground cable travel at about half that or about 500 ft/µs. A good cable analysis system should include two movable cursors which, when positioned at zero and a reflection point, provide a measurement of distance to that point, in feet.

A TDR sees each increment of cable, say each foot, as the equivalent electrical circuit shown in Figure 1. The combination of these components is referred to as the characteristic impedance (Z_0) of the cable. If every increment of cable is perfect and exactly the same, all components of the equivalent circuit of every foot are also exactly the same. This perfect run of cable will produce no reflections until the end of the cable appears. At the end of the cable the pulses see a high impedance, an open circuit, causing an upward (+100%) reflection. See Figure 2.

If the cable end is grounded, a short circuit, the pulses see a low resistance and a downward (-100%) reflection is caused. See Figure 3.

A low voltage TDR is an excellent tool for the prelocation of open circuits and conductor-to-conductor shorts. For shielded power cables, faults with a resistance higher than 200 ohms are almost impossible to distinguish from normal clutter reflections on the cable. Unfortunately almost all faults on primary underground distribution cable are high resistance faults in the area of thousands of ohms or even megohms. Due to the reflection characteristics of these high resistance faults they are impossible to see using only the low voltage TDR.

Arc Reflection Method

The arc reflection method of fault prelocating combines the use of a TDR (cable radar) and a surge generator (thumper). By using an arc reflection filter, a low voltage TDR and a high voltage surge generator can both be connected to the faulted cable and the TDR can be looking down the cable while thumping. The filter protects the TDR from the surge generator high voltage pulses and routes the low voltage pulses down the cable. This method utilizes the fact that when an arc is created at the fault, its resistance is reduced to a very low value, less than 200 ohms, which will reflect radar pulses. The arc location will appear as a downward going reflection on the TDR cable trace. See Figure 4. The cable analysis systems should capture and store the complete trace including the downward going fault location in memory so measurements can be made easily. Rather than thumping and walking the cable route to discover the fault location, the cable analysis system should provide a prelocation measurement with as little as one or two thumps and about 95% of the time gets you within 10 to 20 feet of the fault. Pinpointing efforts can then be concentrated within a well-defined section of the cable. This technique substantially reduces the amount of high voltage exposure to the cable, preventing the initiation of new faults, which will surface after the cable is put back into service.

Surge Generator

The device is basically a high voltage pulse generator consisting of a dc power supply, a high voltage capacitor and some type of high voltage switch. The power supply is used to charge the capacitor to a high voltage and then a contact closure discharges the capacitor into the cable under test. If the voltage is high enough to break down the fault, the energy stored in the capacitor is rapidly discharged through an arc at the fault creating a detectable sound or "thump" at ground level. The important specifications of a thumper are how high a voltage can be developed and how much energy is delivered to the fault. The energy output of any surge generator measured in Joules (Watt-Seconds) is calculated as follows:

