Electric Energy T&D MAGAZINE

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The Long-Term Supply Imperative

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

The day-to-day challenges of the electricity business often keep the focus of companies on short-term issues. This is understandable, given the just-in-time nature of delivering electricity to customers. Electricity is the original and ultimate example of just-in-time manufacturing. It cannot be stockpiled in large quantities like other commodities. The instant someone turns on a light or their PC, the additional electricity required must be immediately available from a generating station, which may be hundreds of kilometers away. It is not surprising then that much is made of meeting the immediate challenges, and often the longer-term issues are given less attention.

Electricity is the lifeblood of modern society. Without a reliable supply of electricity, all other sectors of the economy can grind to a halt. In our modern information age, few human endeavors can proceed, especially if the computers and electronic devices society depends on everyday do not have any electricity to run them. Modern society expects and fully depends on electricity service reliability that meets the highest standards. And this is a mandate the industry takes very seriously; it is indeed "Job One".

The development of new market mechanisms has only increased the spotlight on the immediate challenges of delivering power to customers. Day-ahead trading, hour-ahead contracts, congestion management and real-time markets tend to further focus the mind on meeting immediate needs. And while addressing the immediate requirements is core to the mandate of the industry, what may be lost in this equation are the long-term requirements. The question put simply is this: Will we be able to meet customer needs in a decade from now?

The long-term supply question is one that encompasses more than just generating capacity, though this is certainly the core issue. Yet related to that are equally important issues about whether we will have the right skill sets among personnel, market mechanisms to most efficiently meet demand, transmission systems able to provide flexibility and sufficient transfer capability, technologies and service which customers will require, and appropriate environmental regulatory regimes. In short, are industry, government, regulators and stakeholders taking the steps today needed to meet the long-term needs of electricity customers and the economy?

The question of generating capacity is one that has garnered attention in some regions of North America recently. Population and economic growth has not kept pace with capacity in specific states and provinces, resulting in shortages in California, and near misses in other areas such as Ontario. The long-term picture is something the Canadian Electricity Association (CEA) has studied in the Canadian context, and it is the core mission of the North American Electric Reliability Council (NERC).

The supply picture across North America has, over the past few decades, become increasingly tighter. The Energy Information Administration of the U.S. Department of Energy reports that between 1978 and 1992, America's utility capacity margins averaged between 25 and 30 percent. Since then, the capacity margins had declined to less than 15 percent nationwide by the end of the last decade, and increased to close to 16 percent by 2001. The capacity margin in Canada has also decreased of late, and now stands at slightly more than 22 percent.

CEA's study of the long-term electricity supply for Canada in entitled "A Bird's Eye View" and seeks to quantify what the supply requirements are for the country over the next two decades. Our study looked at the future needs of Canadians for electricity, took into account projections by the Canadian government and regulatory authorities, considered population and GDP growth patterns, and the current and projected growth in electricity demand. We took into account savings from energy efficiency programs, but also accounted for plant retirement over the next 20 years. Even accounting for a reduction in electricity exports, we were still left with the need to increase electricity supply by 205 terawatt-hours from some 40,000 MW of new capacity over the next two decades.

The challenge of meeting new supply needs is not unique to Canada. NERC annually produces a Reliability Assessment that looks at requirements over the next decade. The most recent assessment, published last fall, reported that "capacity adequacy in North America over the next ten years will continue to depend upon the timely construction of new generating facilities by merchant power plant developers. Merchant developers announced plans for more than 286,000 MW of new capacity during the ten-year period, a potential increase of 30.6% compared to the 934,370 MW currently installed in North America."

The NERC report noted the changes to the electricity industry structure over the past decade. In the past, vertically integrated electric utilities, operating under a state or provincial obligation to serve, planned and constructed new generating units to meet requirements. "Today, most new generating facilities in North America are merchant projects. Where this is the case, generation planning is now primarily being conducted by developers who examine areas of the continent that offer the greatest business opportunities."

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Whether vertically integrated utility or merchant plant developer, the barriers to developing and deploying new generation are the same: Uncertainty surrounding the ability to obtain suitable transmission arrangements, the ability to obtain necessary siting and environmental permits, the ability to obtain financial backing, and political and regulatory actions

With respect to transmission, the issue is clear. With increasing transmission congestions in a number of regions, meeting future needs must be addressed as not simply a generating capacity question, but one of ensuring adequate transmission capacity. Future generation and transmission both face hurdles when it comes to siting and environmental challenges. We need to move to a more streamlined and smarter regulatory environment in order to ensure societal needs for review and oversight are conducted in a fashion not unduly long and burdensome, all the while respecting the need and importance of review processes.

The financing of projects has become more difficult in the post-Enron age. Investors have been wary of an industry affected by the Enron debacle, the Telecom market deflation, and the continued fallout from September 11th. This lack of investor confidence is a serious challenge to the construction of needed generation and transmission projects and could affect meeting the future needs of customers, particularly troubling given what we know about the need for new generation.

Industry needs to continue its dialogue with decision-makers, regulators and other stakeholders in an attempt to find concrete solutions to these challenges. The solutions will likely include addressing everything from streamlining permitting processes to ensuring a fiscal environment that will attract the capital required to build for the future.

Ensuring future needs does not stop at supply and transmission. Much has been said and written about the state of distribution systems in many regions of North America. The infrastructure, described by some pundits as "crumbling" in some regions will clearly need attention to ensure continued reliable and safe operation.

Equally important will be to ensure the industry will have access to a pool of talent, able to meet the challenges in the years ahead. As the industry becomes more competitive and focused to a greater degree on immediate issues, not enough emphasis has been placed on ensuring future human resource requirements will be met. The strong connections that once existed between electric utilities and educational institutions have diminished. At the same time, much of the industry has undergone downsizing over the past decade, the result being an aging workforce in many instances. Greater emphasis therefore will be required to foster the expertise and skills the future will demand.

The long-term challenges may be great, but industry planners are working to see that we meet those challenges. We need to ensure the appropriate policy, regulatory, investment and human resource cultivation decisions are made so these plans can be carried out to the benefit of customers. ■

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Industry News

Condux Offers AFS-404 for Conductor Installation

The AFS-404 Hydraulic Puller-Tensioner from Condux International is capable of stringing one or two ropes, or bundled conductors. The AFS-404 provides up to 8,992 lbs. of pulling force and can be used for new construction or reconnductoring. It comes equipped with a hydraulic dynamometer with set point and automatic control of maximum pull, and an electronic meter counter. High resistance interchangeable nylon sectors on the unit's 60-inch bull-wheels help eliminate bird nesting. The AFS-404 is capable of handling conductor up to 1 5/16 inches in diameter.

The AFS-404 is designed for easy towing. An optional noise reduction kit is available, as well as an optional wireless radio remote control. Condux International manufactures a complete line of cable installation tools and equipment.
For more information: www.condux.com ■
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FCI-Burndy Introduces the New Hyreducer™ Splice at IEEE/PES 2003

For copper-to-copper, aluminum-to-aluminum, or aluminum-to-copper applications
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Please visit Booth #3609

FCI-BURNDY, a leading manufacturer and provider of connector solutions to the industrial, energy, application tooling and automotive industries, presents the HYREDUCER™ Splice, at the IEEE/PES 2003, Booth #3609, in Dallas, TX, September 7-12. Designed for use in underground systems, the HYREDUCER is ideal for applications in the utility market.

The HYREDUCER Splice is available in aluminum or copper. The copper splices, Type YRB-T, are tapered and recommended for use on copper-to-copper cables. The aluminum splices, Type YRB-UTTN and YRB-UTW, are tin-plated and recommended for use on aluminum-to-aluminum or aluminum-to-copper cables. Moreover, all of FCI-Burndy's HYREDUCER splices have solid center stops for use with oil filled and non-oil filled cables.

The outside diameter of the splices is held constant to minimize installation dies. Also, connectors are prefilled with Penetrox® oxide inhibiting compound and are rated up to 35kV.

About FCI-BURNDY Products

FCI-BURNDY Products, located in Manchester, NH, is the second largest connector manufacturer in the world, and provides reliable

connection systems and solutions to the telecommunications, data, industrial and instrumentation, energy, automotive, and military/aerospace industries. For additional information contact FCI at 47 East Industrial Park Drive, Manchester, NH, 03109, call Customer Service at (800) 346-4175 or visit the website www.fciconnect.com. ■
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TT Technologies to Display HDD for Last Mile Operarions at ICUEE

The compact Grundodrill 4X, designed for residential service and "last mile" operations, will be on display at ICUEE 2003. The Grundodrill 4X offers 9,800 lbs. of thrust and pullback. The drill features a dual hydrostatic pump system that gives the operator optimum control during drilling operations. The unique four-auger stake down system provides greater stability, helping maximize thrust and pullback power.

The Grundodrill 4X also comes equipped with the exclusive Smart Vice system. The computerized Smart Vice system simplifies the drilling process by performing vice cycling operations automatically. It provides the operator with single push button control, improving efficiency and speeding up drill times. The vice is also self-centering, reducing wear and tear. ■
For more information: www.tttechnologies.com
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The Jarraff all Terrain Tree Trimmer with New Cab Design at ICUEE

The Jarraff All-Terrain Tree Trimmer with new high performance cab will be on display at ICUEE 2003. The new cab is completely enclosed, providing protection from the elements and added safety. Full panel, tinted lexan windows prevent distortion and provide a clear view of operations. The new cab also come with heating or air conditioning options or both. The cab provides a dynamic field of operation, with a 360-degree range of motion and a 40-degree lateral tilt.

Available in both wheeled and rubber track configurations, the Jarraff is completely self-contained and requires minimal set up time. A hydraulically powered, non-conductive fiberglass boom provides cutting height up to 75 feet. The boom is shock resistant and has a 90° range of motion. The Jarraff adds safety to every job because workers never leave the ground. ■
Fore more information:
www.jarraff.com
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Sharper Simpler Smarter

Sharper Simpler Smarter™, the key design concepts in a new infrared camera solution that combines unprecedented ease of use with advanced functionality.

Designed to be Sharper Simpler and Smarter the new IR FlexCam® infrared camera responds to the expressed demand for an easy to use feature rich IR camera. Designed to pinpoint and document electrical faults before costly failures or shutdowns occur, the FlexCam camera was created with ease of use as a central feature combined with leading edge IR camera functionality.

The IR FlexCam is a real world solution for the power-delivery industry. Infrared scanning is a necessity to efficiently and accurately monitor substations, transmission lines, power connections, and other transmission equipment. With the IR FlexCam you will be able to diagnose potential problems before they become catastrophic, saving tens of thousands of dollars on extensive repairs and downtime. By utilizing the IR FlexCam, electric utility companies will be able to increase reliability, conserve costs, and save money.

The FlexCam offers a rugged, lightweight and ergonomic design. The unique 180° articulating lens joint and large image display allow the user to easily rotate the camera lens and facilitates scanning of awkwardly positioned targets.

Industry News

The powerful functionality of the camera is accessed through a windows CE platform, six-button control panel, and inbuilt mouse that allows for exceptionally easy and intuitive use.

It is designed around a maintenance-free uncooled microbolometer IR detector that produces a highly sensitive video-rate thermal image, which can be viewed on the camera's sunlight readable 5" color LCD. Exceptionally clear imaging allows users to scan both moving and still targets while recording subtle temperature changes in real-time. Advanced IR technology allows users to freeze the infrared image and retain in-field, fully radiometric temperature measurements on all of the points on a single image. The IR FlexCam camera also includes FlexView, a sophisticated report generation and analysis software package, which augments the camera's capabilities.

According to John Goodrich, President of Infrared Solutions, "The FlexCam represents an extremely significant advance in IR camera design and packaging. The emphasis on the Sharper Simpler Smarter design concept responds to feedback from the market requesting cameras that are easy to use in a real life work situation without compromising functionality. Never before has such a powerful combination of sophisticated infrared technology been packaged with the end user in mind and with such a focus on ease of use. IR inspection is now made easier and more cost effective for plant engineers and other infrared camera users. Infrared Solutions has focused on bringing a cost effective and affordable world class solution to the market. As the first providers of radiometric uncooled infrared cameras, and with a strong track record of successful condition monitoring products in predictive maintenance and related fields, we know the FlexCam will provide rapid maintenance savings and a very quick return on investment."

Infrared Solutions Inc. designs, manufactures, and markets infrared imaging systems worldwide. Product applications include predictive maintenance/condition monitoring, non-destructive testing, research and development, quality control and manufacturing process control. ■

For more information please visit the Infrared Solutions web site at www.infraredsolutions.com

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ULD-40

NDB Technologie inc. announces the release of a new product, the ULD-40. This instrument is used to detect and locate any type of defect generating ultrasounds in the air, like Corona effects that are sometimes found on overhead power installations. The principle of the ULD is to capture ultrasound signal and convert it in audible signal so that the user can "hear" the defect. All he has to do is turn the instrument on and point it towards the possible source of ultrasound or to scan it around, looking for a signal increase. Simple and quick to operate, the ULD is an ideal tool for any maintenance and inspection program.

The ULD-40 is useful in many sectors like electricity, aerospace, chemical industry, pulp & paper and textile, to name a few. In fact, this tool can be used everywhere ultrasound is tracked to detect and pinpoint defects. Corona effects on high-voltage installations, bearing wear on heavy rotary machinery and leaks on gas tanks and pipes are examples of typical ULD-40 applications. A user-friendly instrument, the ULD doesn't require any training and can be put in service straight out of the box. It can be used with its parabolic sensor, equipped with a laser pointing device, for precise remote inspections. Also, headphones are available for noisy environments.

NDB has acquired a solid expertise in various fields such as electric power and control. Electrical applications include: cable location, phase identification and GPS-synchronized long-distance phasing. NDB's expertise in the area of measurement involves micro-resistance measuring, partial discharge detection and fault location. Also, through the years, the team developed an expertise in field application instruments, especially for handheld devices used in harsh environments. In fact, this expertise has in turn enabled the company to access the most demanding markets in terms of standardisation. For more information visit www.ndb.qc.ca. ■

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By
Joseph Weiss
P.E., KEMA

IEEE Task Force Revising Equipment Standards to Protect Against Cyber Attacks

Energy utilities face a greater risk of cyber attacks today than ever before. This growing threat has prompted IEEE and other industry standards organizations to examine industry standards relating to equipment and policies that may inadvertently be increasing the vulnerability to attacks in cyberspace or inadvertently preventing the implementation of cyber security technologies. The goal is to provide utilities with the guidance needed to protect their automated transmission and distribution (and power plant) control systems from unauthorized incursions.

Until recently, most utilities and standards organizations had not considered cyber attacks, but their impacts can be potentially devastating in terms of financial and physical damage. An attack in cyber space can take many forms, but the most common involves hackers who gain access to vital operating or business systems through remote access or wireless entry points.

In some cases, the perpetrator may steal or alter critical information relating to the utility's customer files or the operating indices of equipment. In either situation, the information is proprietary and could be dangerous in the wrong hands. The other type of cyber incursion has even worse consequences. It involves a hacker actually taking control of operating systems and disrupting service to customers or damaging equipment. What makes these attacks more frightening is that they are very difficult to detect, often being blamed on faulty hardware or software.

These and other incursions have taken place in larger number over the past few years although their details have been under-reported in part because there is no methodology for identifying reportable events or a central body within the utility industry to investigate such problems. The underlying issue, however, is vulnerability, and energy utilities have unwittingly left themselves open to cyber attacks by implementing automated control and remote access technologies with numerous entry points and virtually no protection.

This vulnerability is particularly risky now due to the combination of a volatile political situation in the world and a hyper-competitive energy market in a struggling economy. News reports say international terrorists may be targeting our energy infrastructure – a threat not to be ignored. But recent incursions suggest the more immediate threat comes from inside the industry or untended impacts from attacks on the Internet.

The power industry is always competitive, but in today's difficult economy many security analysts believe heightened competition may drive some individuals to use cyber means to gain information on other utilities' operations and customer bases. In addition, the down economy has compelled utilities to lay off works and subcontractors, many who have the knowledge to take out frustrations on their former employers in cyberspace. Such disgruntled workers may pose the most significant current threat. Additionally, there is a significant reticence to share vulnerability information or impacts.

For most utilities this threat is new, and they do not know how to protect themselves. To provide some guidance, the IEEE Power Engineering Society (PES) has created a task force to study applicable PES IEEE standards that may contribute to the cyber vulnerability of the power infrastructure.

Once standards that can be impacted by cyber have been identified, IEEE PES will have the appropriate subcommittees look at each one in detail to determine if, and how, the vulnerability may be eliminated. In some cases, new security procedures may be the solution. Others may require the implementation of existing technology, or perhaps the development of entirely new products designed for control system cyber security. Although these and other standards revisions are meant to assist the industry, utilities must take caution to avoid the confusion and false sense of security that will undoubtedly arise as multiple new standards are introduced.

Identifying Vulnerabilities

IEEE and similar organizations worldwide (e.g., ISA- the Instrumentation, Systems, and Automation Society, International Electrotechnical Commission-IEC, International Council on Large Electric Systems- CIGRE, etc) have provided a valuable service to the energy industry worldwide by devising and publishing consensus standards on equipment, training, policy and regulations. Standards in equipment design and operation offer direction for vendors to use in bringing useable and compatible products to market, and provide utilities the specifications required to select and implement the appropriate equipment and procedures. But most of all, these standards ensure that utility equipment is operated and maintained efficiently. This is where the link between standards and cyber vulnerability resides.

In the quest for improved efficiency – the ability to operate less expensively with fewer personnel – utilities in the past decade have enthusiastically embraced automated control such as Supervisory Control and Data Acquisition (SCADA), Distributed Control Systems, and Programmable Logic Controllers with remote access capabilities. Transmission and distribution infrastructure in particular has seen the automation of its operations centers and substations with remote terminal units, intelligent electronic devices and smart meters.

Without question these advanced technologies have enhanced efficiency of utility operations, but they have also provided open entry points for cyber incursions because they are designed – according to standards – for efficiency, not security. In fact, the reason these devices are so efficient is because they are open. They can be operated from almost anywhere and are designed to freely share information with other systems.

The utility industry was historically built with closed systems that were impenetrable by nature, which meant no one in the enterprise had to be concerned with cyber security. Unfortunately, this attitude continued even after open systems were introduced and implemented. And the nonchalance carried over into the development of today's existing standards for transmission and distribution equipment.

The other factor contributing to the situation is institutional and common to many industries – the chasm between the IT and Operations departments within the utility. IT people are responsible for cyber security and have taken steps to protect their devices. Unfortunately, without an understanding of complex operational systems, IT doesn't recognize the required reliability and availability of these systems and the impact cyber security mitigation can have on these systems. This aspect of cyber vulnerability is certain to heat up within utilities in the near future as IT personnel begin taking steps they believe will reduce the threat, but with potential negative impact on system operation.

Particularly frightening about the cyber situation is its pervasiveness. A utility is vulnerable if it has automated or integrated key control systems with hardware or software that is web-enabled or accessed by wireless communications. The Internet, an intranet or wireless device is an open door to uninvited entry. A typical automated control system, for example, has a front door

through which operations personnel conduct their daily business, a backdoor for used by system administrators, and a side door for vendors. If security exists at all, it can be circumvented by almost any hacker.