$$E = V^2 \leftrightarrow \frac{C}{2}$$

E = Energy in Joules, C = capacitor in mf, V = voltage in kV

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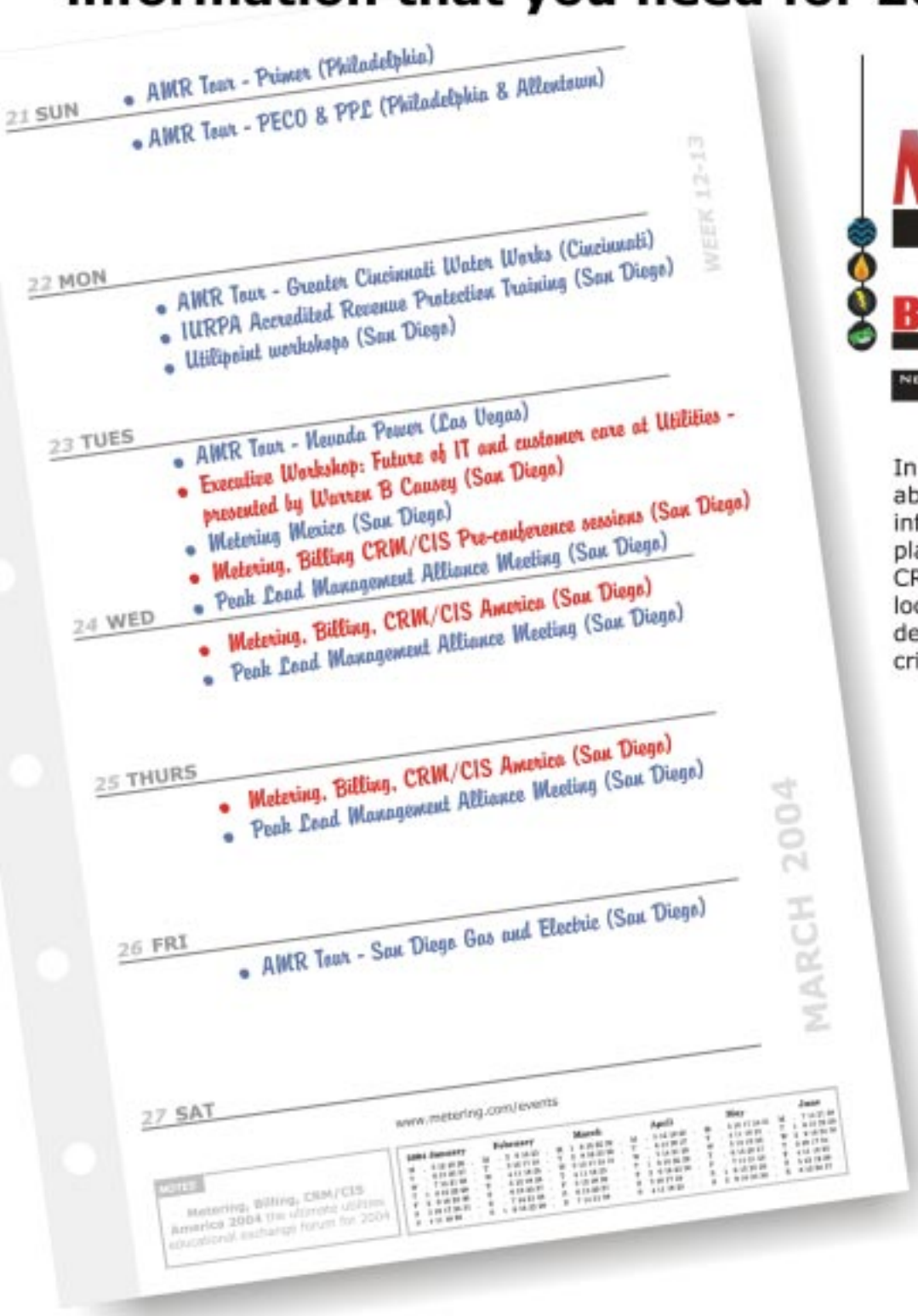

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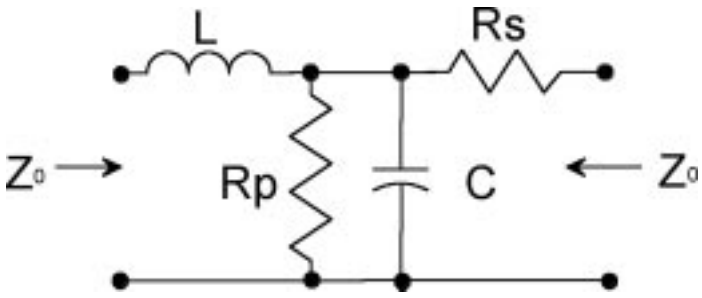

Figure 1. Cable Incremental Equivalent Circuit

The classical fault locating process is to hook up the surge generator, crank up the voltage and walk the cable route until the thump is heard or better yet felt. This process pinpoints the fault allowing a repair crew to dig a hole and repair the cable. The higher the voltage, the bigger the bang and the easier it is to find the fault. In some cases it takes hours (or days) to locate the fault and all that time the cable is being exposed to high voltage thumping. A few years after polyethylene cable began to be installed underground, evidence began to surface that due to "treeing" in the insulation, high voltage thumping of this plastic cable was doing more harm than good. Due to this information many utilities have issued work rules reducing the voltage to be used for fault locating. Another fact of life is that from the point of discharge at the fault to the isolated end, the cable sees a peak-to-peak voltage wave of double the surge voltage at every thump.

A very common surge generator in use for many years included a 4 microfarad capacitor that generated 1250 Joules at a voltage of 25 kV. If the fault locating crew is told that the maximum output voltage of the thumper must be limited to 12.5 kV (one half of 25 kV), the output energy of their thumper is reduced by a factor of four down to 312 Joules. In a practical world, the threshold for hearing a thump at ground level with no acoustic amplification and no background noise is in the range of 300 to 400 Joules. If the thump at the fault cannot be heard, voltage will have to be increased in order to find the fault, make a repair and get the lights back on.

Ideally, a surge generator that uses a 12 microfarad capacitor, which allows thumping at lower voltages while still delivering reasonable energy to the fault, is required. Thumping at 12.5 kV, as above, now produces a very audible 937 Joules. The surge generator, when thumping at its maximum voltage of 16 kV, produces 1536 Joules and should include both a built-in arc reflection filter and surge pulse pickup.

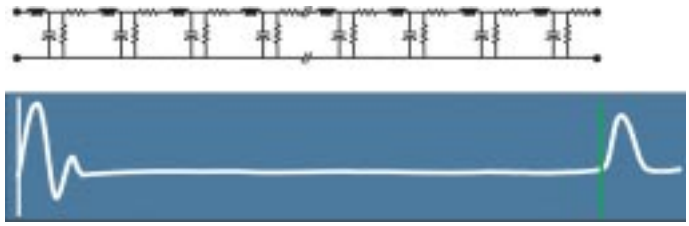

Figure 2. Equivalent Circuit and Low-Voltage TDR Trace with Open End

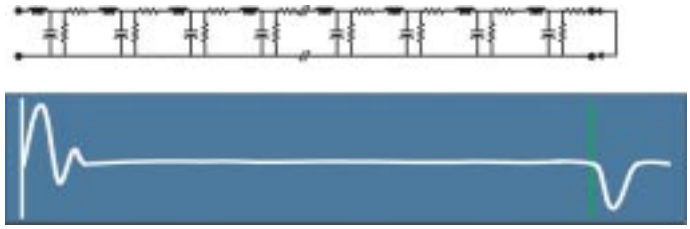

Figure 3. Equivalent Circuit and Low-Voltage TDR Trace with Grounded End

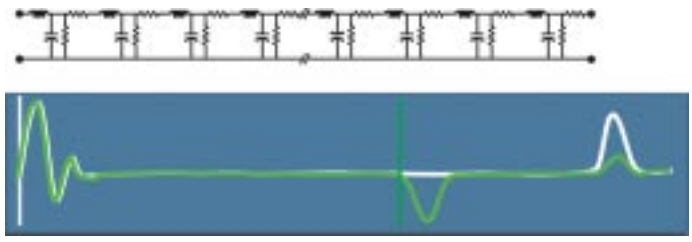

Figure 4. Equivalent Circuit, TDR Traces showing Fault Location

Pinpointing

Before digging in order to repair the faulted cable, some type of pinpointing technique must be used. The classical methods all revolve around some means to enable hearing the sound produced by the discharge of energy at the fault. The simplest and well-used method is the fault-locator-ear-on-the-ground-butt-in-the-air technique. Other approaches involve traffic cones, shovel handles and a length of conduit. Slightly more modern equipment uses electronic amplification and an acoustic pickup positioned on the ground. These techniques all assume that the sound travels directly from the fault to the earth's surface unimpeded and that the loudest sound is directly above the fault. If the cable is in duct or conduit or under paving this assumption may not be valid. A surge detector/fault pinpointer that combines an electromagnetic surge pickup and one or two acoustic pickups to zero in on the fault is the instrument of choice here. The receiver measures and displays the elapsed time between surge and sound. As the fault is approached, this time interval decreases to a minimum directly over the fault. This technique relies on the timing between the two events, not just simply on the volume of the sound. If dual acoustic pickups are used, the receiver will also indicate which direction to move toward the fault.

Conclusion

Using the combination of a cable analysis system, a surge generator and a surge detector/fault pinpointer, the process of underground fault locating becomes more efficient, gets service restored quicker and minimizes the possibility of programming the cable for additional faults while finding the present fault. ◆

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Keeping the Lights On: *The Power of Internet Security*

By: William K. Campbell , Vice President, Information Security Business Strategy, Symantec Corporation

The blackout of August 2003 highlighted the fragility of the North American electric power infrastructure to the government, utility shareholders and the general public. It was the largest blackout in North American history and cost over $50 billion in economic losses. This number is, at least in part, due to the increasing reliance on electric utilities.

As this reliance has increased, so have utilities companies' efforts to control and manage power from generation through to delivery. These efforts have resulted in the implementation of extensive information systems. Clearly, open system technologies are streamlining core business operations including customer service, power and outage management and supply procurement. Just as people are becoming more reliant on power companies, power companies are becoming more reliant on technology.

Information networks allow companies to maintain centralized monitoring of their energy management systems (EMS). They also enable these organizations to get power from generation to end users – which often involves great distances. Supervisory control and data acquisition (SCADA) systems were created for this very purpose. SCADA systems provide centralized management and monitoring of dispersed facilities and collect electric system data from nodes placed throughout the power system. The immense size of modern power grids has made SCADA systems indispensable. The average SCADA system has between 30,000 to 50,000 data collection and control points. Centralized management of network data ensures coordinated control and maximum staff efficiency.

Because the electric power grid was recognized to be essential to our infrastructure, early EMS and SCADA systems were constructed separately from other corporate systems. However, over time the convergence of power company networks and the demand for remote access to SCADA systems has led to many of them becoming accessible through non-SCADA networks.

EMS and SCADA systems created a more efficient way for electric companies to do business and the Internet took them a step further by enabling more cost-effective operations, more efficient communication and more innovative business practices. The benefits of connectivity are clear. Yet it is only recently that many electric utilities have come to understand the risks involved with making networks more accessible to a wider range and number of users. The reality is that providing better access to customers, suppliers and other third parties significantly increases the threat to the sensitive and proprietary information contained in those systems. Further, linking corporate networks and the networks that run an electric utility's operational control system are increasingly common. It is just as common for these networks to be inadequately protected.