Some of the most common and vulnerable entry points into control systems include the following:

- systems linked to a corporate network or intranet,
- remote sensors that feed control, diagnostics, and/or status data back to a central control system,
- telecommunications links to vendors for uploading of software updates,
- integration points between business and operations systems,
- remote access to internal systems, including modems and web links.

Ironically, those utilities that have equipped themselves for better performance through implementation of automated technologies are the ones most at risk. And those without automation now are probably considering it, which means cyber security must be included in their plans. The bottom line is that this issue is relevant to nearly all utilities.

Examining Standards

IEEE has authored hundreds of standards relating to the efficient operation and design of utility equipment. The PES Cyber Security Task Force is focusing on those standards where the vulnerabilities reside – substations, protective relay devices and control centers. These have experienced the lion's share of automation and integration over the past several years. Standards with no communications or networking requirements are quickly eliminated from further study.

The task force met on July 14, 2003, to begin evaluating standards and requesting the expert assistance of the various IEEE committees responsible for the substation, relay and control center standards. Although the total number of standards that must be altered may not be extensive, the complexity of the situation became immediately apparent to the task force during its initial meeting in January 2002.

As mentioned, many standards were adopted with efficiency in mind. Cyber security was not a consideration. Unfortunately, the reason so many devices, such as SCADA components, operate efficiently is that they have no security. Security measures often reduce efficiency.

Using SCADA as the example, some applications have been created to transmit breaker status data to the control center every 4 milliseconds. While this timing leads to efficient operations, it leaves no extra time for the SCADA to interrogate the data request or examine the authenticity of the data. Essentially, there is no room to build a security measure into the standard operation of the device without negatively impacting its performance. Security comes with a price.

PES will undoubtedly consider many similar trade-offs. It is too early to predict precisely how these revisions will be enacted and at what cost to utilities.

The first changes to standards recommended by IEEE will likely relate to procedures that can be altered to provide a temporary, but by no means fool-proof, enhancement to security. These steps will offer a work-around solution until new technologies with built-in security can be developed, a process that can take years. Procedural solutions can be as simple as routinely changing system access passwords or spelling out exactly who can have access to critical systems and be able to operate remote devices.

The long-term solution for cyber security comes back to technology and corporate culture, which often does not exist for control system infrastructure protection. IT personnel will be quick to suggest building firewalls, but these products are not specifically designed to protect an operations center. Until firewall devices are introduced for control systems, any existing product must be considered a stop-gap measure that offers only partial protection. The same is true for intrusion detection devices, which are currently available but not designed for control system applications.

The new standards ultimately emerging from the IEEE will seek to close entry points and track authorized users through the use of customized firewalls, detection devices and other new technologies. By limiting access to authorized personnel and establishing a pattern of typical use, utilities will more readily prevent cyber intrusions and detect them more quickly when they do occur.

Implementing Standards with Caution

The issue of cyber security is finally beginning to getg the attention it deserves from the power industry, but as a result, utilities can expect multiple new standards in the near future. Therefore, caution must be taken to ensure a utility takes into account all of the standards which apply to it. A case in point is the new NERC cyber security standards (Urgent Standard 1200) published in mid- 2003 and taking effect in first quarter 2004.

To counteract this situation, KEMA Inc., an international utility consulting and technical services firm based in Fairfax, Va., is working with multiple utilities in cooperation with IEEE and other standards organizations to develop security policies specifically designed and adopted for T&D control systems. These independently created policies, coupled with revised IEEE equipment standards, will enable utilities to take major steps towards protecting themselves from attacks in cyber space. ■

About the Author

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Utility Advertising:
A Delicate Balancing Act

By Linda K. Rader

BEST OF THE BEST

Communicator of the Year
Winner: Mississippi Power
a subsidiary of Southern Company

Top 10 Communicators:

1. Mississippi Power
2. Arizona Public Service
3. Wisconsin Public Service
4. NorthWestern Energy
5. Buckeye Power
6. Tennessee Valley Authority
7. Savannah Electric
8. Entergy
9. NW Natural
10. Pacific Gas & Electric

COMPLETE CAMPAIGN

Image or Public Relations

Group A

Gold	American Electric Power
Silver	Alliant Energy
Bronze	Salt River Project

Group B

Gold	Mississippi Power
Silver	Buckeye Power
Bronze	Savannah Electric

Marketing

Group A

Gold	Entergy Services, Inc.
Silver	Tennessee Valley Authority
Bronze (tie)	Northwest Natural Gas
	California Department of Consumer Affairs

Group B

Gold	City Utilities
Silver	City Utilities
Bronze	Mississippi Power

NEWSPAPER

Best of Show – Newspaper

Salt River Project

Single Newspaper Ad – Image or Public Relations

Group A

Gold	First Energy
Silver	Tennessee Valley Authority
Bronze	Salt River Project

Group B

Gold	Mississippi Power
Silver (tie)	Mississippi Power
	NorthWestern Energy
Bronze	NorthWestern Energy

Single Newspaper Ad - Marketing

Group A

Gold	NW Natural
Silver	Dominion
Bronze	Salt River Project

Group B

Gold	Buckeye Power
Silver	NorthWestern Energy
Bronze	City Utilities

Series of Newspaper Ads – Image or Public Relations

Group A

Gold	Arizona Public Service
Silver	Salt River Project
Bronze	LG&E

Walking the tight rope between profitability, public image and customer relations can be tricky, especially when the entire energy industry financial community, and following the Great Northeast Blackout of August 14, 2003, the general public in both Canada and the United States, are watching utility movements closely.

Amid the current three-ring circus of scrutiny of some electric, natural gas and water utilities, municipalities and co-ops, a few advertising and public relations employees are becoming superstars among their peers. Their ads and public messages make people laugh, conserve energy, participate in the community affairs, and become more aware of the role of energy in their own lives.

Judged by their peers, Mississippi Power, a subsidiary of the Southern Company, won top bragging honors among electric, natural gas and water utilities of the United States, Canada and Great Britain. They won the title 'Communicator of the Year' in the marketing and communications organization Utility Communicators International's (UCI's) annual Better Communications Competition.

"In hard economic times, companies do not want to be out there being flashy, yet they want to be memorable," said Charlie Basham, project manager for Southern California Edison Company and president of UCI for 2002/2003 and 2003/2004.

The competition recognizes the 'Best of the Best' of utility advertisements, community public awareness campaigns, Internet sites, annual reports, television and radio spots, and corporate sponsorships. 2003 honors were presented at the annual convention in San Diego, California.

Rounding out the top ten companies for this year's honors (in descending order): Arizona Public Service, Wisconsin Electric Service, NorthWestern Energy, Buckeye Power, Tennessee Valley Authority, Savannah Electric, Entergy, Northwest Natural and Pacific Gas & Electric. Points were accumulated for each honor received.

American Electric Power (AEP) made a single entry into the competition this year and won first place honors for a complete ad campaign dealing with public image. AEP's eye-catching series of photographs depicting colorful, body contorting and balancing acts of the Canadian Cirque du Soleil performers was set against a solid, dark background.

"Using the imagery of Cirque du Soleil is serendipitous, and our external research shows that of those who saw last year's four-ad campaign, ad awareness increased three-fold," said Teresa McWain, director of external communications for AEP. "We're hearing from our target audience – the financial community – that AEP's message of strength, experience and flexibility have stopping power." The high profile ads ran March through November/December in 2002 with such success the company renewed the campaign this summer.

AEP won in Group A, which is comprised of the largest utilities (those with more than 550,000 customers). Alliant Energy earned silver honors by placing second in the category. Salt River Project placed third.

UCI, acting as circus master, changed the A/B group parameters in 2003 in an attempt to encourage more small companies to compete in the competition, explained, Connie Blalock, manager of advertising for Alabama Gas and this year's chair of the Better Communications Competition program. It worked.

In 2002, Salt River Project (SRP), placed first place in Group B (smaller customer base companies) in both complete campaign categories – public image and marketing, won approximately 15 different honors, and was named the 2002 'Communicator of the Year'. The transition of this single creative, award-winning company to Group A, starting in 2003, both caused a shake-up of top winners in Group B and confirmed SRP's strength against the entire competitive field.

The reshuffling could be visualized as stuffing dozens of circus performers into a single Volkswagen bug and then watching to see who comes out first or for whom the crowd cheers loudest when all have emerged. Among the remaining Group B participants, not only did Mississippi Power win the complete campaign for public image and place third for marketing, it showed well in multiple diverse competition categories. Mississippi Power was named the overall winner of the entire competition, and earned the title, 'Communicator of the Year.'

Ohio-based Buckeye Power and Georgia-based Savannah Electric, respectively, took home the silver and bronze honors for complete campaigns in public image.

Best of Show

'Best of Show' honors are awarded to the best of all the projects entered into the various general categories of the competition, regardless of company size or number of customers served. The four encompassing categories were: newspaper ads, television ads, radio ads and print messages. Due to one tie, the five 2003 'Best of Show' winners were Salt River Project (newspaper category), Savannah Electric (television category), Dusquesne Light (print category), and a tie for the radio category between ComEd and Jackson Energy Authority.

Dusquesne Light's 'Watt's For Lunch' campaign featured an actual metal lunchbox.

How does a company get its message across to a greatly diverse population? Some try humor, involvement, community activism or financial incentive. Others focus their messaging on electric safety, conservation or the environment. Some try desperately to keep out of the mainstream media altogether.

From an advertising standpoint, several California-based companies excelled in the competition. The California Department of Consumer Affairs tied for third place in the marketing portion of the complete campaign category with Northwest Natural Gas. The Tennessee Valley Authority TVA, which claims to have cut its debt by 10 percent, or $2 billion, since 1997, placed second, all in Group A.

Some claim California's ongoing governor recall is, in part, related to runaway energy bills. The resulting political circus generates media attention and constituent discussions. Hopefully the announcement of billionaire Warren Buffet acting as financial advisor to actor Arnold Schwarzenegger's campaign will reinforce (or reintroduce) to California politics the seriousness of energy economics and personal responsibility in energy consumption.

Humor in Energy Bills?

Several utilities in other parts of North America successfully tackle spreading their corporate messages using humor. Since all the ads submitted to the contest are displayed on massive panels during the annual competition awards ceremonies, and the full-length winning television and radio ads are played for the entire group, sometimes cheering erupts from the audience for a particularly creative approach to a shared issue.

In the deep South, Entergy made an entertaining series of commercials that featured a quirky but lovable, fix-it neighbor known as Bill. Overly concerned about energy conservation, he drops by neighbor's homes at any hour to advise on how to use energy more efficiently. In one summertime television commercial, he drops in – literally - from the dining room ceiling, supported by only a harness, during a romantic candlelit dinner for two promoting electric bulb efficiency. Entergy won first place in the marketing portion of the complete campaign contest in Group A.

Entergy introduced 'Neighbor Bill' in a few parts of Mississippi in 2002, wrote Checky Herrington, communications manager for Entergy Mississippi, in the July 2003 Mississippi customer newsletter, 'Entergy Currents'. "He was so popular we decided to expand the campaign this summer." In 2003, the ads ran on both television and radio, and Bill appeared both in the July bill and on the company's Internet site.

"It is especially important to get the message out to our low and fixed-income customers because they cannot easily manage a significant change in their energy costs," said Herrington.

One challenge Entergy faced in commercial development was to find an actor with an appropriate accent to play the Bill character since they needed someone who appealed to a diverse demographic audience. "He needed a to be a real Southern guy," said Sandra R. Alstadt, Entergy Corp.'s direct of utility communications, who added they didn't want "too Southern of an accent," because the character had to also appeal to the metropolitan New Orleans market.

ComEd's crowd pleasing 60-second radio spot entitled 'Vacation' features a soft violin background and a voice similar to Tom Burdett in the classic Motel 6 commercials.

"To help you keep warm this winter," the folks at ComEd suggested, "try taking the family up to Nova Scotia this winter. It's pretty much a dreary, frigid wasteland this time of year." Besides, it continues, "They eat lutefisk up there… And you really don't need to soak fish in lime. It stinks enough already without sticking it in anything."

Exhibiting a (tongue-in-cheek?) sensitive side, "And of course if you are a native Nova Scotian, please [don't complain]. I am sure it is a fine place in the summer and we hear great things about the Halifax dragon boat festival."

In the end, the commercial advises logging on to ComEd's web site to "learn things about Chicago and Nova Scotia… Stay Warm." The underlying message is to promote caulking materials for winterizing a home.

Leave 'Em Singing

Another clear favorite of an informal pole of advertisers who won other categories was ComEd's 60-second television spot promoting a special local business. It was described by different attendees as humorous, believable and "definitely quirky". Some couldn't remember which utility sponsored it, but they could all

Group B

Gold	Savannah Electric
Silver	Mississippi Power
Bronze	UGI Utilities

Series of Newspaper Ads – Marketing

Group A

Gold	Tennessee Valley Authority
Silver	NW Natural
Bronze	Entergy

Group B

Gold	NorthWestern Energy
Silver	Mississippi Power
Bronze	Buckeye Power

Magazine – Single Magazine Ad

Group A

Gold	First Energy
Silver	Arizona Public Service
Bronze	Allagasco

Group B

Gold	NorthWestern Energy
Silver	NorthWestern Energy
Bronze	Buckeye Power

RADIO

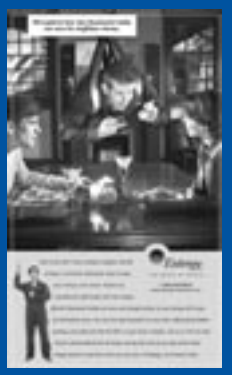
Best of Show – Radio

(Tie)	Jackson Energy Authority
	ComEd

Radio Commercial

Group A

Gold	ComEd
Silver	Southern California Edison
Bronze	Salt River Project



Awards as taken from: www.uci-online.com

Group B

Gold	Jackson Energy Authority
Silver	Mississippi Power
Bronze (tie)	Wisconsin Public Service
	Buckeye Power

TELEVISION

Best of Show – Television

Savannah Electric

Single Television Ad – Image or Public Relations

Group A

Gold	ComEd
Silver	Pacific Gas & Electric
Bronze	Arizona Public Service

Group B

Gold	Savannah Electric
Silver	Savannah Electric
Bronze	Gulf Power

Single Television Ad – Marketing

Group A

Gold	Tennessee Valley Authority
Silver	MidAmerican Energy
Bronze	Pacific Gas & Electric

Group B

Gold	Wisconsin Public Service
Silver	Salt River Project
Bronze	Gulf Power

PRINT

Best of Show - Print

Dusquesne Light

Printed Pieces – Bill Insert

Group A

Gold	Dominion East Ohio
Silver (tie)	Entergy Services
	Dominion Virginia Power
Bronze	Salt River Project

Group B

Gold	UGI Utilities
Silver	Wisconsin Public Services
Bronze	Jackson Energy

Printed Pieces – Direct Mail

Group A

Gold	Dusquesne Light
Silver	Tennessee Valley Authority
Bronze (tie)	Cinergy
	NW Natural

Group B

Gold	Wisconsin Public Service
Silver	Mississippi Power
Bronze	UGI Utilities

remember the details. Some even sang a bit of the song many know as 'Sleigh Bells Ring' or 'Walking in a Winter Wonderland'.

Starting with a clearly off-tune rendering of the familiar words, "Sleigh bells ring. Are you listening?," the ad opens with multiple shots of an industrial production process, and continues to feature what appear to be three employees crooning in equally challenged, yet altogether endearing, voices. Only when a deep man's voice sings, "In the meadow, we can build a snowman…" does one realize the photos are depicting an assembly line for large plastic yard snowmen. As the tune continues, the snow creature bodies transform. They are sprayed with texture and the faces, eyes and smiles of the white forms are painted to their familiar, friendly colors. The final action scene shows a satisfied employee testing the internal lights on one snowman after another. This scene is overlaid with the ComEd logo and the phrase, "Proud sponsor of snowmen everywhere."

It is not known how many additional plastic yard snowmen were sold last winter in the greater Chicago area, but certainly more than a few commuters started singing the catchy song as they passed suburban snowmen.

In the Tennessee Valley Authority's gold medal single marketing television ad for its Energy Right program, a man opens his (energy) bill, takes a double-take, and then promptly drops it on the floor and runs down the basement steps. "Babe, come here," he says with a big grin on his face as he approaches his wife, but walks right past her to fully embrace the water heater. With arms outstretched, he hugs, caresses and gently gives it several soft kisses. Obviously they saved money on their electric bill by purchasing it.

Environmental Messaging

Some ads aim for that warm, fuzzy feeling that comes from nature, and from protecting it, embracing it in the district, or adapting or revitalizing an area so it can be enjoyed by many.

The Hauser Group received a 'best of show' and two first place awards for ads it created on behalf of Savannah Electric in the single television ad category. Its 'Animals' TV spot received a first place and 'Best of Show'. It's 'Everything counts' received the silver. The winning spots were included in Savannah Electric's environmental advertising campaign, which also includes billboard ads targeted throughout the Savannah and surrounding coastal Georgia region.

Savannah Electric's winning television ad features turtles scurrying to ocean, dolphins jumping and diving, and fiddler crabs and sand pipers feeding. The only human is heard and not seen as he provides the following voiceover.

"In a way, animals share a lot in common with us. They go to work everyday, spend time with friends, even manage to get out and shop. And like us, they don't take well to changes in the way they live… We're doing something about it. After all, we work hard to make your home comfortable; it's only fitting we do the same for them. Savannah Electric – we live in the same world you do."

Savannah Electric's 'everything adds together' marsh ad was shot on location around Savannah, Georgia, and pans out from a single blade of grass to encompass the entire marsh teaming with life.

Louisiana-based Cleco, which tied with Wisconsin Public Service for the gold under special booklet or pamphlet, consistently uses environmental messaging.

Customer Service

The Jackson Energy Authority's 60-second radio ad for water heaters tells the tale of a water heater repairman who showed concern for an elderly customer. It won first place in Group B for a radio commercial.

Late one dark, rainy and stormy night he responded to a repair call after her water heater exploded. He made certain her immediate problem was addressed, and then followed her to her relative's home to insure her safety on the drive. The ad invokes compassion in the tone of voice by highlighting actual participants. Distinct local flavor is evident by the accents and sentence structure used in recalling the story by both the repairman and the niece of the woman whose water heater had broken.

"It was raining, and my telephone rang, Her water heater had busted in the attic," started the niece.

"It had her house flooded completely. I felt sorry for her cause she was upset. That was the main problem. The water heater can be fixed, but I just didn't want to leave her there upset…," noted the repairman.

The final comment was a message from the company. "Keeping our neighbor's lives running as smoothly as possible is a full time job. We know you have better things to think about than… Rain or shine, you can rest assured we're on the job."

Delivering the Printed Message

Just as not every circus act makes crowds cheer, gasp with amazement or howl with laughter, energy companies have the responsibility of disseminating more traditional company messages to their customers.

Part of the joy of this competition is to witness, first-hand, the variety of messages and images used to accomplish similar tasks. "This year's creativity was all over board in terms of execution – in terms of how to deliver the message within a budget," said Southern California Edison's Basham.

The joy, and sometimes frustration, of the advertisers' job is that messages differ greatly between regions, and even within single companies depending on the nature of the supply (gas, electricity or water), competitors, customer demographics and/or the status or stagnation of energy restructuring in the area.