In many cases, SCADA networks have been installed by third-party systems integrators that have exclusive authority to maintain them. This presents yet another potential security risk, as well as a challenge to sound IT management practices.

To address these risks, electric power companies must focus on collaboration between CIOs and IT staff who run the corporate network, but also COOs and the staff who run the operational network. Cooperation and coordination ensures that risks are properly addressed and assets are properly protected throughout the enterprise.

SCADA systems are a unique beast. Increased business dependence on the corporate network and widespread use of SCADA systems for energy management, means that electric power operational infrastructures are exposed to attack from an increasing pool of potential platforms and

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sources. However, few SCADA systems were designed with security in mind and adding security to them after the fact has proven to be challenging. There has been an assumption that SCADA systems are complicated and proprietary and therefore few people know enough about them to do much damage. But it is now clear that a determined attacker can obtain the requisite information without much difficulty, often by merely searching for it on the Internet. Furthermore, this assumption of "obscurity" fails to recognize the risk of an insider attack by someone who is not only knowledgeable but may even have legitimate authorization to access the systems.

Yet, a recent study conducted by Gartner Research in February 2003, indicates that many utilities are unwilling to spend the money it would take to implement robust security measures in their SCADA and business networks. In this light, consider these statistics taken from Symantec Corporation's October 2003, Internet Security Threat Report:

- By October 2003, Symantec documented 1,432 new vulnerabilities, a 12 percent increase over the number found in the same period the previous year.
- The speed of propagation of blended threats is increasing. For example, the Slammer worm impacted systems worldwide in less than a few hours.
- The overall rate of attack activity rose by 19 percent in 2003.

It is clear, electric power companies must take aggressive proactive steps to secure their networks before an incident causes shareholders to lose confidence and the federal government imposes mandatory security regulations.

There are several business cases to be made for preventing security breaches. Operational continuity is perhaps the most important case for ensuring a secure network. The need for reliability and availability of electricity throughout the power grid is at the core of the electric power industry. To prevent unauthorized access and disruption of service, electric utilities must remain vigilant about the protection of their electricity management.

The industry is slowly recognizing the need to protect the North American power grid. On August 13, 2003, just one day before the 2003 blackout, the North American Electric Reliability Council (NERC), approved Urgent Action Standard 1200. The standard recognizes that adherence to industry standards and other proactive cyber security measures are vital to avoiding the imposition of mandatory government enforced security measures.

So how do electric utilities address evolving security challenges? Effective network security begins with a thorough assessment of each network and its security architecture, followed by a carefully developed plan for improving security. Following is an overview of key steps that need to be taken to minimize the number and impact of security breaches:

1. Perform Regular Risk Assessments: Many electric utilities conduct regular risk assessments of their EMS and SCADA systems, but the majority do not. Risk assessment combined with appropriate post-assessment remediation action is essential to mitigate risks. A regularly scheduled assessment of corporate networks, Web servers and customer management systems is also

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essential to comprehensive security. Reviews of this nature can reveal unintended gaps in security, unknown linkages between public and private networks and firewall configuration problems.

2. Design an Effective Information Security Architecture: Firewalls, intrusion detection systems and virtual private networks can all help protect networks and data from malicious attacks, but if they are not deployed in the right places with the right configurations, these technologies can be rendered effectively useless. To minimize risks associated with poor network architecture, electric utilities should consider working with qualified information security professionals not only for the initial design, but on an ongoing basis to ensure that evolving network architectures do not compromise information security.

3. Deploy a Balanced Security Architecture: Corporate and control networks need to be surrounded by several different robust technologies and practices to be well protected. These components include assessments and early warning technology, protection technologies including firewall technology and finally, monitoring and management technologies.

4. Choose a Trusted Partner: Hiring experienced IT security experts can be cost prohibitive so many organizations decide to outsource the management and monitoring of their security devices to highly specialized managed security companies. These managed security services companies enable corporations to maintain a real-time security monitoring capability at a relatively low cost.

Electric utility companies must take steps to quickly protect electric generation and delivery systems – and their associated business networks – against viruses, hackers and other online threats. Many electric utilities are past the beginning stages for understanding the need for cyber protection but are still trying to educate management and employees on the need to implement appropriate security practices. These practices are essential to maintaining secure networks and ensuring the continuity of power generation and delivery in the future. ◆

ABOUT THE AUTHOR

William K. Campbell, Vice President, Information Security Business Strategy, Symantec Corporation.

William K. Campbell is vice president of Information Security Business Strategy in the Strategic Vertical Solutions and Support Group at Symantec. Campbell's group specializes in the utilities, energy, telecommunications and chemicals industries.