Printed materials, bill inserts, annual reports, special booklets and/or pamphlets may provide glimpses of humor, seriousness, genuine interest in events or issues relating to customers that happen to be children, low-income, or of minority or native cultures.

FirstEnergy's award-winning ad for customer service appears from magazine to billboard sizes. It depicts a frosty photograph of a line worker in a bright cap sporting a seriously weathered and frozen mustache. It reads simply, "We're out in the cold. So you're not."

Both photograph and text are closely related to last year's message, acknowledged First Energy, yet still pleased the often-critical communications audience and this year's judges.

FirstEnergy also employed a simple phrase, "So what's up with this weather?" for a winning newspaper ad. What's up? "It's a play on words," said Timothy Quine, director of advertising for FirstEnergy Corp. The power lines or the repairman on the power poles. "They are the modern-day cowboys," he said, and are looked up to by what many consider a surprisingly rural customer base of the former Ohio Edison.

As one utility industry advocacy group UCI member astutely noted, "Hey, if it is a good campaign and seems to work, not changing it is actually a good idea. If it ain't broke…" After all, he noted, "Utility companies are not like other industries that have 50 different ad campaigns."

Year after year, Northwestern Energy consistently produces one after another strong visual ads teaming with regional or local flavor. In Group B, the company won gold for its series of marketing newspaper ads, and won both gold and silver for its single magazine ads. It was awarded silver honors for the single marketing newspaper ad, and tied for second and won the bronze in the single newspaper ad for image or public relations.

Differences in customer interests within a single organization are visible by comparing and contrasting Dominion's award-winning double-sided, single-sheet mailing to customers in Ohio and Virginia. The striking graphics were done by the same person for both. Both carry the same message for the 'extra set of eyes', a separate but identical shut-off notice sent to a designated third-party prior to curtailing energy. Variations and logical specific regional emphasis varies regarding messages regarding their different climates and regulatory environments.

For the winter 2002 'Customer Connection' Dominion's emphasis in Ohio was on 'chasing the chill away', while in more temperate Virginia, the opening message focused on Virginia choice. Yes, some states are still implementing choice programs, and on January 1, 2003, Virginia Power customers were eligible to choose the company that provided their electricity. The same shivering cartoon mouse appeared on both front pages, but his colorful, striped muffler, green mittens, and fuzzy slippers were displayed much larger and more prominently to Ohio customers.

Ohio's customer choice program has won back-to-back awards with its every day depiction of activities. This past year, across multiple media formats, they featured linemen in homes – cooking eggs, hitting the snooze alarm, or participating as the surprise lead guitarist in a garage band.

Printed Pieces – Special Booklet or Pamphlet

Group A

Gold	Salt River Project
Silver	San Diego Gas & Electric
Bronze	Entergy

Group B

Gold (tie)	Wisconsin Public Service
	Cleco
Silver	Wisconsin Public Service
Bronze	Gulf Power

Printed Pieces – Annual Report

Group A

Gold	APS/Pinnacle West
Silver	Salt River Project
Bronze	Avista Corp.

Group B

Gold	Tacoma Public Utilities

Employee Communications – Printed Piece

Group A

Gold	Arizona Public Service
Silver	ComEd
Bronze	ComEd

Group B

Gold	Cleco
Silver	Idaho Power
Bronze	UGI

Internet Site

Group A

Gold	Pacific Gas & Electric
Silver	Pinnacle West, parent Co. of APS
Bronze	Dominion Resource Services

Group B

Gold	Gulf Power
Silver	Idaho Power
Bronze	Wisconsin Public Service

SPONSORSHIPS

Group A

Gold	Southern California Edison
Silver	Salt River Project
Bronze	Manitoba Hydro

Group B

Gold	Black Hills Power
Silver	Black Hills Power
Bronze	Northwest Energy

POTPOURRI

Group A

Gold	Pacific Gas & Electric
Silver (tie)	San Diego Gas & Electric
	Dominion Resource Services
Bronze	Salt River Project

Group B

Gold	Black Hills Power
Silver	Buckeye Power
Bronze	Mississippi Power

Empowering The Powerless

"No one should be powerless" is the caption on the award-winning bill insert sent by UGI Utilities that features a close-up photograph of a contemplative elder woman on the cover. Inside, it reads, "No one should be without electricity."

UGI Utilities has an older demographic that might not instinctively know they might be eligible for a utility bill assistance program, said Deborah Leuffen, UGI's manager of marketing communications. "They may be too proud, or they may not think of themselves as low income individuals." The flier lists income eligibility requirements and encourages them to call for more information.

The company does not normally produce bill inserts in color, but made an exception for this one, she said.

Annual Reports

In the annual report category, Group B winner Tacoma Public Utilities' cover had no photo, just two colors, yellow and blue, stacked one over the other, respectively. In a year when the content of corporate financial reporting and annual reports received headline and front-page news, this category deserves added emphasis. There is a unique art form to combining composition, content, placement of items and graphic representations along with hard-core yet 'transparent' financial reporting.

Sponsorships

Everybody loves a winner. Southern California Edison won with its "Energy Conservation is Always in Season" campaign. The Anaheim Angels players delivered the message on radio and television. After the 9/11 disaster caused food banks to nearly go dry, they teamed with a community food bank and rewarded food and cash contributions with a voucher good for a free ticket to a weekend game to watch the Angels play. Coincidently, the team won the World Series that year. Basham conservatively estimated the program generated more than 1/2 billion impressions of the Edison International (the ball park carries the company's name) on a global basis.

Canada's Manitoba Hydro received a Bronze award for its sponsorship of the National Aboriginal Achievement Awards (NAAA) to recognize career achievement by Aboriginal professionals in diverse occupations. The awards were established as a way to build self-esteem and pride for the Aboriginal community, and to provide role models for Aboriginal youth.

Manitoba Hydro's sponsorship & promotions department decided to leverage its sponsorship of the NAAA by holding a Creativity Contest and inviting Aboriginal students in Grades 10-12 to participate. The goal of the contest was to inspire Aboriginal youth to "Follow the Path of a Dream". Visuals for the promotion included images of traditional dream catchers. The winners (and their adult escorts) attended the NCAA ceremony in Winnipeg.

Black Hills Power (BHP), an electric utility with fewer than 60,000 customers serving western South Dakota, northeastern Wyoming and southeastern Montana, brought home two first-place and one second-place awards. It won both first and second places for the Sponsorships category in Group B. Northwest Energy placed third.

The first place entry was for "Black Hills Power Station," a train depot BHP had built at Storybook Island in Rapid City. Nicole Schrubb, a BHP public relations associate designed the winning collateral communications materials. Sponsorship second place was awarded for "Wildlife Experiences," a conservation and education program delivered by Melissa Horton to area schools. Collateral materials were also designed by Nicole Schrubb.

Potpourri

BHP also took first place in the final competition category, the anything-goes potpourri with a display of Black Hills Power's (BHP's) history. Designed by Mutch Usera, BHP's marketing and economic development manager, the project was associated with "Yesterday's Tomorrows," a Smithsonian Institute exhibit hosted by Deadwood, Belle Fourche, and Hill City.

Buckeye Power and Mississippi Power were awarded the other two Group B honors. In Group A, the potpourri winners were, in order, Pacific Gas & Electric, a tie for second between San Diego Gas & Electric and Dominion Resource Services, and Salt River Project.

Creativity is Contagious

There is a certain amount of expected adaptation of a particular concept by other companies. As long as the two company territories are not contiguous or arch competitors, candid discussions and open suggestions flow relatively freely. Attending a highly charged gathering of talented, creative minds definitely pays forward dividends. ■

About the Author

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Collecting Billing Data at the Meter

Innovative metering technology that meets tomorrow's business requirements today

By: John R. Goodman
Senior Account Executive of Metering Systems, Elster Electricity, LLC.

Metering technology is continually advancing in step with on-going advancements in microcomputer, memory, electronic assembly and communications technology. The innovative metering and communications technology available in today's utility market is beginning to revolutionize the way utilities collect and use both daily usage and billing data.

Today there is a growing concern among industry groups, consumer groups, and legislators regarding the availability and pricing of energy. This article discusses how advancements in metering and communications technology are addressing those concerns for the energy provider and the consumer. Utilities in both regulated and deregulated markets are beginning to offer demand response programs that allow consumers to participate in the cost fluctuations of the wholesale energy market. In demand response programs, utilities pass on savings to consumers as they manually or automatically reduce their energy demand on days when wholesale energy prices peak. However, utilities face several barriers in implementing demand response programs. One of those barriers is the metering, communications, and computer system technology required by utilities to generate the daily usage data needed to enable residential consumers to participate in demand response programs.

At first look, the cost of populating residential areas with interval meters and the required system software appears prohibitive. Additionally, regulators in some areas have not addressed the issues of demand response pricing, the technology needed to implement it effectively, and who pays for infrastructure costs. These issues may inhibit utilities from investing in interval meters that were designed for large commercial and industrial (C&I) accounts just so they can offer their residential customers a demand response program. This is especially true in deregulated markets where a customer might not remain with a particular service provider for more than a couple of years.

Problems Inherent with Interval Data

Historically, interval data has been the chosen method for collecting daily load usage data at energy delivery points. For years, interval data recording has been used on large C&I utility accounts and at delivery point substations to provide daily usage of kW, kVAR, kVA, and power factor (PF). Until today, utilities had no choice but to use similar data recording devices to collect interval data from smaller C&I and residential accounts with the objective of providing hourly load use profiles for both the energy consumer and energy provider. In addition to providing load profile data, interval data has been used to compute total energy consumption, maximum demand, TOU energy, and to implement dynamic or critical tier pricing (CTP). The profile information is also used by utilities for load research studies that analyze usage patterns, support existing or planned rates, and to develop cost saving incentives and programs for residential consumers.

While it is widely accepted by utilities that billing data can be computed from interval data, there is some inherent risk in labeling the computed results as billing data. A data validation, editing, and estimation (VEE) process is required to confirm that collected interval data matches the true energy consumption seen at the meter. If a discrepancy is found, then a level of estimation and editing is required to account for the lost data, and this is not typically viewed as billing data, but is considered modified data. There is also a time element of interval data. Any skew in the real time relationship of interval data can have a dramatic impact on the computed demand and TOU data.

Additional attention for validation, editing, and estimation is given to interval data in instances where the stream of data is interrupted somewhere in the process. Such interruptions may occur because of a problem with the meter, the pulse initiator, the recording medium, or in the data transmission from the field site to the central office system. Also, power outages must be distinguished from net zero consumption periods. Validation verifies that the collected data matches the energy difference between the start and stop meter readings, and that the number of intervals collected matches the reported time between data collections. If any of the validation procedures fail, estimating and editing of the data is required. Very complex procedures are used by utilities to estimate lost data. Same-time data from similar accounts, same-time data from previous days for the same account, the average of the last several days and the same-date data from a year ago, plus other variations, have all been used to estimate the missing data. Most estimated data is biased in favor of the consumer so that a billing quantity would not be challenged as being artificially high. Even so, estimated interval data can be challenged and occasionally utilities need to make concessions for this.

Stand-alone electronic meters that support multi-season, multi-tier TOU rates have been available for several years. As more dynamic, critical tier pricing response programs are envisioned, there is a corresponding need to change peak billing time periods. Any change to the TOU program, perhaps on a daily basis, makes these types of meters unsuitable for implementing cost saving programs. Hence, within the utility industry there has been a perception that only interval data can be used to implement critical tier pricing. The interval data is used to reconstruct the dynamically changing critical tier billing data. However, by combining a multi-rate tier capable meter with two-way communications, consumption during critical peak periods can be easily routed to alternate rate storage registers in the meter, even if this occurs at different times on a daily basis. For example, a critical tier billing register could be engaged for two hours today, three hours tomorrow, one hour the

next day, and so forth. When billing is due, the total energy used during critical peak periods is easily read from the meter. Thus the need for interval data is eliminated as a requirement to implement both TOU and real-time, critical tier pricing rates.

The Advantages of Collecting Billing Data Directly from the Meter

From previous experience, collecting interval data appears to be an expensive and burdensome solution for implementing demand response and other billing programs envisioned now or in the future. However, metering equipment manufacturers have developed new technology and now offer single phase electronic meters that provide demand, TOU and billing data directly from the meter. The need to collect interval data and compute billing data is no longer the only solution available. Residential electronic meters are available that can compute daily load usage, demand, and critical tier usage within the meter. The billing data is readily available to both the consumer and service provider locally at the meter via the meter display. Billing data can also be transmitted to remote metering automation systems using two-way communications. Even though these meters store and transmit billing data rather than interval data, these meters can also record interval data for load studies, but interval data is not necessary for the acquisition of daily energy usage and complex forms of billing data.

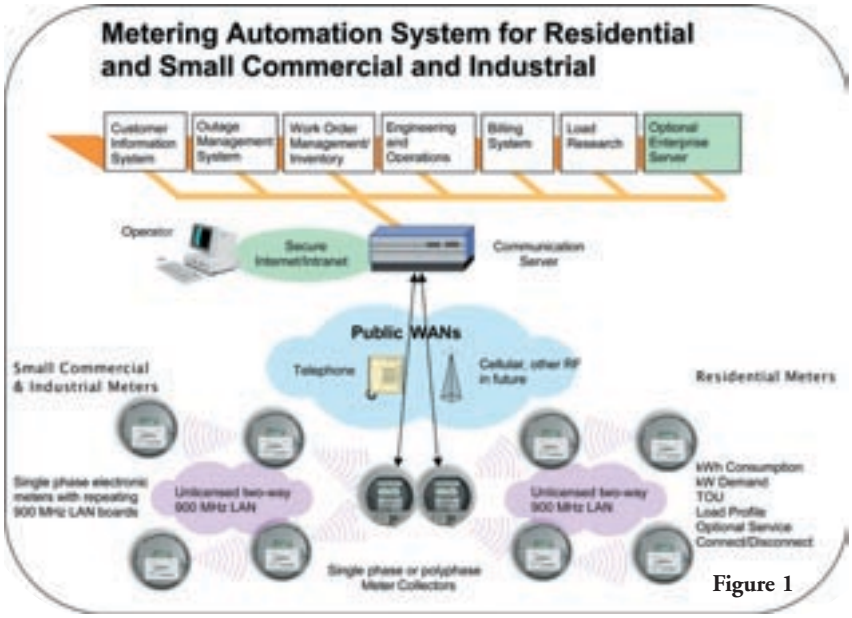

Figure 1

Metering Automation System Overview

Figure 1 shows an overview of how a metering automation system is deployed with meters that compute daily load usage and billing data within the meter. It uses standard, wide area network (WAN) communications like landline or cellular telephone to communicate with area meter collectors. The meter collectors in turn, manage a local area network (LAN) of meters using a repeating unlicensed 900 MHz radio frequency (RF) technology.

Several key features make this system unique from the other solutions on the market today.

- The flexibility of electronic metering offers multiple metering options on the same platform. Energy, bi-directional energy, demand, time-of-use, critical tier pricing, and load profile can be engaged at any time, on any meter in the system. This reduces metering costs, offers more flexible customer service and rate programs, and significantly reduces site visits and associated costs when new functionality is required to meet customer needs or competitive challenges.
- Obtaining billing data from the meter eliminates the discrepancies inherent in pulse-storage systems. There is no audit trail to follow with systems that attempt to recreate complex rates by storing data in the network or by reconstructing it from multiple pulse-based energy interval readings in the metering automation system. When the meter generates billing data, any data read remotely from the meter can also be read locally at the meter.
- The local area network data collectors are meters. Previously, radio-based metering automation network designs required mounting data collectors on pole-tops or streetlights to increase the coverage of the local 900 MHz RF network. Use of a repeating network greatly expands the meter collector coverage areas. Meter collectors can be either single phase or polyphase meters. The advantages of meter collectors are:
  - Meter collectors cost less than pole-top data collectors
  - Meter collectors are less expensive to install than pole-top data collectors. Units are installed at ground level, so no bucket trucks or crews are needed. Also, no special power wiring is needed
  - Meter personnel can install meter collectors, no special crews or coordination with distribution operations are needed
  - Meter collectors are easier to site, especially in areas with underground service and no utility poles
  - Meter collectors are less expensive to maintain and operate

- The expanded capabilities of 900 MHz communications technology provide full two-way communications to each and every end-point meter. Other communications system characteristics include:
  - The ability to deploy a robust, repeating architecture. All meters on the LAN with 900 MHz two-way communications can function as an RF network repeater and each meter/collector can manage up to 1,024 meters on the LAN. This greatly expands the coverage area of the communications network around any given meter/collector and lowers system capital cost, lowers maintenance, and reduces communications expenses.
  - Meters using two-way spread spectrum frequency hopping technology are self-registering. The meters are installed like ordinary meters, with no special installation procedures required to set up the local area network, just plug-and-go. The meters automatically register with the meter collector, which in turn notifies the metering automation system of the meter registration. This self-registering process simplifies system installation and ensures the best communication path to every meter is obtained.
  - The two-way communications network is self-healing. When local RF communication conditions change and a meter can no longer communicate with its meter collector, the meter automatically registers itself via an alternate path with the same or a different meter collector (**see Figure 2**). This greatly enhances communications throughput, improves reliability, and reduces system maintenance.

Metering automation systems available today are designed to meet the needs of utilities in both regulated and deregulated electricity markets and are suitable for either large-scale deployments or targeted applications such as hard to access, or high-turnover areas. These systems offer the benefits of a full two-way communications network and utilize advanced repeating unlicensed 900MHz RF architecture. When combined with electronic single phase meters that are capable of computing billing data within the meter, the system's two-way communications capability and flexible functionality allow it to support many revenue-generating and cost-cutting services. The system's architecture provides the following capabilities:

- Scheduled and on-request remote meter reading services for billing or other data needs
- Advanced energy measurement options, including energy in (delivered), energy out (received), sum, and/or net metering
- Implementation of consumption, demand, TOU and critical tier pricing rates, with no on-site visits for reprogramming or meter change-outs required
- Load profiling of selected meter locations
- Tamper indications and alarms
- Remote connect and disconnect in the meter
- Demand limiting in the meter

The Case for Intelligent Data Computing Meters

The advanced communication technologies used in metering automation systems allow service providers to do scheduled and on-request reads of energy consumption directly from the meter. The computation of energy consumption from interval data is not necessary. Energy usage can also be captured on a TOU schedule, stored in the meter, and read directly from the meter. Demand, a major attribute in identifying the energy requirements of individual consumers, is also measured at the delivery point and read directly from the meter. The data used for billing is not computed at a remote location with the assumption that all intervals of data are intact and have the correct time reference at the central computer. When using billing data retrieved directly from the meter, the need for estimated load usage and billing (which is usually biased towards the consumer) is virtually eliminated. The audit trail for billing data starts at the delivery point and the measurable performance and accuracy of the meter. Any problem with data is directly associated with the accuracy and performance of the meter that is providing the data. When billing data comes directly from the meter, the need to analyze interval data, and the time and resources needed to verify the meter accuracy, proper operation of the pulse initiator, interval timing, and the validity of the transfer process are eliminated.

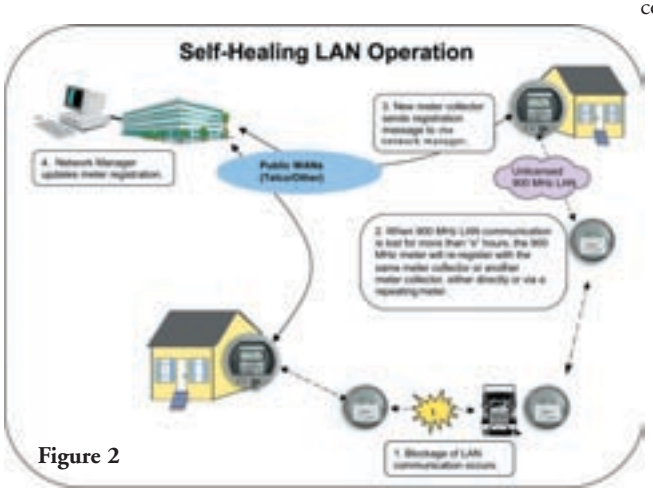

Figure 2

Metering equipment manufacturers and their development teams are continually bringing innovative ideas and solutions to the utility industry. The innovative process of collecting billing data at the meter is available today. The notion that interval data is the only viable solution for collecting load usage and billing data is no longer valid. Single phase residential electronic meters that collect data, use two-way communications and are easily deployed in scalable metering automation systems provide utilities with an optimum solution. This cost-effective solution enables utilities to offer creative rates, demand, TOU energy, and dynamic pricing programs to customers who want to participate.

Today's innovative metering technology is at the cusp of providing the business solutions that utilities need for tomorrow and in the future. These technologies and solutions provide an economical way for utilities to offer customers the opportunity to actively participate in daily price fluctuations of the wholesale energy market. Until now, interval data has been the only available solution for utilities to collect daily load usage data on residential and small commercial accounts. It is time for the utility industry to examine the more economical opportunities of reading billing data directly from an accurate metering device at the point of delivery. Collecting billing data directly from the meter permits utilities to implement complex rates using traceable data, and there are fewer issues that require estimates and edits to recreate billing data. With today's available technology, billing data is traceable to a verifiable meter and not based on data that is computed, after the fact, at a remote location. ■

About the Author

John R. Goodman is a senior account executive of metering systems for Elster Electricity, LLC in Raleigh, North Carolina. John is a graduate of Texas Tech University and has worked for Westinghouse Electric Corporation, ABB Inc., and Elster Electricity where he is currently a senior account executive and proposal manager for the AMR Systems group. He has worked with electric utilities extensively throughout his career in the development and marketing of automated distribution, load management, meter data management and AMR systems. John has authored numerous papers on AMR systems, load management, and automated distribution. For more information contact john.r.goodman@us.elster.com

AMRA 2003 International Symposium

September 7-10, 2003

America's Center, St. Louis, Missouri

Dear Colleagues,

AMRA welcomes delegates of the 2003 International Symposium to St. Louis — the Gateway to the West. The association, its Board of Trustees and Program Committee are pleased to announce the commencement of another successful Symposium. Themed, "Mapping Your Future: From Data to Value," the event is filled with educational sessions, networking opportunities and technology displays. Program highlights include:

Educational sessions in several program tracks focusing on:

- Business Cases
- Metering and Systems
- Implementing Solutions
- Systems Integration
- Enterprisewide Efficiencies
- Customer Care
- Industry & Regulation

Outstanding keynote presentations from:

- Eric Cody, Vice President and Senior Energy Advisor, Plexus Research Inc.
- Patrick Mullen, Vice President for Distribution Operations and Customer Service, Minnesota Power Co.
- Rob Robinson, Vice President for Customer Service, Philadelphia Suburban Water Co.
- Thomas Voss, Senior Vice President for Customer Services, AmerenUE

Nine intensive presymposium courses:

- Full-Scale AMR Deployments: Picking the Right Technology to Fit Your Business Strategy
- ANSI C12-19/IEEE-1377 Utility Industry Tables for Use in Enterprise AMR
- Practical Guide to AMR Project Management — From Feasibility Through Installation
- Pre-assessing Communication Technologies for AMR and Added-Value Applications
- Commercial and Industrial AMR: Beyond the Basics for Optimal Data Acquisition
- AMR Decision Step 1: Should We Be Shopping for AMR?
- Protecting Your Investment: FCC Certification Technical Requirements and Patent Issues
- Telecommunications Technologies and Solutions for AMR — Home Area, WAN, Public and Private Links
- ANSI C12 Communication Protocol Suite for the Transfer of Standard-Compliant AMR Data

And an exhibit hall packed with the world's top companies offering:

- Advanced metering hardware and software
- Wired and wireless communications technologies using public and private networks
- Resource- and information-management solutions
- Consulting, installation, route management and turnkey services

Come to the AMRA 2003 International Symposium for highly valuable educational sessions and an exhibit hall that showcases all leading technology and service companies. We're sure attendees will enjoy this learning experience, establish new business relationships and have fun. We look forward to seeing you in St. Louis and providing you with meaningful education and resources throughout the year.

Dave Herchko, AMRA Program Committee Chair
Joyce Paschall, AMRA Executive Director
Lyn Maddox, AMRA Meeting Director

Keynote Speakers

- Thomas Voss
Senior Vice President for Energy Delivery/Customer Services AmerenUE, AmerenCIPS, AmerenCILCO and Ameren Services

Energy Delivery: Bringing Value to Your Company and Your Customer
AmerenUE has been a pioneer in AMR implementation as well as remote, automated and customized customer services. Voss, the executive responsible for deploying more than 1.3 million automated meters across Ameren's Missouri service area, will discuss the role of metering and other technologies in providing improved reliability and customer service. A native of St. Louis, he also will welcome attendees to the city and share a few highlights about the city's history and attractions.

- Eric Cody
Vice President and Senior, Energy Advisor, Plexus Research Inc.

Technology Decisions in an Earthquake:
What Utility Executives Are Thinking These Days
Decisions to invest in AMR and other enabling technologies can come under scrutiny as industry changes continue. Senior executives, often ill equipped to directly judge the value and risk of proposed technology investments, are acutely aware of financial pressures and growing industry uncertainty amidst weak economic conditions. The industry has witnessed a divergence of utility operating models as the road to retail competition has taken several unexpected turns. Together, these influences make presenting the case for AMR investment uniquely challenging. Cody will provide an insider's perspective into how utility executives judge technology today, and offer constructive advice to those who face the task of "getting to yes."

- Patrick Mullen
Vice President of Distribution Operations and Customer Service
Minnesota Power Co.

Meeting Business Objectives and Regulatory Requirements
Now and in the Future
Implementing AMR for meter reading is only the first step for Minnesota Power. The IOU, which serves the Northern third of Minnesota, uses the technology as a catalyst for managing the entire organization. The utility's deployment is now 75 percent complete, and the system already is enabling significant efficiencies in metering reading as well as engineering, operations, customer service and data-sharing across several departments. AMR is quickly becoming a cornerstone of the utility's success through the realization of an aggressive business case, system integration, enterprisewide streamlining, innovative compliance with regulatory requirements and evolutionary improvement in customer satisfaction.

- Rob Robinson
Vice President for Customer Service
Philadelphia Suburban Water Co.

Creating Value from Data
Most utilities look at the obvious savings of automating the meter reading force as a key reason to invest in AMR. Others have looked at additional drivers for spending the capital. But in the end most utilities cost-justify the expense of displacing the meter reading force by using several platforms. More recently a customer-centric approach is being added to create value for the customer and in return provide opportunities to add revenue gains for the utility.

Schedule at-a-Glance

Preliminary Symposium Schedule

Saturday, September 6

8 a.m.–9 p.m.	**Exhibit Setup** (20′ X 20′ and larger booths only)
3 p.m.–6 p.m.	**Registration**

Sunday, September 7

7 a.m.–5 p.m.	**Registration**
7 a.m.–5 p.m.	**Exhibit Setup**
8 a.m.–Noon	**Course 1.** Full-Scale AMR Deployments: Picking the Right Technology to Fit Your Business Strategy
8 a.m.–Noon	**Course 2.** ANSI C12-19/IEEE-1377 Utility Industry Tables for Use in Enterprise AMR
8 a.m.–Noon	**Course 3.** Practical Guide to AMR Project Management — From Feasibility Through Installation
1 p.m.–5 p.m.	**Course 4.** Pre-assessing Communication Technologies for AMR and Added-Value Applications
1 p.m.–5 p.m.	**Course 5.** Commercial and Industrial AMR: Beyond the Basics for Optimal Data Acquisition
1 p.m.–5 p.m.	**Course 6.** AMR Decision Step 1: Should We Be Shopping for AMR?
6 p.m.–7:30 p.m.	**Speaker Reception**

Monday, September 8

7 a.m.–5 p.m.	**Registration**
8 a.m.–Noon	**Course 7.** Protecting Your Investment: FCC Certification, Technical Requirements and Patent Issues
8 a.m.–Noon	**Course 8.** Telecommunications Technologies and Solutions for AMR — Home Area, WAN, Public and Private Links
8 a.m.–Noon	**Course 9.** ANSI C12 Communication Protocol Suite for the Transfer of Standard-Compliant AMR Data
10 a.m.–1 p.m.	**Exhibits Open**
11:30 a.m.–1 p.m.	**Lunch Served in Exhibit Hall**

Monday, September 8 (Continued)

1 p.m.–3 p.m.	**Opening General Session** - Maritza Jackson, AMRA President - Thomas Voss, Senior Vice President for Customer Services, AmerenUE 2003 Awards Presentation - Eric P. Cody, Vice President and Senior Energy Advisor, Plexus Research Inc.
3 p.m.–6 p.m.	**Exhibit Hall Open**

Tuesday, September 9

8 a.m.–5 p.m.	**Registration**
10 a.m.–6:30 p.m.	**Exhibits Open**
11:30 a.m.–1 p.m.	**Lunch in Exhibit Hall**
5:30–6:30 p.m.	**Reception in Exhibit Hall**

Wednesday, September 10

8 a.m.–Noon	**Registration**
8 –9:15 a.m.	**General Session** - Pat Mullen, Vice President for Distribution Operations and Customer Service, Minnesota Power - Rob Robinson, Vice President for Customer Service, Philadephia Suburban Water Co. - Annual Business Meeting
10 a.m.–1 p.m.	**Exhibits Open**
11:30 a.m.–1 p.m.	**Lunch in Exhibit Hall**

Session Legend For Sept. 8 & 9

A **Charting the Course:** Business Case

B **Exploring Technology:** Metering & Systems

C **The Expedition:** Implementing Solutions

D **The Expedition:** Implementing Solutions

E **Across the Great Divide:** Systems Integration & Enterprisewide Efficiencies

F **Spirit of Care:** Customer Focus

Session Legend For Sept. 10

5A **Electronic Single-Phase Metering:** What's In It For You

5B **Wireless Networks for Today and Tomorrow**

5C **Utility Restructuring:** A Regulatory and Legislative Update

5D **Communications — The Critical Link**

5E **Creative Financing Options**

5F **Optimizing the Value of AMR Data Through Integration**

1 *Concurrent Session*

Monday, September 8

3:30 p.m–5 p.m

-A-

Risk, Relationship, and Return: the New Road to Utility Capital Budgeting and Investment
- Craig Boice, Boice Dunham Group

Business Case Assessment: The Role of AMR at American Electric Power
- Leland Smith, American Electric Power

Chair: Dave Herchko

-B-

Scaleable Deployment of Interval Metering in Support of Dynamic Pricing and Demand Response
- Robert Brice, Sempra Utilities
- Eric Dresselhuys,
- Silver Spring Networks

Metering Communications: Will I Ever Be Happy?
- Sharon Allan, Elster Electricity

Network Planning & Simulation for Large Scale Wireless Network Deployment
- CC Huang, Helicomm Inc.

Chair: Dick Preston

-C-

Charlotte Meklenburg Utilities Implementation of Smart Read
- Angela C. Lee,
Charlotte Mecklenburg Utilities

Implementation Planning for a Large Water AMR Project — the Cincinnati Experience
- David Bennett,
Greater Cincinnati Water Works
- Donald Schlenger, Cognyst Consulting, LLC

AMR Case Study: Town of Ipswich
- Tim Henry, Ipswich Water

Chair: Bruce Lackey

-D-

AMR Project Management Perspectives
- John Yanek, PPL Electric Utilities
- Michael Wiebe, MW Consulting

Connecting Metering Strategy to Corporate Strategy
- Jay Carl Nichols, Duke Energy

Chair: John Brett

-E-

Real Time Pricing: AMR and Demand Reponse Working Together
- Steve Kearney, Meter Smart

Internet-Metering — New Revenue Opportunities Connecting Real-Time Supply and Demand Systems
- Edward Andrews, Nashville Electric Service
- Kevin Komara, PJM

Chair: Ed Malemezian

-F-

Security, Privacy and Safety for Utility Customer Services
- Kenneth Wacks, Home Systems Consulting

Intelligent Buildings — Meter Reading and Energy Management
- Ron Zimmer, CABA

The Big Bang: A Case Study in Improving Customer Service by Integrating All Field Work Into a Single System
- John Sala, Allegheny Power Co.

Chair: Dave Hanes

2 *Concurrent Session*

Tuesday, September 9

8:30 a.m–10:00 a.m.

-A-

Multi-Family Housing Case Study for the Submetering Industry
- Bernard Hasten, Speedread Technologies

A Hybrid Mobile and Fixed-Network RF AMR System Approach
- Tony Segrest, Auburn Water Works

Advanced Metering Technology: Enabler in the New Energy Marketplace
- Jim Bales, IBM

Chair: David Jones

-B-

Submetering & IEEE 802.15.4 — An Overview of IEEE's New Standard for Short-Range, Low-Power Wireless Networking
- George Karayannis, Helicomm Inc.

Connecting the Enterprise
- Bob Loth, Central Texas Electric Cooperative
- John Brett, Tantalus Systems Corp.

Electric Co-Op Multiplexes AMR and SCADA Over a Multidrop Communications Network
- Allan Masterson, Monroe County Electric Cooperative
- Jeff Tankersley, DA Solutions

Chair: Rob McEver

-C-

National Study: Metering Initiatives in the United States and Canada
- Carolyn Kinsman, Automated Communication Links Inc.

Residential Time-of-Use and Innovative Rate Structures — Where Are They Headed? What to Plan for… Realistically Speaking
- Ralph Abbott, Plexus Research Inc.

Chair: Don Block

-D-

System Installations That Deliver Positive Customer Experiences
- Joe O'Malley, MDI

Implementing a Total AMR Solution
- John Harrington, Madison Gas & Electric Co.

AMR Technology Across Multiple Communication Architectures
- Charlie Emerson, Trico Electric Cooperative

Chair: Dave Herchko

-E-

Integrating AMR Data With Multiple Information Systems
- Julius Hackett and Fred Davis, Southside Electric Cooperative

Technology Jackpot: An AMR System That Delivers Meter Reads and Enables Reduced Line Loss
- Gerald Mikel, Steel Waseca Cooperative
- Mark Kodet, Hunt Technologies Inc.

Leveraging Your AMR Data — The Pot of Gold
- Brian Pollom, Puget Sound Energy
- Venki Ramachandran, WACS

Chair: Howard Scott

-F-

Don't Let Your Customers Blink Twice: Use of the Blink Counter as a Means to Improved Customer Care
- Don Pearman, Ozarks Electric Cooperative Corp.
- David Haynes, TWACS by DCSI

Utilizing AMR System to Gain Operational Efficiencies While Managing Power Outages
- Victor Burns, Central EMC
- Kevin Fennel, Hunt Technologies Inc.

Chair: Ed Malemezian

3 *Concurrent Session*

1:30 p.m–3:00 p.m.

-A-

Proving New Technology with an Unproven Partner
- Richard Pate, Landis+Gyr

The AMR Value Proposition
- Ed Malemezian, Ed Malemezian Consulting Inc.

Innovative Implentation Strategies for Ensuring AMR Success at the City of Richmond
- Lew Adkins, City of Richmond Department of Public Utilities

Chair: Kendall Smith

-B-

Evaluating AMR Networks at Georgia Power
- Kevin McDonald, Georgia Power Co.

Broadband Over Powerline
- Steve Collier, NRTC

Simple Security: The Grand Challenge of User Convenience
- Bill MacGregor, SchlumbergerSema

Chair: Carolyn Kinsman

-C-

Next-Generation Advanced Digital Cellular Networks — Telemetry Applications for Utilities
- Chad Samson, Sprint-PCS
- Ramin Missaghieh, Verizon Wireless

Chair: Ron Chebra

-D-

Targeted AMR at Austin Energy
Anthony Hawkins, Austin Energy

LCRA's Approach to Value-Added Services for Wholesale Customers
- Leon Henderson, Lower Colorado River Authority
- Mike Keith, Meter Smart

AMR Integration Into Existing Business Systems and Processes
- Ken Simmons and Marc Bourrie,
- Lee County Electric Cooperative

Chair: Mike Wilkinson

-E-

AMR and Load Management — an Integrated Financial Tool
- Michael Wiebe, MW Consulting
- John Yanek, PPL Electric Utilities
- Dick Preston, Comverge, Inc.
- Bob Richardson, TWACS by DCSI
- Gary Fauth, MW Consulting
- Additional presenters TBA

Chair: Sandy Fernstrom

-F-

Proactive Approach to Water-Loss Management and Customer Care
- Dan Hilyer, Opelika Utiilities

Customer Self-Service via the Web — Ameren's eCustomer Initiative
- Mary P. Heger, Ameren Services Co.
- Virgilio C. Fabella, Ameren Services Co.
- Lisa K. Gendron, Ameren Services Co.

Chair: Bruce Lackey

4 *Concurrent Session*

Tuesday, September 9 (Continued)

4:00 p.m–5:30 p.m.

-A-

The Role of Advanced Metering Technology in Building the Utility of the Future
- Randi Neilson, Itron

How to Negotiate a Winning AMR Contract
- Don Schlenger, Cognyst Consulting LLC

Chair: Dick Preston

-B-

Prepayment Metering — Is it Right for You?
- John Soethe, Salt River Project
- Susan Sanchez, Louisville Gas & Electric Co.
- Additional panelist TBA

Chair: Peggy Richmond

-C-

A Whole Lot of AMR Going On
- Patti Harper-Slaboszewicz, Harper-S Energy Consulting

Market and Technology Trends in AMR
- Garrett Johnston, Chartwell

Significant Growth in AMR Deployments
- Howard Scott, Cognyst Consulting LLC

Chair: Tim Wolf

-D-

Three Implementation Case Studies
Presenters:
- Ken Vlask, We Energies
- Jim Kummer, City of St. Louis
- Kirk Provost, VSI

Chair: Sandy Fernstrom

-E-

Generating Happy Customers: Hassle-Free Distributed Generation
- Mark Kruger, Progress Energy
- Michael Sweeney, Enerwise Global Technologies Inc.

Virtual Communications for DG — Achieving AMR and SCADA Applications at Public Service of New Mexico
Presenters:
- Ed Reyes, Public Service of New Mexico
- Brad Hodges, Celerity
- Arthur Vos, 6D/Comverge Inc.