With more than 18 years experience in software development, quality management, systems integration and security of networked computing technologies, Campbell has spent his career conceiving, planning and executing technology deployments in complex and dynamic business environments. He has consulted to a broad spectrum of companies including Fidelity Investments, Microsoft, Goldman Sachs, AT&T, Fujitsu, Cisco Systems, BellSouth, Arthur J. Gallagher, Halliburton and ExxonMobil.

A graduate of the United States Naval Academy, he designed the first local area network installed at a U.S. Marine Corps facility. Later, he worked as a senior technology consultant with the U.S. Department of Energy, and as a quality engineer for a software company in the energy services industry. He has also spent time in his career with Fidelity Investments, StorageNetworks, Inc and Arthur J. Gallagher & Company. In addition, Campbell founded Eagle's Reach, an information security consulting firm that also develops specialized software. Campbell is a Certified Information Systems Security Professional. He is currently a member of the Professional Practice Committee of (ISC)2, responsible for reviewing allegations of professional misconduct and a representative to the International Information Integrity Institute (I4).

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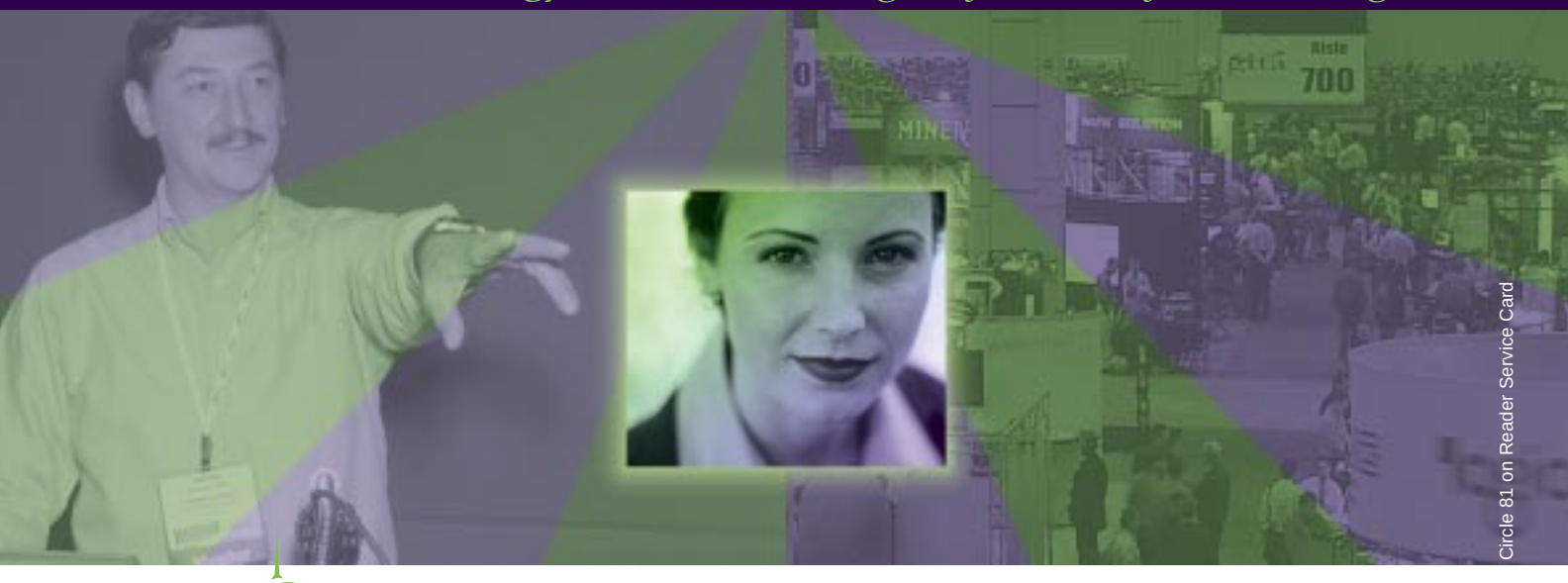

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Combining Staking Design with GIS and Asset Management
Leads to Exponential Productivity Gains

By: *Sean Solberg, VP, Research and Development, MiniMax Corporation*

Most electric utilities have implemented either a Geographic Information System (GIS) or some type of mapping system. Many maintain an asset management system. A small but rapidly growing number are implementing field-based staking (design) systems. Automated field staking provides the mechanism to greatly increase productivity and enable digital GIS and asset management updates. Creating digital GIS and asset management (hereafter collectively termed 'GIS') data at the real-world source (out in the field) effectively removes the impediments and time required to maintain those, and many other systems.

There is a tremendous amount of data that typically gets transcribed a number of times in order to maintain a utility's GIS. It does not require much analysis to realize the benefits of enabling that same original data to suddenly go twice as far. This is what happens when you extend the data gathered by a field staking system into a GIS. The obvious advantage to the staking or design engineer is bringing a computerized and automated staking and work order automation system into the field with GIS facility maps. The tremendous advantage from the GIS perspective is keeping a near real-time updated GIS data set reflecting proposed, changed, retired and newly constructed field designs – the vast majority of all GIS data manipulations. By leveraging a field staking system and an interface to the utility GIS, creating data in the field can be twice as valuable.

The GIS Implementation Conundrum

Electric utilities make strategic decisions to invest in and implement a GIS. To fully capitalize on this investment it is imperative to not only integrate the GIS with other systems and processes, but to also maintain the data it holds. GIS data population is typically accomplished in two phases. The initial population starts with field collection and generally takes anywhere from one to five years to complete. An inherent problem with this data collection phase stems from the continuous construction and system changes occurring throughout the system during the field collection process. Ultimately, a field collection project without an accompanying update process just creates a single point-in-time representation of the inventoried assets. After the field collection is complete, there is a continual need for data maintenance due to ongoing system upgrades, changes and new construction.

The second GIS population phase involves ongoing GIS maintenance. This data maintenance is driven by several change sources, each with unique update frequencies. The first and most static data source are land base features. These are often created by city and county governments and include political boundaries, road projects and government facilities. Many utilities have procedures in place to handle such changes. However, due to the infrequent nature of land base modifications, utilities do not usually need to automate this process. The second source of base-map data change involves construction and development including new plats, roads and address changes. These modifications often require automated procedures depending upon how much new construction is occurring within the utility's service territory. Finally, it is the daily work on the utility infrastructure – such as upgrades, retirements and plant additions – that necessitates an automated process for data collection, work management and transferring the resulting changes to the GIS data set. Without an updating procedure in place, the static GIS dataset gets further away from reflecting the actual environment with each closed out work order and service order. The high frequency of system changes and the fact that the majority of these changes are internal to a utility creates an opportunity for a large return on investment when looking at automated field staking systems.

Figure 1: Updating GIS from field staking applications allows GIS professionals to focus on analysis instead of data entry.

Field Staking and GIS

Duplication of effort is, unfortunately, almost always part of existing GIS maintenance efforts. The most common approach is to reference staking sheets or as-built drawings and manually re-digitize the data, duplicating the effort of the staking engineer who created the design in the first place. Another common approach is to return to the field after construction to obtain GPS readings and inventory the as-built assets with GPS data-logging field units. When these labor intensive updating procedures are not in place the unfortunate alternative – after a number of years of unrecorded system changes – is to re-inventory the entire territory, an expensive proposition that means a utility is again relying on outdated, one to five year old data. More significantly, both approaches require manually re-manipulating data that was used during the field design and work order process.

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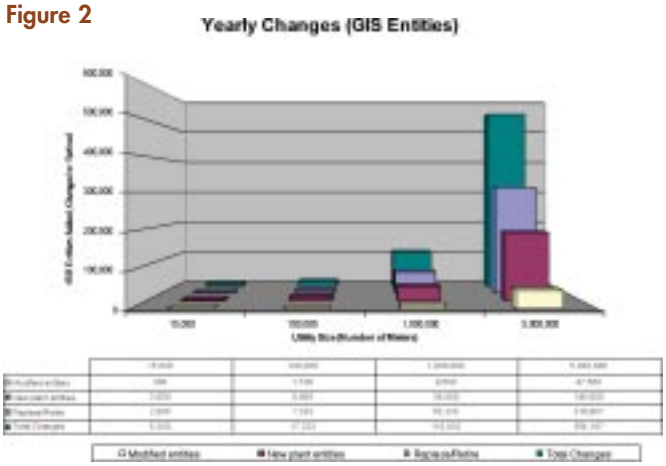
Figure 2