Chair: Jim Andrus

-F-

AMR and Your Customers: A Case Study
- Len Tanner, ORCOM
- Charles Kiely, District of Columbia Water and Sewer Authority

Beyond Meter Reading — Using AMR as a System Optimization and Customer Service Tool
- Corey Dobbie, City of McKinney, Texas
- Scott Durham, Datamatic

Chair: Mike Koutelis

5 *Concurrent Session*

Over the Horizon — Passageways to Success

9:30 a.m–11:00 a.m

-5A-

- Victor Sitton, Elster Electricity
- Moe Oullette, GE Meter
- Jim Fisher, Schlumberger Electricity Inc.
- Arlin Rummel, Invensys Metering Systems
- Thomas Tesmer, Landis+Gyr Inc.

Electronic single-phase meters, particularly attractive for AMR deployments, have become price and feature competitive with induction meters in the last two years — and they offer compelling advantages. But questions and uncertainties make utilities wary to make a major commitment. This panel representing the major meter suppliers will discuss design and performance characteristics of electronic single-phase meters. Topics will include current sensing, processing, environmental tolerance, AMR integration, advanced functions, expected life, performance advantages and revenue implications. The session moderator will encourage attendees to ask specific questions and raise additional issues.

Chair: Steve Hadden

-5B-

- Doug Staker, Itron Inc.
- Glen Brownlee, Tantalus Systems Corp.
- Gary January, Elster Electricity

Building the better AMR mousetrap includes having a radio-frequency solution. Though earlier fixed RF networks hit a few speed bumps, the benefits in bandwidth, functionality and installation have utility leaders turning their attention to the new breed of RF system offerings. New devices are hitting the market, and trials are building into full-scale deployments. Three top RF technology authorities promoting innovations in public RF networks for AMR and load control will speak about actual utility installations that have proven successful in addressing C&I customer requirements and enabling new programs for residential customers.

Chair: Carolyn Kinsman

-5C-

- Emmett Kelly, Itron Inc.
- Larsh Johnson, eMeter UTC representative TBA

What are the implications of the current restructuring activity on the national and state level for utility metering business practices? Nationwide, more and more government leaders and regulators are learning about the critical role advanced metering and control technologies can play in ensuring the efficiency and reliability of the nation's energy delivery system. This panel presentation will provide an up-to-the minute assessment of legislative and regulatory activity and trends as they relate to AMR technology, as well as analysis of what these developments may mean to utilities, AMR technology providers, end consumers and the industry as a whole.

Chair: Jim Andrus

Over the Horizon— Passageways to Success

9:30 a.m–11:00 a.m

-5D-

- John Rossi, Comverge Inc.
- John Brett, Tantalus Systems Corp.
- Mark Kodet, Hunt Technologies Inc.

No single communications approach is right for everybody. Should you use a public or private network? Should it be wireless? How about a power-line system? And after you narrow down the options, what equipment or technologies are right for your project? This session will provide information to help attendees make these tough decisions. Panelists will address the tradeoffs, potential problems, strengths and weaknesses of each communication system. Bring your questions and be prepared to participate in a stimulating question and answer session as we delve into the critical challenges related to reliable customer communications.

Chair: Don Block

-5E-

- Robert Coffee, Great Bay Capital Management
- Deloris Duquette, Itron Inc.
- Bruce Block, Koch Financial

AMR cost justification has become an even greater concern since 9-11. This workshop will review several models including a total system approach in financing AMR. Expert panelists will review the standard financing options of lease purchase as well as other methodologies such as delayed payment and catastrophic insurance coverage. Attendees will hear details about finance options that specific utilities have chosen and why those strategies work. The session will conclude with a 15-minute question-and-answer period.

Chair: Mike Koutelis

-5F-

- Luann LaValley, Minnesota Power Co.
- Karen Sweat, Kansas City Power & Light Co.
- Craig Maternoski, Wisconsin Public Service Corp.

Integrating AMR data with software applications opens numerous doors to new opportunities and improved relationships. Panelists will present unique business propositions and explain how these services are enabled by integrating AMR with other utility systems. Delegates will learn about the types of integrated data and applicable software applications. And individual case studies will provide information about challenges, accomplishments and lessons learned.

Chair: Becky Lorentz

New in 2003

When the enhanced sessions conclude, be sure to take advantage of extended exhibit hours Wednesday from 10 a.m. to 1 p.m. This final day of technology reviews and networking provides you with an even greater ability to gather the advice and insight you need to develop cutting-edge programs at your utility.

AMRA Exhibitors

COMPANY	BOOTH
Advanced AMR Technologies LLC	412
AMCO Automated Systems	919
AMCO Water Metering Systems Inc.	641
AMR Concepts Inc.	1039
AMRA	109
Automation Solutions Inc.	817
Badger Meter Inc.	139
BLP Components	605
CABA	218
Cannon Technologies Inc.	119
Caprock Mfg. Inc.	405
Chartwell Inc.	819
Comverge Inc.	339
Continental Utility Solutions Inc.	202
Data Comm for Business Inc.	203
Datamatic Ltd.	1019
dataVoice International	821
DFW Plastics Inc.	243
Ekstrom Industries	936
Electric Energy T&D Magazine	502
Elster Electricity, LLC	317
Enerwise Global Technologies Inc.	121
Hart's Energy Markets magazine	803
Helicomm	805
Hersey Meters Co. Inc.	401, 500
Hexagram Inc.	809
Hughes Supply Inc.	920
Hunt Technologies Inc.	301
IMServ Field Services	205
IMServ Meter Data Services	640
Info Energy Inc.	904
Invensys Metering Systems	1013
Itron Inc.	326
Landis+Gyr Inc.	737
Locate Technologies Inc.	204
Marwell Corp.	504
Master Meter Inc.	133
Maxell Corp. of America	103
McGuard Inc.	501
MeterSmart	437
Metretek Inc.	600
Microtex Electronics	217
Motorola Inc.	311
Neptune Technology Group Inc.	209
NERTEC Inc.	1007
Northrop Grumman IT	403
Olameter Inc.	439
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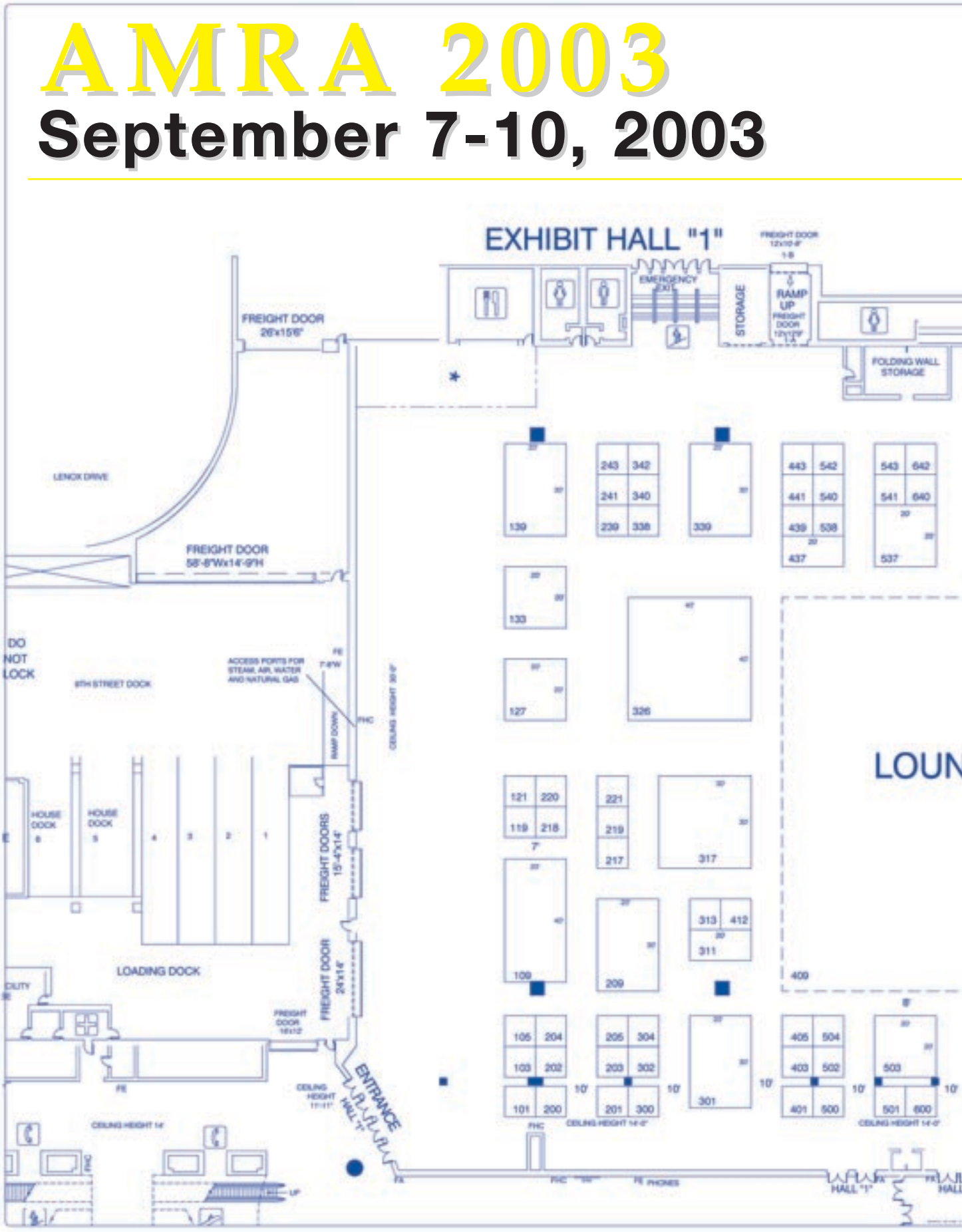
AMRA 2003
September 7-10, 2003



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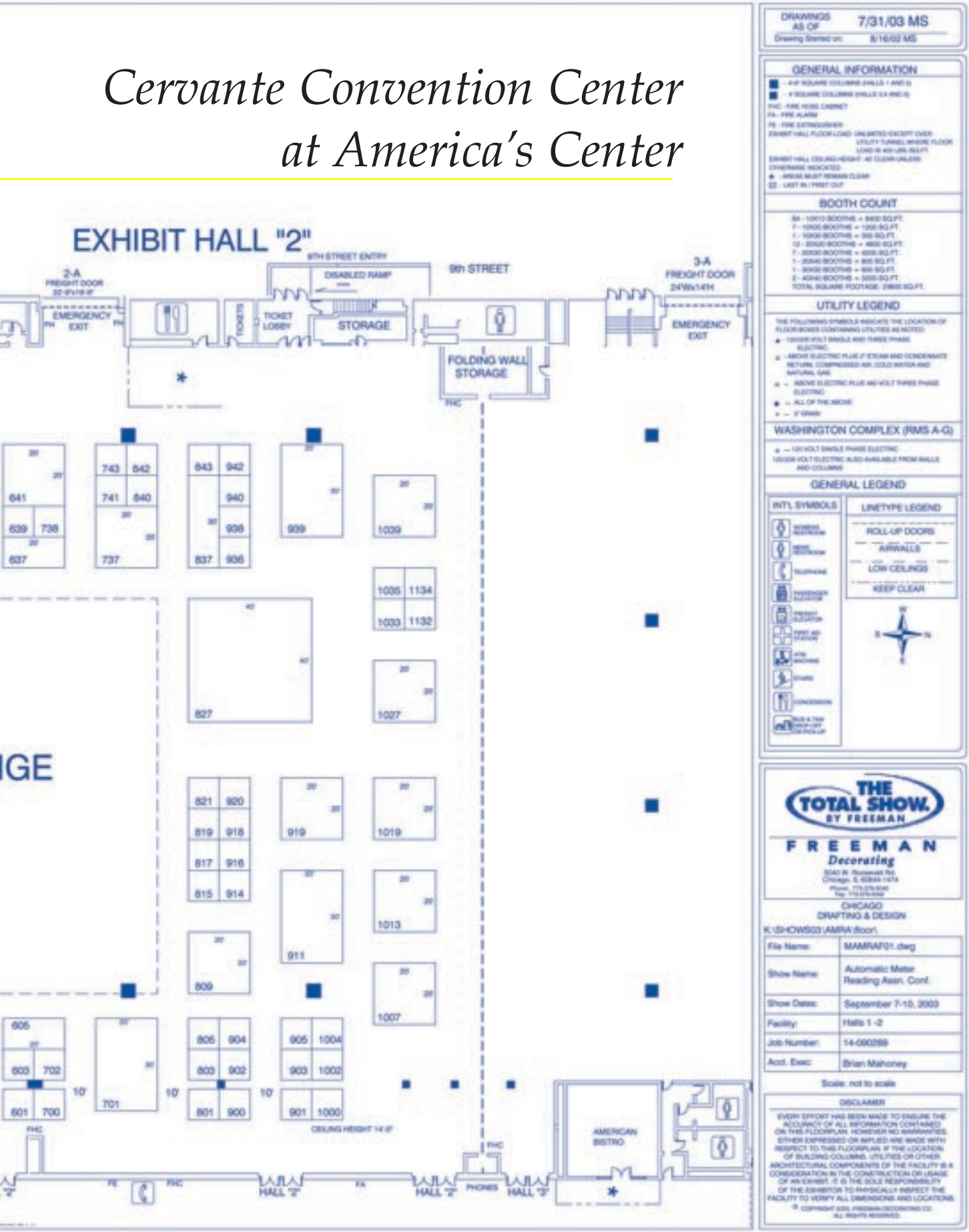

AMRA

Explore St. Louis and its French Colonial Heritage

A French fur trapper named Pierre LaClede founded St. Louis in 1764 as a trading post on the west bank of the Mississippi River. Soon the village became a center of commerce with furs as the main source of exchange for goods. Today, elements of Old St. Louis remain at Laclede's Landing, a quick MetroLink ride away from the symposium headquarters hotel. The nine-block area features some of the most unique restaurants and sidewalk cafes in St. Louis. Experience the charm of cobblestone streets and century-old brick and cast-iron facade buildings, browse through specialty shops, and enjoy live music and entertainment in the evenings.

Also nearby is the Gateway Arch, situated in Jefferson National Expansion Memorial Park. At 630 feet, the Arch is the United States' tallest manmade monument. Watch a giant-screen documentary film about its construction, visit the museum and shops, and take the Journey To The Top — the tram experience that blasts you to the past before lifting you to the apex of the Arch. At night, horse drawn carriages and live music add to the downtown atmosphere.

Other activities within the city include sightseeing excursions and gaming boats — and within a two-hour drive you can dive in a mine, see the past come to life in historic towns and villages, tour Mark Twain's boyhood home, pay homage at Abraham Lincoln's final resting place, learn about the region's French colonial heritage, explore enormous caves, canoe on clear rivers and sample Missouri's award-winning wines. ❋

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Elster Electricity Announces 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.

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

ELSTER

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Discover the value of the diamond

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!

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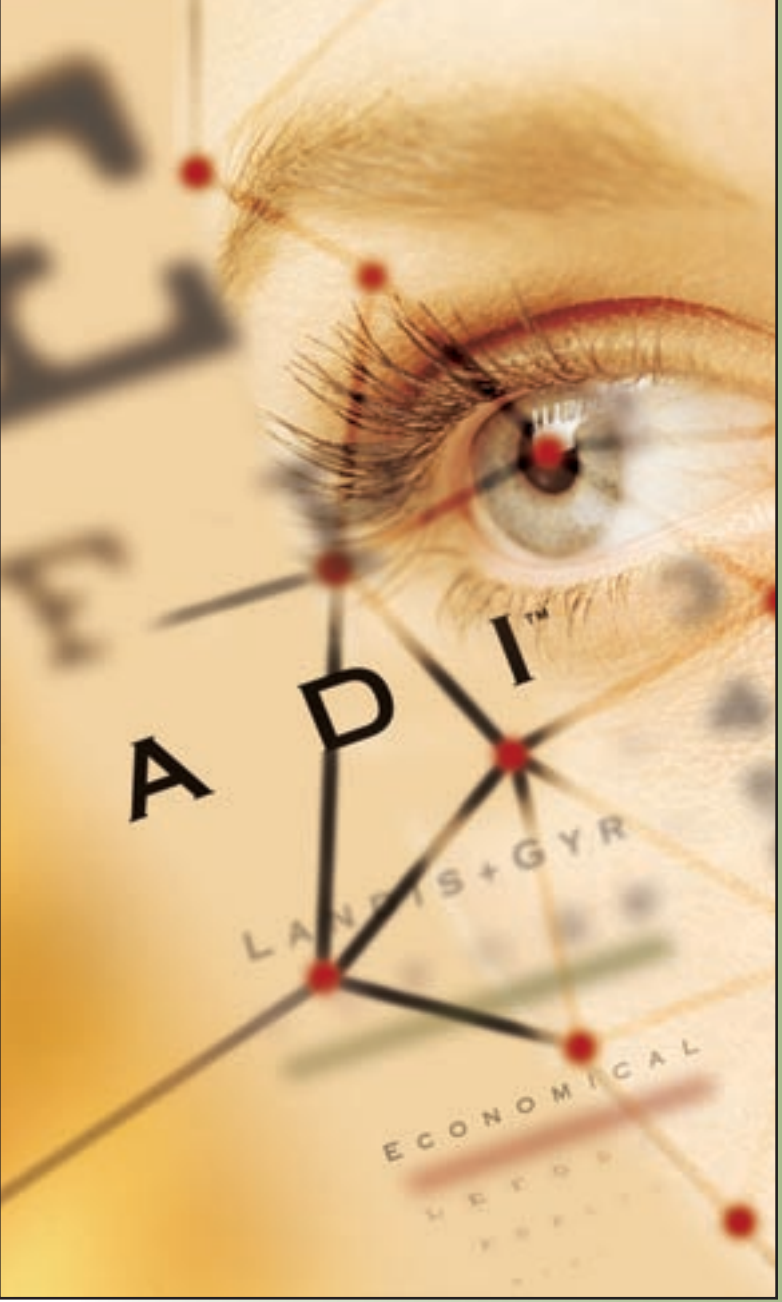

The Clear Route
to Better Customer Connections

Introducing Advanced Data Infrastructure™ (ADI) from Landis+Gyr and StatSignal Systems.

This is not your typical AMR network.

Rather, ADI is a mesh-based, complete end-to-end network, featuring Landis+Gyr's advanced metering technologies and StatSignal's dynamic meter-to-meter communications technology, enabling non-line-of-sight connectivity to make sure you're always in touch.

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The clear route to better customer connections isn't always straight, but it's never been more straightforward.

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Lafayette, IN 47904

New Mesh-Based Technology Makes Mass Market AMR Economically Feasible

The question has never been about the potential benefits of AMR, such as more accurate and timely billing, better customer service, improved energy and operational efficiency, and even the much-talked-about "gateway into the home" possibilities.

Rather, the question has been—How do utilities extend their AMR networks to the mass market with a technology that's not cost-prohibitive?

Now there is an answer called Advanced Data Infrastructure™ (ADI) from Landis+Gyr, leaders in advanced metering solutions, and StatSignal Systems, pioneers of two-way mesh AMR communications technology.

ADI offers a host of unique feature advantages, but the most revolutionary is the intelligence of the dynamic, meter-to-meter communication capabilities that make for low infrastructure, installation and maintenance costs.