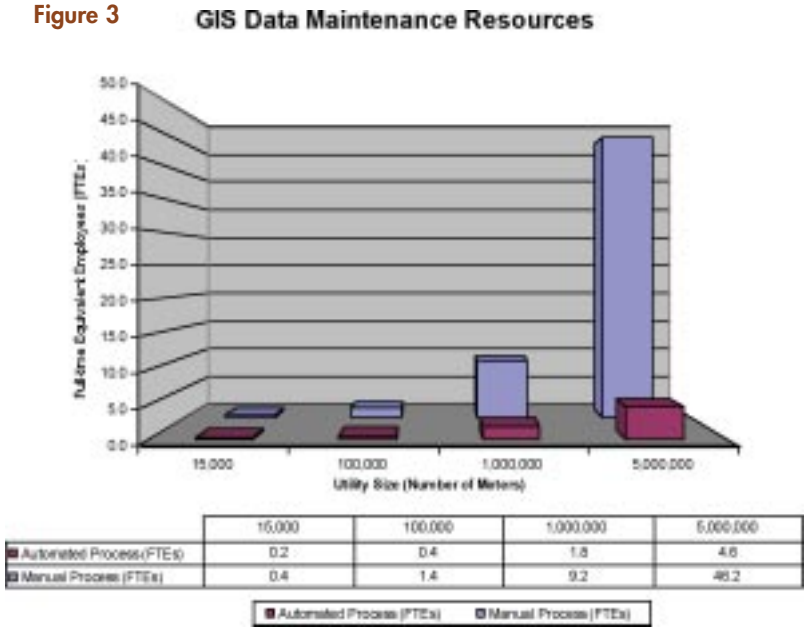


A utility's GIS is dynamic, like the utility itself. The daily changes that occur in the GIS reflects the operation of the utility it supports. Depending on the size of the utility, as illustrated in Figure 2, "Yearly Changes (GIS Entities)," the potential for changes within a GIS due to field work can be significant. Modifications to existing plant, new plant additions and replacement or retirement of existing facilities represent the vast majority of GIS data changes. Automating the data updating processes removes much of the mundane, repetitive data entry workload from GIS personnel and allows them to concentrate on critical business processes and analysis. Figure 3, "GIS Data Maintenance Resources" illustrates the dramatic workload reduction that can be achieved through integration of field staking data into the GIS.

Automating the work order process using field staking tools generates savings throughout the utility beyond the direct GIS benefits. Figure 4, "Cost Benefit Analysis," illustrates a typical utility calculation showing the time savings realized on a 30 station work order. This analysis takes into account the ability to perform cost estimates in the field for the customer, GIS integration, avoiding multiple trips to the job site, reduced error rates and process improvements. Extrapolating the savings realized on this particular type of work order provide compelling reasons to implement a field staking system.

Field staking systems are a real alternative source for GIS data maintenance that have been proven cost effective in hundreds of electric utilities to date. These systems enable the utility to use data gathered during the work order process and digitally update the GIS. They effectively extend the GIS to actual design work in the field, without encumbering the field user with the speed and functional impediments inherent to analytical GIS programs. Creating system designs in the field, where assets are positioned and can be referenced against the reality of the environment where they will be built, not only makes a powerful contribution to the overall accuracy of the GIS data but also makes for a cleaner, more accurate design that is easier for construction crews to interpret and build. This leads to better construction that adheres to the staking engineer's design, fewer as-built changes and less overall time spent during the entire work order process.

Figure 3



	15,000	100,000	1,000,000	5,000,000
Automated Process (FTEs)	0.2	0.4	1.8	4.6
Manual Process (FTEs)	0.4	1.4	9.2	46.2

Contrast the field staking approach to designing in the office from memory. Relying only on GIS data often results in overlooking or imprecisely portraying the relationship between the design and the environment in which it is to be built. In-office design systems are typically built on top of a GIS engine. Implementing this approach requires significant training and an interface built around GIS-centric tools that were built for editing GIS data instead of being design focused. A major portion of the value of a GIS comes not just from the maps, but the relationship between data that are represented and the real world. Imprecise, non-field checked designs lead to change orders, reconfigurations, re-builds and ultimately higher costs.

The Payback Model

A field staking and work order automation system has a compelling value proposition. Utilities implementing field staking typically calculate a complete return on investment within a six month to two year time frame. This enables field staking systems to be deployed on a cash-neutral basis from the utility's standpoint and to generate actual return on equity after the break even point is needed. The following analysis demonstrates portions of the value proposition.

Improved Return from GIS

Leveraging field staking systems and GIS also benefits the design process itself. Staking engineers can bring the entire GIS feature set to the field to use as the basis for the design. This helps orient and inform the designer by visually providing existing information and gives an in-field opportunity to verify the GIS data. Staking out a design in the field also results in the final design reflecting a high degree of positional accuracy. Adding field measurement tools such as real time differential GPS receivers and highly accurate laser range finders dramatically improves the quality of the GIS geo-referenced data. The incorporation of these tools in the staking process also significantly speeds up the actual design process itself.

Figure 4

Cost Benefit Analysis
Estimated Time and Cost Savings
30 Station Job

Work Order Task	Manual	StakeOut	
Travel	2.0	1.0	
Customer Relations	1.0	0.8	
Mapping target area	3.0	1.0	
Survey/retire existing system	4.0	2.0	
Design new system	4.0	2.5	
Subtotal: Field Time	14.0	7.3	
Verify calculations	2.0	0.0	
Legibly re-sketch job in office	2.0	0.0	
Complete staking sheet	2.0	1.0	
Tabulate unit data	3.0	0.0	
Key data, produce reports	2.0	0.5	
Update GIS	2.0	0.3	
Reduced error rates	1.0	0.0	
Closeout and final clean-up	2.0	0.5	
Totals:	30.0	9.6	hours
	1050.00	336.00	dollars
		Savings:	714.00 dollars

A slight change in a utility's approach towards GIS maintenance, by directly incorporating field staking data, will lead to tremendous productivity gains. This can be done without disrupting the rest of the work order process. Deployed correctly, staking designs continue to be processed through the normal work order channels using and automating procedures with the digital data where possible or practical. As the staking designs flow through the existing work order process, the GIS system can be used to analyze and visualize the status of work at various stages. By dynamically acquiring data from the work order / staking system, real-time changes are available for reference through the GIS. For example, it can sometimes take over a year for a design to move from original sketch to completed construction close out. The need to reference designs or construction in progress may arise several times before the proposed design is posted permanently to the GIS. The ability to reference proposed changes throughout the process increases accuracy and reduces the amount of time needed to get a current picture of a project's status.