Each device in StatSignal's patented mesh wireless network acts as a repeater, relaying traffic for every other device, delivering it to the nearest AiNODE™, which is a secured bridge to the Internet. This unique multiple routing offers non-line-of-sight connectivity to the AiNODE, eliminating the need for overlapping towers and extensive redundant system design.

Furthermore, self-initializing meters, device memorization of available communications paths, prioritization of communication paths by signal strength, remote access for operation and maintenance, and fully and remotely upgradable LAN software, all dramatically reduce system installation, operations and maintenance costs.

"ADI is one of the most innovative wireless communications applications to hit the AMR market in quite some time," said Richard Mora, President and CEO of Landis+Gyr. "Not only will ADI facilitate online, real-time energy usage information, but it will offer a springboard to a world of other value-added applications beyond AMR."

Finally, with ADI, utilities can drive value to their customers, increase ROI and improve profitability.

For more information about ADI, Landis+Gyr's meter models specifically designed for AMR technologies or StatSignal's patented mesh network, contact—

Landis+Gyr Inc.
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www.landisgyr.us

The Future Is Coming Into FOCUS

Landis+Gyr Introduces the Ideal Meter for AMR

Ever since last February when metering systems innovator Landis+Gyr announced its intentions to develop the new FOCUS™ meter—an economical, solid-state, kWh-only meter specifically designed for AMR—industry anticipation has been pretty fierce.

Now Landis+Gyr is ready to fulfill initial orders, and the electric utility market finally has a cost-effective metering solution that will help make mass-market residential AMR a realistic goal.

"We incorporated unique features into the FOCUS meter that will save our customers significant time and money," said Hassan Ali, General Manager of Landis+Gyr's U.S. digital business. "In development, we also kept an eye on advances in AMR, so with FOCUS, customers will be investing in technology today that will help them build for the future."

The FOCUS meter houses a single circuit-board design—mounted in the front of the meter—that allows room for modular AMR communications, a KYZ-option output board or integrated (shared circuit board) AMR solutions.

Given such broad compatibility, Landis+Gyr has already formed a series of strategic alliances with several different leading residential AMR technology providers that want to use the FOCUS meter as a vehicle.

In terms of field operations, the FOCUS meter's most intriguing attribute is that it facilitates optical reconfiguration through the meter's cover, which allows operators to select from displayable positive, negative, net and added (security) kWh metrics.

Likewise, operators can change the displayed information, order and digits, as well as preset or reset kWh, adjust calibrations, take direct readings from the on-board meter multiplier and more.

The FOCUS meter, designed for a 15+ year life, also features a field-proven digital multiplication measurement technique that ensures more accuracy and stability over time.

For more information about the revolutionary new FOCUS meter, or some of the advanced and completely new AMR technologies it will carry in the very near future, contact—

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2800 Duncan Road
Lafayette, Indiana 47904

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www.landisgyr.us

Finally, Seeing Is Believing

Yes, it's here—a solid-state kWh-only meter designed with reliability, savings and AMR in mind. The FOCUS™ meter from Landis+Gyr offers an economical platform for mass-market AMR technologies of today . . . and tomorrow.

Optical meter reconfiguration through the cover is just one of many product features that help utilities save time and money. Utilities can select from displayable positive, negative, net and added (security) kWh metrics. They can also change the displayed information, order and digits. A field-proven digital multiplication measurement technique ensures long-term accuracy and stability. And, direct readings are available from the on-board meter multiplier. These features, combined with a single circuit-board design make the FOCUS meter an ideal platform for modular or integrated AMR communications or for a KYZ-option output board.

Call **800-LANDIS-6**
to receive more information about the FOCUS meter—the clear platform of choice for AMR.

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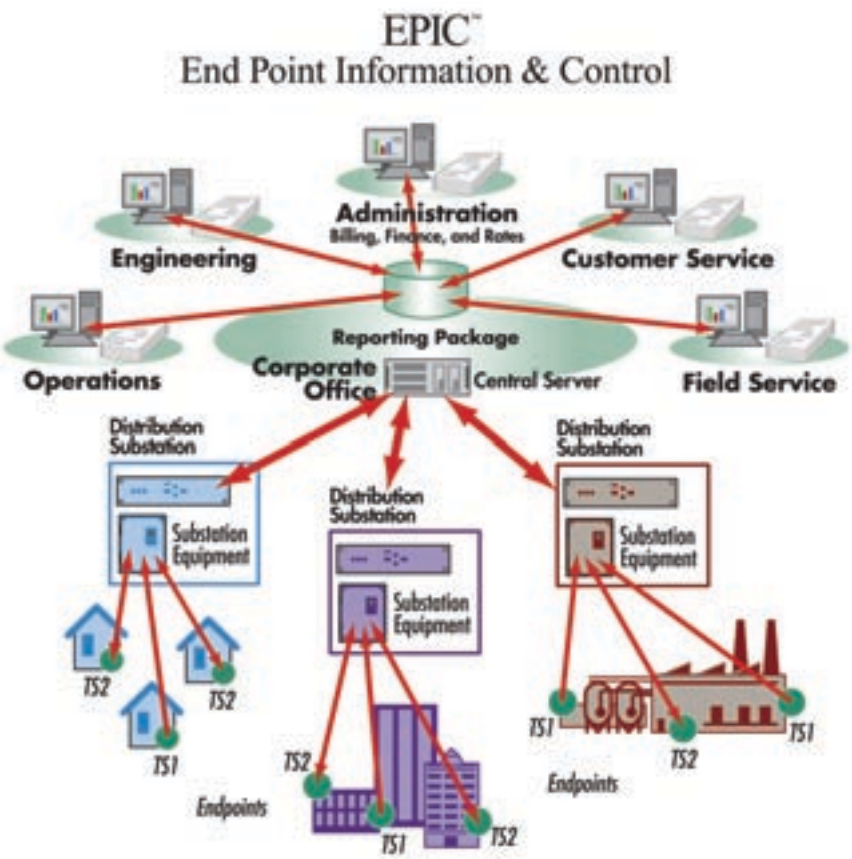

Hunt Technologies, Inc. is committed to providing the most reliable, cost-effective endpoint information system to utilities worldwide. Hunt's products are power line carrier based communication systems that deliver endpoint specific data necessary to conduct comprehensive customer analysis, as well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

Circle 162 on Reader Service Card

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:

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- 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
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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:
Tom Knutsen
Energy Consultant
Customer and Energy Services
Lower Colorado River Authority
tknutsen@lcra.org

Advanced Metering and Internet-Based Data —

New Partnership Helps Central Texas Public Power

Utility uses real-time energy data to educate consumers, improve meter management and detect service problems

Figure 1

Daily meter readings, metered data posted daily to secure websites, annual meter inspections, quick diagnosis of metering problems and coordination of meter repair—these are the backbone services of the Lower Colorado River Authority's (LCRA) support for its customers' major accounts. As public utilities, the LCRA and its customer base, nine rural electric cooperatives and 33 municipal utilities, are not subject to the competitive retail electric market in Texas. Deregulation, however, has forced LCRA to prepare for a changed market.

The intent of LCRA's Key Account Program is energy education through access to interval data—the tool that provides the load shapes and energy use patterns that help consumers understand their electric bills. While LCRA and its utility customers use this data to educate their consumers, they have derived a second benefit from the Key Account Program—improved meter management and detecting service problems.

LCRA offers data collection and metering support services through two Texas-based contractors — MeterSmart Services™ (formerly Utility Data Resources, Inc.) of Arlington and Texas Meter and Device (TMD) of Waco. Since its inception in 2000, this arrangement has grown into a partnership among LCRA, MeterSmart, and TMD. Funding is coordinated under LCRA's energy services program called TexasWi$e™. By participating in TexasWi$e, the distribution companies can select the level of support they want from a menu of metering and data collection services, all for the cost of only a few dollars on their monthly wholesale power bills.

Catching Damage Early

The effects of one unusual winter storm in Brenham, Texas on the last day of 2002 illustrate the workings of this new partnership. Summer-like violent lightning and thunder accompanied the driving rain in that late December storm. The next working day, January 2, 2003, MeterSmart's Norma Jackson reviewed her morning's meter readings. She reads approximately 300 meters daily for Brenham and the 31 other utilities that take advantage of the Key Accounts Program. Looking over the reports from her MV-90 system **(Figure 1)**, she saw that data from a number of meters in Brenham was out of whack. With a few phone calls and e-mails, Jackson set in motion the diagnosis and repair of the problems she detected.

By the time the meter technicians had completed their field work, they found that eight of Brenham's 26 major accounts had suffered damaged or destroyed meters or current transformers or both **(Figure 2).** All were repaired in time for the January billing cycle, ensuring that Brenham had accurate and timely data for its biggest customers.

Brenham meter technician Davin Jezierski finds daily meter readings useful in other ways. Before those 26 meters were read remotely by telephone, he'd hustled to collect billing data manually one day each month. He then spent the following two days pulling reports from his readings, then culling through them for the data he put into the billing system. Outages posed a particular problem. "One time, a meter went out the day after I'd read it, so I had to estimate a whole month's data on that customer," says Jezierski.

He explained that before meters were read remotely, he would estimate a customer's energy use from historical energy and demand records but without interval data. Now instead of Jezierski's spending three days putting together the bills for his major accounts, MeterSmart collects the data and ships it to LCRA for billing. Jackson fills in any missing intervals using utility standard verification and editing protocols, saving Jezierski and others from having to do it manually. The early detection of meter failures makes his work easier. "The best part of this program is the night time reads when I find out the next day if there's a problem," says Jezierski.

Both he and Brenham profit also from finding the annual meter testing LCRA offers through its contract with TMD. Especially useful, Jezierski said, is catching failed current transformers (CTs). When a CT no longer works on one leg of three-phase service, the meter can't record all the power a customer uses. The bill is inaccurately lower, costing the municipal utility money until it discovers the error. After the CT is replaced, the bill goes up, and the utility has to explain to the customer that its measurement systems weren't accurate.

Meter accuracy is critical. "Everything stems from that meter working properly. That's our foundation, it's our measuring system," states Deena Locklear, who manages billing for Cap Rock Electric's McCulloch Division in Brady, Texas, an early participant in the LCRA project. Her utility depends on the TMD service, as she says, "We're pretty limited on the resources available to us, and they're very good."

Figure 2

Origins of the Partnership

The combination of the MeterSmart/TMD partnership came about in 2000 after LCRA concluded that its regulated transmission group, which had included meter services for its wholesale customers and meter reading for a number of their customers, could no longer deal with any retail consumers. It phased out its consumer-level metering work and looked around for an outsider to read the retail meters. The solution was to outsource the meter work to TMD and the data translation support to MeterSmart. Over three years, this arrangement has grown into a partnership that LCRA customers find beneficial.

The range of services supports those distribution entities that can do most of their meter work alone and enables smaller ones to rely entirely on TMD's shop. TMD installs advanced meters with interval data recorders on accounts identified by the co-op or municipal staff. Each installation includes a full check of the meter service equipment, verification of the accuracy of CTs and meter multipliers, and an annual check. Included in the full-service package is a guarantee for replacing broken meters at no cost, a benefit to a municipality like Brenham that saw two recorders worth almost a thousand dollars each die in one storm. MeterSmart works with the field technicians at the time of installation to set up the meter's formal record in MV-90 and then reads the meters daily. It posts daily reads to secure websites for each distribution company and consumer.

Data on the Web—Applications

Utility staffs find several uses for the web-based data. Locklear depends on the web postings both for billing and customer service. She's had MeterSmart reading her three largest customers' meters and posting the data daily to the utility's website. "I get the information right off the Internet and bill them like that," she said. Doing it that way saves her staff a lot of time. Cap Rock also uses the web presentation to assist it with customer concerns. Not long after MeterSmart began its web posting, Cap Rock's field supervisor got a call from one customer who'd complained about an outage over a weekend. While Cap Rock couldn't see the down time in any of its records, it could pull the load curve from the web and see when the service failed and resumed. As Locklear explains, "It lets us see what our customers are doing and when they're doing it."

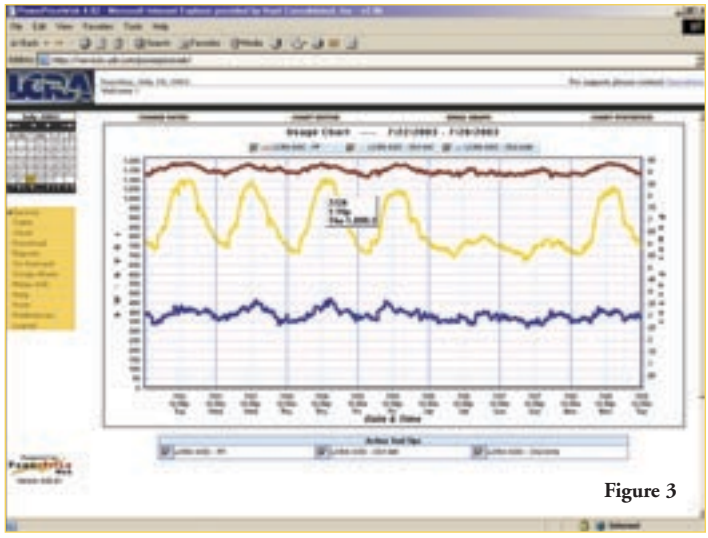

Figure 3

Not only have customers seen the benefits of daily monitoring of their retail accounts, so also has LCRA (**Figure 3**). As a wholesaler, LCRA delivers power to substations where the distribution companies take ownership of electricity after it is stepped down from transmission to distribution voltage. LCRA meters and bills at that exchange point, and billing takes place on the 25th of each month. Recently on billing day, the billing system flagged a discrepancy at one of the substations providing power to Cap Rock Electric. Two of its major accounts drawing power from that substation are metered in the LCRA program. The problem the billing system detected was that the sum of the plants' energy for the billing period was greater than the energy measured at the substation.

Because the meter for one plant had failed and been replaced that month, the original assumption was that the estimated data for the outage was too high. Billing and customer service staff at LCRA undertook an inquiry into the load history. What they found was that the substation's peak demand for the month was much lower than normal. The load curve had remained constant, so the LCRA Data Translation group that reads and examines substation data on a daily basis had not noticed the lower peak. Working in partnership, LCRA and MeterSmart re-examined the data and discovered that the substation's load appeared to have dropped about a third late in the billing month. The next day one of one of LCRA's substation metering specialists found that the current transformer for one phase of the substation meter had cracked. LCRA estimated the few days' missing data and sent Cap Rock an accurate bill. The cooperative effort averted the loss of measuring millions of kilowatt-hours before an annual meter inspection would have found the failed CT. Further, neither LCRA nor Cap Rock had to deal with billing a customer for a corrected read that would have cost the customer more money.

End-use consumers use the web data, too. Peter Koestler is the engineer responsible for managing energy at the Spoetzl Brewery in Shiner, Texas, a municipal utility that uses the full meter and data collection package offered under TexasWi$e. MeterSmart reads the meters at Spoetzl, whose Shiner Bock beer is a regional favorite, and posts the data to Spoetzl's secure web site. "We download the raw data and create graphic representations according to our production schedule," Koestler explained. "We're trying to find out what happened at the time we see an energy peak, to understand it and see if it makes sense to adjust what we can do to avoid the peak." Brewing beer, of course, takes precedence in his work, but Koestler pointed out, "We're always exploring cost savings, and the tools we get from LCRA are a great source of information."

The Meter — Point of Convergence

Comments like those above perfectly characterize the original intent of LCRA's Key Accounts effort—to provide customer education through web-based presentation of real-time interval data. Through Shiner and LCRA, seeing his data on the web whenever desired enables Koestler, and scores of consumers like him, to make timely decisions based on up-to-date energy information. However, no one foresaw the benefits emerging from the distribution and transmission management applications of the daily meter reading process. Truly, the cash register of the electric utility industry is the meter itself. Interviewing it on a daily basis not only provides a useful way to build customer energy awareness, but also transforms the meter into a valuable witness for early detection of system problems, thus preventing or minimizing potential revenue loss. ■

About the Author:

Tom Knutsen is an energy services consultant for the Lower Colorado River Authority (LCRA) in Austin, Texas. He and a co-worker share responsibility for the meter and communications infrastructure, data collection, and billing data delivery for key end-use consumers served by LCRA's wholesale customers. LCRA is helping its customers prepare for the deregulated, retail, electric market in Texas by educating their principal consumers on electric pricing and services. Knutsen has worked at LCRA since 1981 in various capacities involving residential demand-side management, industrial load management, DSM evaluation, end-use consumer pricing, and customer service. Before LCRA, he spent five years as a beat reporter for daily newspapers. He holds an A.B. in history from Yale College and an M.A. in communication from the University of Texas at Austin.

Captions:

Figure 1: MeterSmart's Rusty McCloud and Norma Jackson oversee the company's MV-90 data translation servers.

Figure 2: TMD technician Mike Lewis programs a meter while calling MeterSmart Services to configure the meter in MV-90.

Figure 3: MeterSmart's PowerPrice™ Web shows meter data collected as recently as the previous day. It is easy to access and manipulate, and stays current. Shown here is a graphic display of the weekly energy usage at LCRA's Austin, Texas office.

By:
Dr. Deepak Divan
Fellow IEEE

Executive Insights:

Enhancing Distribution Grid Operations with a 24x7 Grid Information Resource

The utility T&D network represents one of the key assets for most utilities. Unfortunately much of this infrastructure is aging, with segments that are often over 50 years old, and has no 'smarts' built into it. As a result, even in today's networked world, most utilities operate with little or no real-time information from the distribution grid. The very information utilities require for day-to-day operations is often extremely cost-prohibitive to obtain or is simply not available.

As a result, utility business processes driven by events that occur at customer facilities or on the distribution network, suffer.

For instance, a major C&I utility customer experiences a power interruption that causes an expensive interruption to their manufacturing process. When this customer turns to the utility for an explanation, the utility may lack data to locate the source and resolve the problem. In fact, it typically takes 2-16 weeks to research and understand the customer's problem, very expensive and frustrating to both the utility and the customer.

Many other utility business areas also require grid data to function: operations engineers need to locate and diagnose grid faults; senior management requires real-time impact reports on the effects of storms; operations engineers need historical reliability data for specific distribution feeders; and planning engineers want baseline reliability data for different regions in a service territory

Operating without grid information, utilities commonly experience an increased frequency and duration of outages, inefficient responses to problems on the grid, less than optimal reliability levels, and dissatisfied customers.

Utility Operation With Existing Resources	Utility Operation With 24x7 Grid Information Resource
Reactive, inefficient, outage management processes, including - • Two calls notification • Poor location of fault information • Poor diagnostics capability • No service restoration notification • Poor customer support	Proactive, efficient outage management processes, including - • Automatic pre-call notification • Accurate real-time fault location • Near real-time diagnostics capability • Automatic power restoration notification • Proactive customer support
Frequent customer complaints • Expensive, reactive PQ monitoring • Utility blamed for all events • Poor customer management	Enhanced customer satisfaction • Automatic access to PQ event data • Accurate identification of problem • Effective customer support & mgmt
Poor data on grid events and behavior • SAIDI, SAIFI etc estimated with poor granularity • Reactive response to problems	Extensive data mining capabilities • SAIDI, SAIFI etc generated automatically with high granularity • Early identification of imminent problems

Even when there is a complete power outage, the utility typically does not know until a customer calls the utility! Today's technologically savvy customer finds it astonishing that the utility does not have continuous knowledge of the status of the T&D network - one of its primary and most expensive assets.