Concerns about the quality of the posted data can be addressed through internal quality control procedures. By carrying the staking design changes through the work order process, adjustments that reflect as-built construction can be made before the final data is posted to the GIS, yet is available for reference while pending. In office design engineers and cartographers can clean-up the data by previewing and posting the final design to the GIS system. This way the final data, connectivity and cartographic decisions remain in the hands of the GIS personnel. This crucial step ensures maintenance of data integrity and results in 'good-looking' maps. Requiring this edit/approval step prior to posting ensures quality assurance rules are applied without duplicate data entry of the field design work.

The Timeline for Return

Using field based staking tools in conjunction with a GIS helps lower the barrier for a utility to begin GIS implementation. Many utilities are put off by the large up front cost of setting up, populating and maintaining a GIS. Using the data from a field staking tool can form the foundation of a complete GIS by starting down the path of having intelligent map data available. Instituting a work order automation and field staking system before or even during GIS implementation allows a best-practice approach to be developed before the GIS staff becomes inundated with trying to run the system. It also allows GIS professionals time to focus on data analysis, trends and system operation, not simply updating graphics and data. All of this leads to reaping an early return on investment.

Those utilities already in the middle of deploying their GIS can reap benefits by using the data collected by the field designed work orders. As already mentioned, most GIS attributes are automatically collected by the staking engineer during the design process. Strategic decisions and investments are oftentimes made and determined by analyzing GIS data. Formulating a good plan for automated data maintenance before starting a GIS project can allow utilities to reap value from a GIS in the near-term, even before the comprehensive implementation is complete.

Utilities are under increasing pressure to do more with less. Bringing information that is part of the field design and work order process into the GIS increases accuracy, removes redundant data entry, and speeds the return on the GIS investment. Updating the GIS on a frequent basis and adding geographic and on-location visibility into designs, from sketching to close out, provides the opportunity for advanced analysis on how a utility's infrastructure is developed and maintained. By leveraging the technology, work done in the field can now go twice as far. ◆

ABOUT THE AUTHOR

Sean Solberg is the Vice President of Research and Development for MiniMax Corporation. MiniMax is the leading provider of field productivity tools to the utility industry. Its flagship product, StakeOut, automates the design, staking and work order process from design to construction. Mr. Solberg oversees the continuing development MiniMax's product line including StakeOut and GIS integration. For further information see www.minimax.net.

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- ❑ Pathfinders & Trailblazers

Date submitted: .....

Please tick all that apply:

- ❑ Key Women in Energy – Global Honours
- ❑ Key Women in Energy – Americas Honours

N.B. **ALL** telephone codes must be included

STEP 2: NOMINEE DETAILS: (Please include as much information as possible)

NAME: ..... JOB TITLE: .....

COMPANY: .....

ADDRESS: .....

EMAIL: ..... TEL: + ...

COUNTRY OF WORK: ..... COUNTRY OF BIRTH: .....

WEBSITE: .....

MEDIA/PR CONTACT: .....

MEDIA/PR EMAIL: ..... MEDIA/PR TEL: +.....

STEP 3: NOMINATOR'S DETAILS:

NAME: ..... TITLE/COMPANY: .....

ADDRESS: .....

EMAIL: ..... TEL: + ...

STEP 4: NOMINATION: (Please attach a separate piece of paper if necessary. Detailed information is critical for selection).

In no more than 500 words, tell us why you believe your nominee deserves the award for which they have been selected.

.....

.....

.....

.....

STEP 5 SUBMIT THE APPLICATION – EITHER:

1)	**ELECTRONICALLY:**	**COMPLETE & SUBMIT THE FORM AT WWW.KEYWOMENINENERGY.COM**
2)	MAIL:	MAIL TO Linda K. Rader, RaderEnergy, PO Box 27391, Houston, TX 77227-7391, USA
3)	FAX:	+1 713 622 8490
QUERIES:	Linda K. Rader:	+1 713 960 0001 raderenergy@att.net **or** keywomeninenergy@att.net

Nomination forms may be handed back to Linda Rader any shows she attends

* The Potential category is limited to new-hires to energy since 1/1/2001.

Linda Rader reserves the right and sole discretion to select or reject any candidate, to accept nominations after the stated deadline, to select from nominations prior to the closing deadline and/or from persons not officially nominated. The judges decision is final. Individuals have the right to self nominate, and also to decline their nomination.

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