Using currently available systems for such information is very limited, and prohibitively expensive. Security and control issues prevent most utilities from providing real-time access to their SCADA or financial systems. Further, the high cost of SCADA monitoring and complexity of implementing fully featured and functioning

AMR systems, has made it impractical to extend the monitoring to the distribution grid and feeders.

Clearly, there is a need for a solution that provides real-time situational awareness and knowledge of the T&D network at an affordable price.

Recent technology advances in low cost microprocessors, communications, powerful database systems, and the internet can be harnessed to provide a secure and cost-effective 24x7 real-time grid information resource for the utility.

New value streams, such as notification by email, pager, or phone of major grid events, and immediate, web-based access to detailed information on these events can dramatically enhance the utility's response to service disruptions. The ability to view and analyze power quality disturbances remotely and in real-time, can improve the utility's ability to effectively manage their support for their C&I customers.

Access to information on event details, including waveforms and RMS voltage data associated with the events, can provide root cause analysis and diagnosis, fast location of faults and the possibility of preventing major failures through early intervention.

Finally, the database associated with the grid information resource can provide valuable benchmarking, reliability performance assessment, and can enable new service level agreements with customers based on a differentiated level of quality and reliability.

Utilities clearly need to have better knowledge (and thus control) of the T&D network. The ability to reduce the amount of time needed to support a major C&I customer from 2-16 weeks to under an hour can dramatically enhance the level of customer satisfaction, increasing customer loyalty and opening up avenues for new revenue streams from these existing customers.

From a strategic perspective, improving operations and asset utilization while reducing costs and creating new revenue streams, is absolutely key to sustaining and enhancing a utility's competitive position. A proactive move towards realizing a 24x7 grid information resource is clearly one that will pay rich dividends.

These new capabilities, made possible by significant technological advance coupled with cost reductions, are already helping utilities to-

- Reduce frequency and duration of outage – improved system reliability
- Improve SAIDI, SAIFI and CAIDI indices – increased revenue potential
- Improve efficacy of work crews and operations engineering – reduced cost
- Improve customer management – enhanced customer satisfaction ■

About the Author

Dr. Deepak Divan, Fellow IEEE, is Chairman, Founder & CTO of SoftSwitching Technologies, a leader in the power technology market. Their I-Grid® system offers a web-based real-time power monitoring system that is the basis for a grid information resource that can operate alone or interface with OMS systems. Their Dynamic Sag Corrector® (DySC®) product offers industrial manufacturers and OEM's the ability to eliminate the leading source of unscheduled process or equipment downtime – poor power quality and reliability. He can be reached at 608-662-7200 or ddivan@softswitch.com

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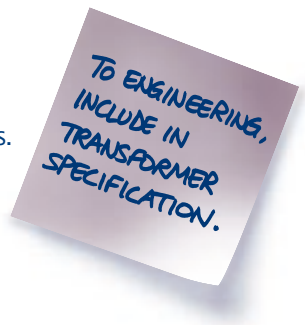

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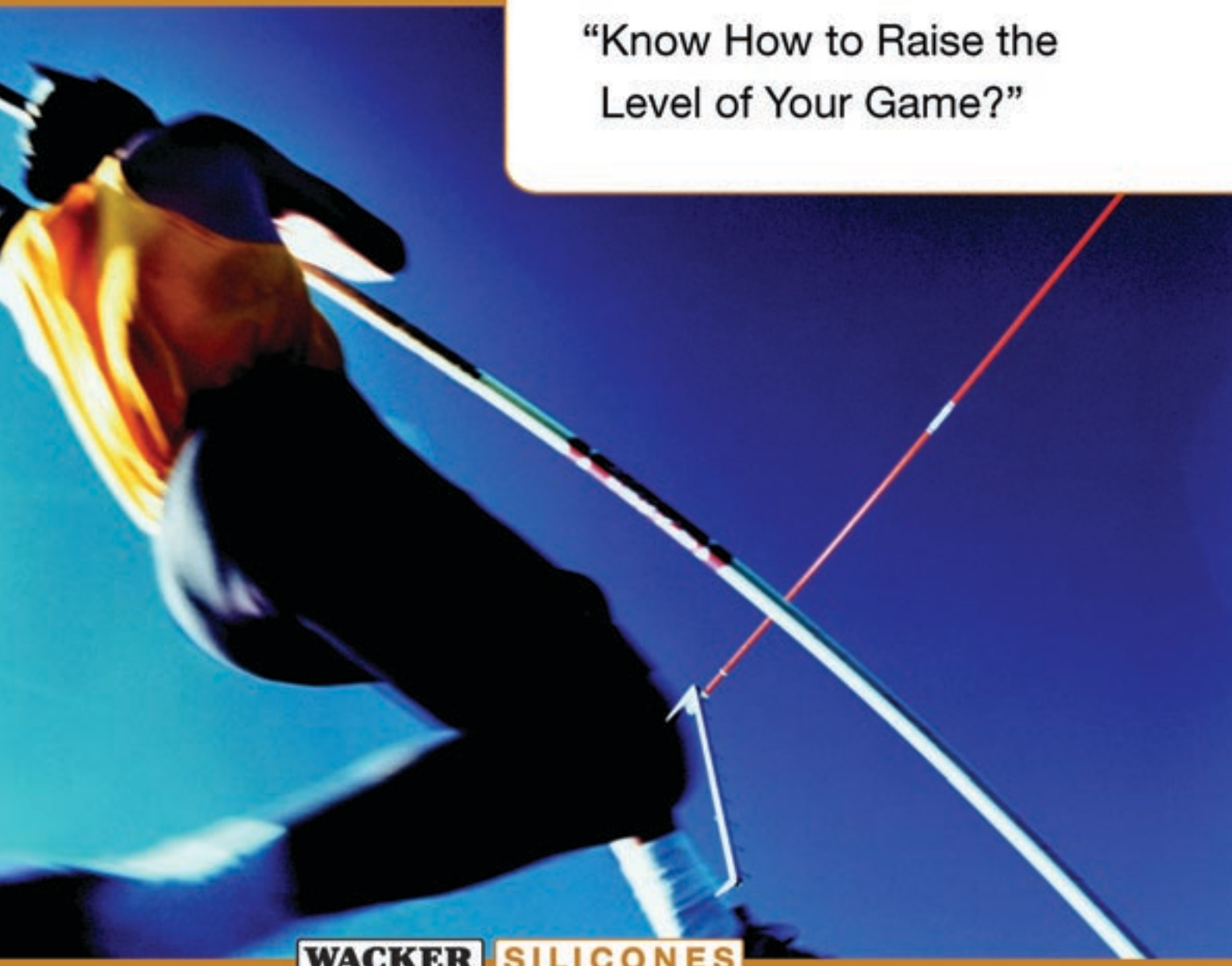

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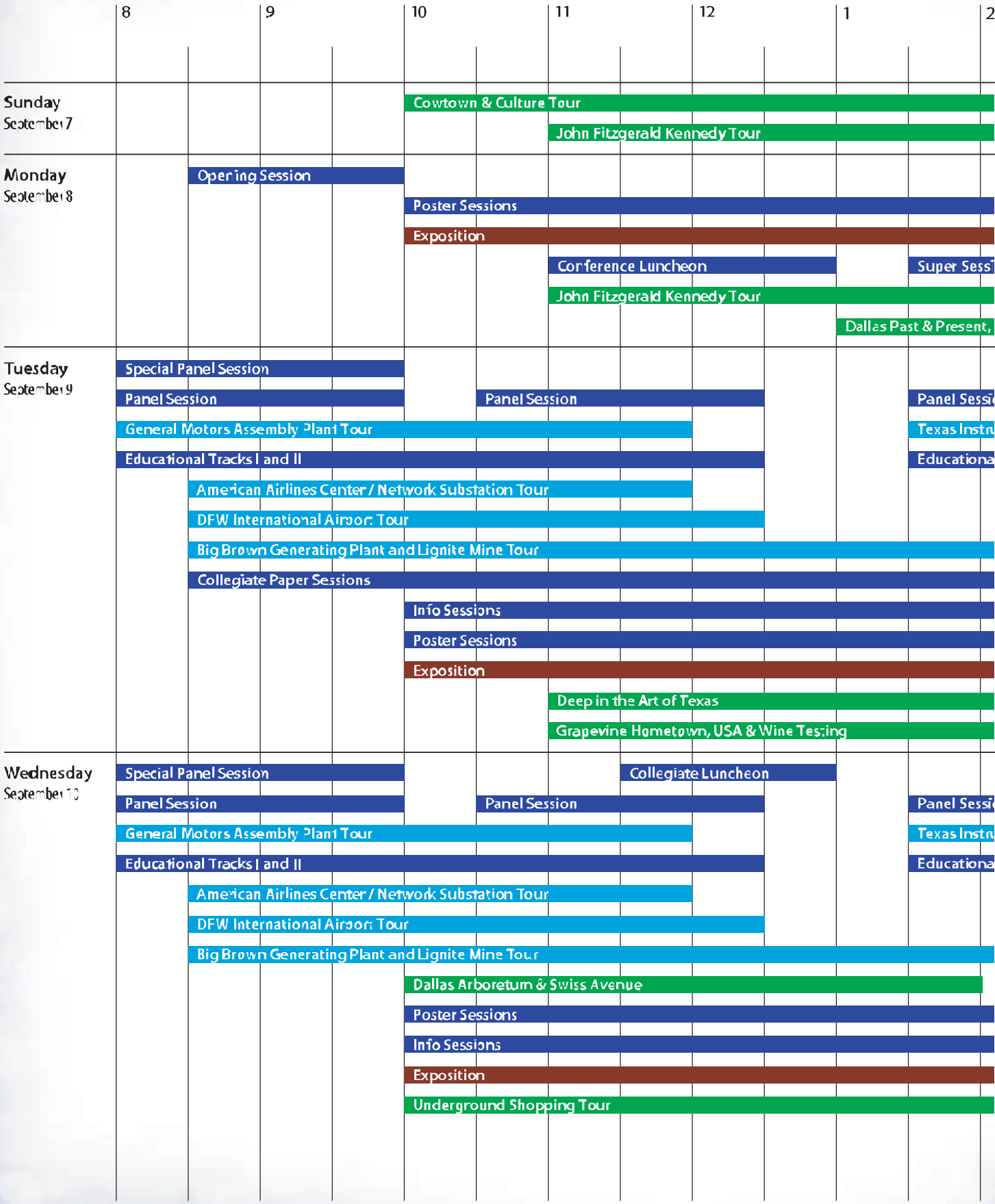
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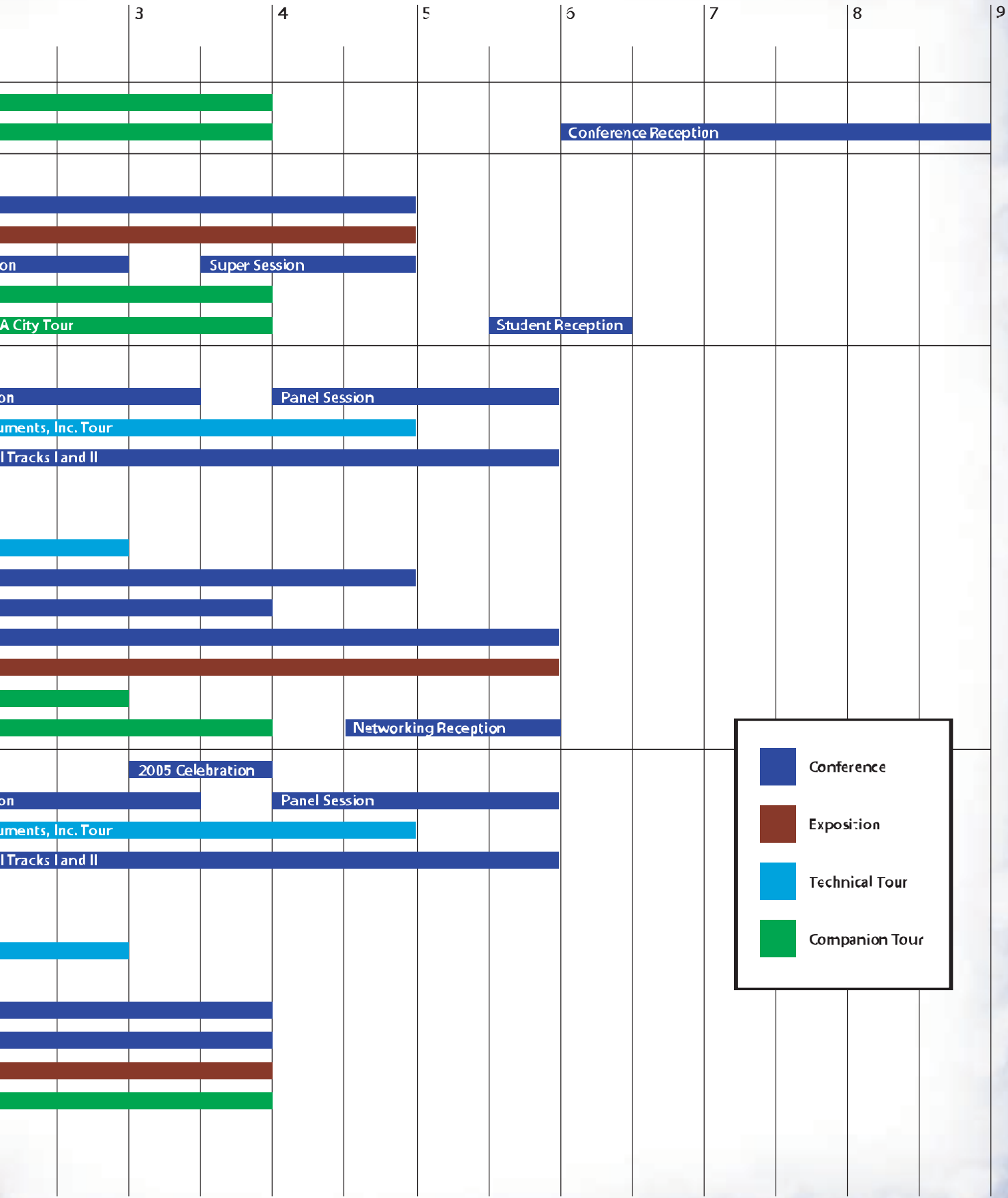
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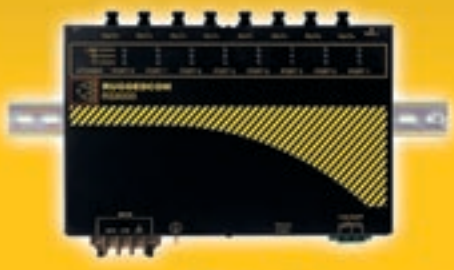

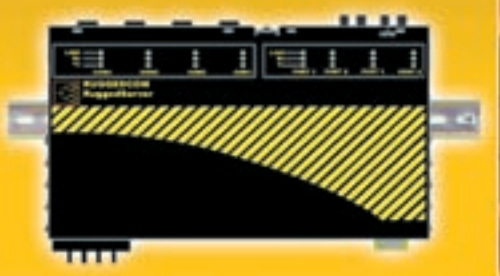

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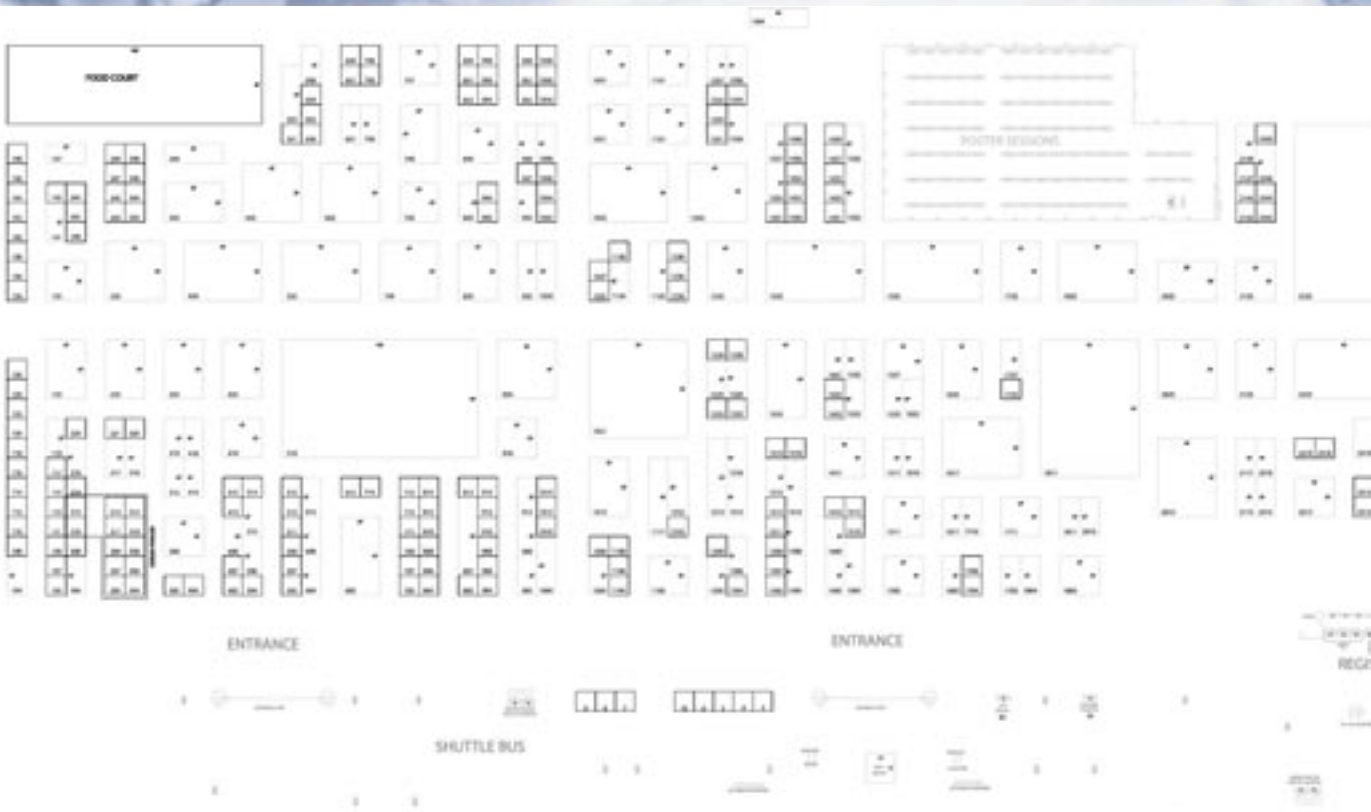

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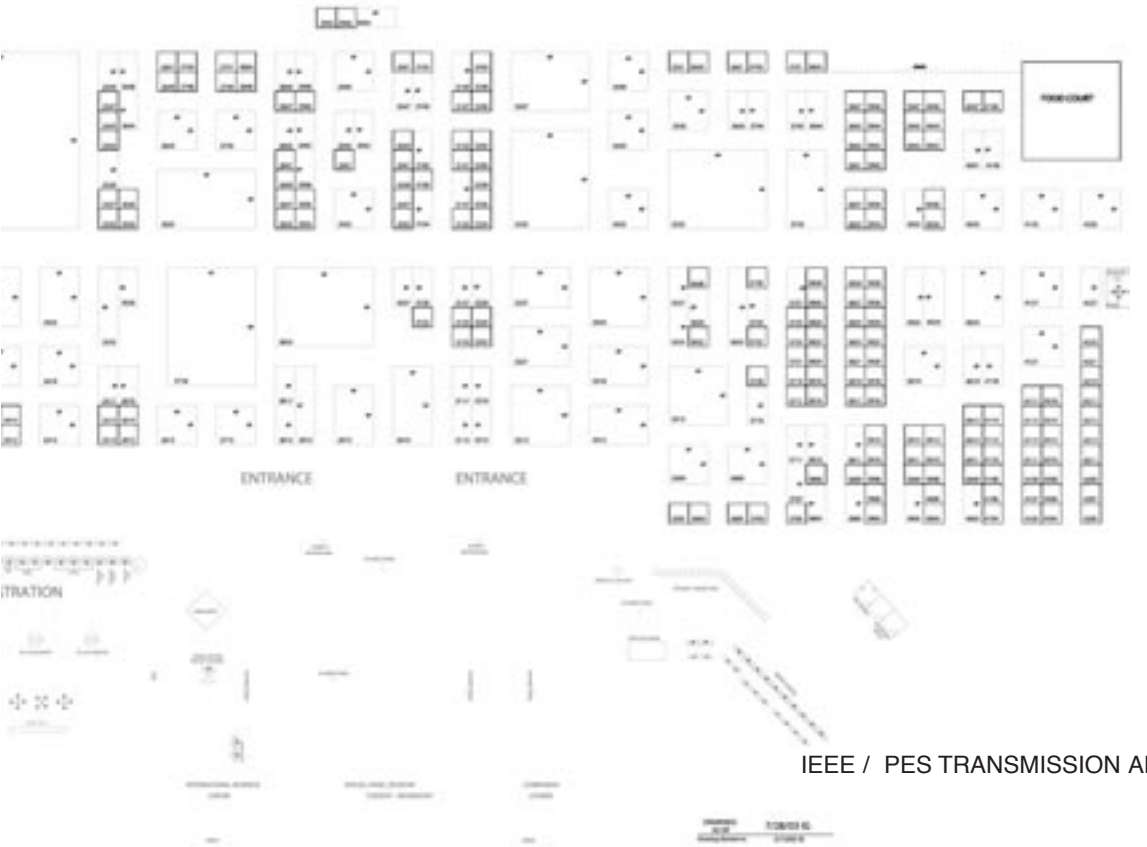

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By: Ronald Seeholzer
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www.eei.org

Company, Industry Actions Restoring Investor Confidence in Nation's Power Sector

After enduring its worst financial crisis in decades, the nation's electric power sector now appears to be righting itself and looking forward to the challenges ahead. At mid-year, the Standard & Poor's (S&P) Electric Utility Index produced a 15.03 percent year-to-date return. This exceeded the 10.76 percent increase in the S&P's 500 Index as a whole.

The industry has faced major challenges: The Enron implosion; a boom-and-bust cycle in merchant generation; the general economic slowdown. Each played a part in shaking the confidence of industry shareholders, investors, and the public. In looking back over the past two years, the following statistics will help to put in perspective just how far the power sector's fortunes had fallen:

- Between December 2000 and December 2002, the shareholder-owned electric utility sector lost $78.3 billion in market capitalization—a 23.9 percent drop.
- In 2002, the EEI Index, a measure of the over all stock performance of shareholder-owned electric utilities, was down 14.7 percent.
- Throughout 2002, according to S&P, credit rating changes in the shareholder-owned electric utility sector were overwhelmingly negative, as downgrades outnumbered upgrades by a monstrous 120 to 10.

Much of the bad news from the electric sector could be attributed to the overall economic downturn and the inappropriate actions of a few companies. Nonetheless, the financial outlook for the industry was certainly negative at the beginning of 2003. Since then, however, the outlook has begun to brighten. The majority of electric companies have maintained a steady course. The industry is now building on the solid businesses they have run for many years.

Today, the power sector is optimistic. This is not to say that the electric industry does not continue to face challenges, including the economy's continued malaise, shrinking supplies of natural gas, pending federal energy and environmental legislation, and an aging and increasingly stressed infrastructure. But shareholder-owned electric companies are re-evaluating their business approaches and making improvements that will leave them in a stronger position for the future.

Actions By Power Companies

Electric power companies are refocusing on their core strengths—generating, transmitting, and distributing electricity. Companies are making improvements that will leave them in a stronger position for the future. Among the actions individual companies are taking, include:

- Improving financial information disclosure practices
- Renewing focus on the core businesses--selling non-core assets, canceling turbine acquisitions /new construction to shore up balance sheets
- Issuing new equity, and paying off debt
- Realigning trading around their own generation assets and customer obligations and accelerating debt repayment

These efforts have already begun to return dividends. A number of companies have turned in impressive earnings to date this year. Among the outstanding company examples are:

- Constellation Energy Group (NYSE: CEG)—Second-quarter earnings of $0.58 per share exceeded the company's earlier earnings guidance (which excludes special items) of $0.33 to $0.43 per share, and represent the

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seventh consecutive quarter in which they've either met or exceeded earnings guidance.

- Exelon Corporation (NYSE: EXC)—Announced an 8 percent improvement in operating earnings for the second quarter of 2003 versus the same period in 2002.

- PPL Corporation (NYSE: PPL)—Declared an increase in reported earnings of $116 million, or $0.67 per share, for the second quarter of 2003 compared to a net loss of $27 million, or $0.18 per share, in the second quarter of 2002. For the first half of 2003, PPL reported earnings of $355 million, or $2.09 per share, compared to a loss of $30 million, or $0.20 per share, in the first half of 2002.

- Entergy Corporation (NYSE:ETR) has announced second quarter 2003 operational earnings of $270.1 million, or $1.17 per share, which equaled the company record for second quarter operational earnings per share set in 2002.

Actions by the Industry

Through EEI, the electric power industry is also leading an unprecedented action plan to restore confidence among investors. The goals are to embrace greater transparency in financial information disclosure and accounting, and best practices in corporate governance and market oversight. The strategies are to work with key regulatory agencies on public policies, conduct aggressive outreach to Wall Street, and lay the foundation for a variety of industry initiatives.

Among the accomplishments of the past year:

- EEI worked with the Federal Energy Regulatory Commission (FERC) to hold technical conferences on capital finance and credit in energy markets. FERC plans to use the sessions to clarify the state of financial investments in energy and clear up contradictory anecdotal reports on the availability of financial backing. These conferences also served as the basis for FERC to consider initiatives such as its proposed policy statement to spur investment in transmission and the formation of regional transmission organizations.

- EEI vigorously led the charge for elimination of the double taxation on dividends, a centerpiece of the President's economic stimulus package. This included a reduction in the top rate on dividend taxes to 15 percent, down from the current top rate of 38.6 percent. This is vital, since the power industry pays out more in dividends than any other industry. This Bill also included an increase in bonus depreciation from 30 to 50 per cent through 2004. These changes would free up needed capital, put more money into the hands of investors to invest, and boost shareholder confidence—all good signals to Wall Street.

- EEI has worked with member company CEOs and company executives to survey implemen tation issues surrounding Sarbanes-Oxley to determine industry best practices.

- EEI continues to seek clarity and definition of proposed financial disclosure and corporate governance rules with key agencies, such as the Securities and Exchange Commission, and will continue to respond to proposed rulemakings, as well as advocate the shareholder-owned industry's positions.

- EEI has an extremely comprehensive outreach and educational initiative for Wall Street and the media. For example, EEI held a series of seminars regarding improved financial disclosure, merchant energy best practices, and corporate governance issues.

- Working with Deloitte & Touche, EEI developed a comprehensive study of suggested guidelines for financial information disclosures that are responsive to the Sarbanes-Oxley Act. The study integrates the work of EEI member companies along with insights from industry experts, SEC recommendations, proposed rulemakings and meetings with regulators.

- EEI is working in close cooperation with the industry's Committee of Chief Risk Officers to assist in formulating recommendations on governance and controls, valuation and risk metrics, credit risk management, and risk management disclosures. These recommendations provide more transparency and comparable financial information about the risk management practices of physical and financial energy trading and marketing companies.

- EEI has developed guidelines for a Model Audit Committee Charter.

- EEI created a Master Netting Agreement designed to enable companies to better manage their risks and improve liquidity by netting electric, gas, and financial contracts. These in turn help promote a liquid, well-functioning marketplace.

- EEI is leading the development of voluntary initiatives for market oversight and is strongly advocating timely resolution of problems.

Challenges Ahead

Even with the progress the industry has made, definite challenges remain. Background on each is listed below. Although the outcome of these issues is far from definite at this time, EEI will be working to help shape policies that provide incentives to expand and improve our nation's electricity infrastructure and to provide greater regulatory certainty about environmental costs. The result should be a vastly improved investment climate and a stronger electric power industry.

Congress:

Support for moving an energy bill remains strong. President Bush remains committed to ensuring the passage of a Bill. The House has passed legislation, as has the Senate. Both measures will now be debated in a House--Senate conference this fall, where a final Bill is expected to emerge.

One of EEI's top priorities for an energy bill is to maintain the nation's fuel diversity. Fuel diversity gives stability to the industry and acts as a hedge against unanticipated events, which could limit access to any fuel, or push its price to unacceptably high levels.

EEI encourages Congress to pass a comprehensive energy bill that addresses challenges to all fuel sources: clean coal technologies; natural gas production and pipeline infrastructure; nuclear decommissioning and next generation nuclear technologies; hydroelectric relicensing; and the development of competitive renewables.

The question regarding renewables is not whether they will be a part of our energy future—they will—but rather how best to move forward. A market-based approach, in which renewables thrive because customers want them and investors believe in them, is preferable to government mandates. This allows a more effective integration of renewables into our fuel mix, and, therefore, into our future.

EEI is also working for repeal of the Public Utility Holding Company Act (PUHCA). Both the House and Senate Bills include repealing PUHCA. PUHCA restricts the flow of capital into U.S. energy markets, inhibiting much needed transmission capacity in the states. PUHCA also limits investment and growth opportunities in U.S. energy markets by imposing outmoded restrictions on the business activities of electric and gas utility holding companies.

In addition to supporting generation and structural issues, a comprehensive bill should provide incentives to build the transmission infrastructure. These incentives include tax provisions for the sale or spin-off of transmission facilities; accelerated depreciation; streamlining the transmission siting process; encouraging the use of pricing incentives to stimulate infrastructure investment; and providing flexibility in the way Regional Transmission Organizations operate. It is also imperative that government-owned utilities and co-ops are subject to the same laws and regulations that apply to shareholder-owned utilities. It is difficult to encourage robustly competitive electricity markets when the rules of the market do not pertain to all the players.

FERC:

In April 2003, FERC issued a white paper on its proposed Wholesale Market Platforms (WMP) as an intermediate step before issuance of a final rule in their Standard Market Design rulemaking. The Commission has also acknowledged the reality of regional differences and agrees with EEI's recommendation for a flexible, regional WMP implementation schedule.

Chairman Wood has gone on record to say that it is more important to do it right than do it fast. From the beginning, EEI has advocated the importance of "getting it right" and has been vocal in its concerns that FERC was proceeding at a pace too fast to fully take into account important operational, geographic and other significant differences in the various regions of the country.

The industry is moving forward on the development of a wholesale market platform with much greater clarity in terms of the process and the issues, and at a more deliberate pace that will yield more effective and lasting results. FERC has also responded to EEI's concerns that it needs to provide incentives to encourage transmission investment. In a press release dated January 15, 2003, FERC proposed to allow additional percentage points on a utility's return-on-equity when it participates in a regional transmission organization, divests its RTO-operated transmission assets, or pursues additional measures that promote efficient operation and expansion of the grid. This type of incentive is a good start, but concerns have been expressed that the policy statement shows a clear bias toward utility divestiture of transmission assets. The statement appears to penalize vertically integrated utilities that are transferring operational control – but not ownership – to regional transmission organizations.

Natural Gas:

During the past decade, natural gas has become an important fuel for making electricity. It is a highly efficient generating source with low emissions, and it now comprises 18 percent of U.S. electricity generation. However, gas has become, in some ways, a victim of its own success and the country now faces higher prices and potential supply constraints.

To address the long-term challenge, EEI encourages federal policymakers to ensure that an adequate and diverse fuel supply is available for the generation of electricity. Fuel diversity means that coal, nuclear, hydro, wind, solar, natural gas—and other fuel sources as they become available—can continue to be used by generators of electricity to mitigate price or supply risk in any one source.

In particular, the country must avoid policies that punish one particular fuel source or reward another. In the same vein, EEI encourages members of Congress, who are now weighing national comprehensive energy proposals, to enact legislation that will enhance the nation's ability to explore, produce, and transport natural gas to customers who need it.

Photo courtesy of AEP

The Environment:

EEI welcomes the Bush Administration's multi-emissions plan—the Clear Skies Initiative. The industry has long advocated a comprehensive, flexible, and cost-effective approach for reducing air emissions that would harmonize the current piecemeal and inefficient regulatory system. EEI will be encouraging Congress to move forward with legislation to meet the nation's clean air goals more efficiently and cost effectively.

On the issue of greenhouse gas emissions, President Bush is committed to voluntary actions, rather than mandated targets and timetables. This is far more cost-effective and less disruptive to the economy. Businesses in every sector are challenged to further reduce emissions through robust voluntary programs that can be measured and documented.

In January 2003, EEI's member companies joined the Department of Energy on the electric power sector's initiatives to reduce greenhouse gas emissions. This new collaboration is called "Power Partners." Already, 40 electric companies—representing 87 percent of EEI member companies' generation—have made the commitment as Power Partners to expand on the proven success of the existing Climate Challenge, an electric industry program that eliminated 237 million metric tons of carbon dioxide in 2000 alone. Industry and company initiatives include demand side management, reforestation, investments in renewables, and research and development of new technologies. These contributions to a cleaner environment must be counted and encouraged.

Electricity is vital to the nation. Even in the sluggish economy of 2002, total U.S. demand for electricity surged by 4.1 percent over 2001. As the nation's economic recovery gains momentum, so too will the demand for electricity. To continue to meet this demand, much work will need to be done. The electric power industry knows that restoring confidence among shareholders, investors, and the public is among the most important jobs ahead. But the industry is proceeding with the faith that its expertise, commitment, and leadership—traits that have built the world's finest electricity system—will enable it to reach its goals. ■

Edison Electric Institute (EEI) is the association of United States shareholder-owned electric companies, international affiliates and industry associates worldwide. Our U.S. members serve approximately 90 percent of the ultimate customers in the shareholder-owned segment of the industry, and nearly 70 percent of all electric utility ultimate customers in the nation. They generated almost 70 percent of the electricity generated by U.S. electric utilities.

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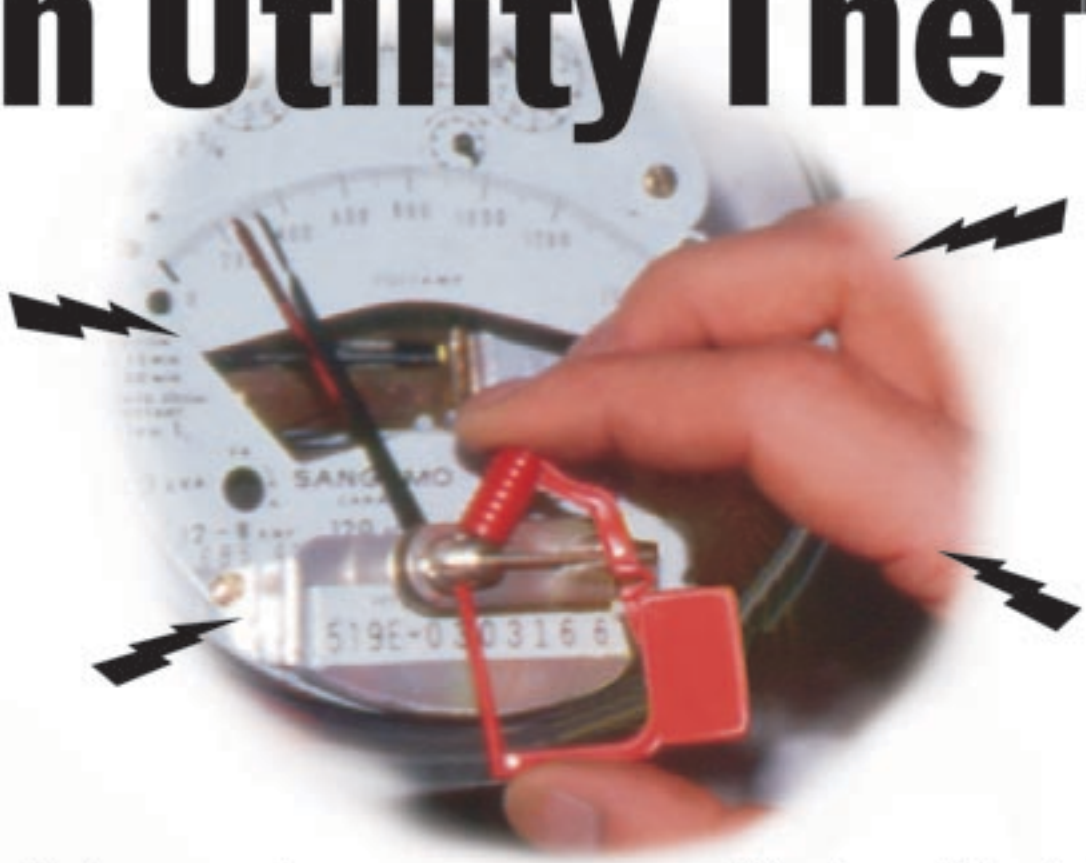

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Redundancy in Substation LANs with the Rapid Spanning Tree Protocol (IEEE 802.1w)

By:
Michael Galea &
Marzio Pozzuoli
RuggedCom Inc.
Industrial Strength Networks

Introduction

Ethernet local area networks (LANs) are steadily gaining more acceptance in substation automation applications where the LAN has become an integral part of the protection and control system. Most protective relaying manufacturers now offer Ethernet ports on their relays in both fiber optical and copper media. Information models and exchange methods currently being defined as part of the IEC 61850 standard allow for real-time control (e.g. Trip/Block) messages to be sent across the LAN between relays or other intelligent electronic devices (IEDs). Furthermore there is a trend towards multicasting sampled data of current and voltage parameters over a 100Mbps Ethernet LAN as defined in IEC 61850-9-2 (Process Bus). With Ethernet LANs playing such a critical role in protection and control systems new standards such as IEEE 802.1W Rapid Spanning Tree Protocol which are used to implement network redundancy and ring architectures are of critical importance.

Background

Ethernet switches operate by forwarding traffic between their ports. The switch examines each Ethernet frame and records (learns) its MAC address and the port upon which it resides. When a frame arrives for a given MAC address, the switch "knows" on which outgoing port to send it. If a frame arrives and its destination MAC address is unknown, the switch will “flood” the frame out all of its ports.

If switches in the network are connected in a loop a ‘broadcast storm’ will result where a single broadcast frame will circulate endlessly. This condition consumes all available bandwidth on the loop making the network unusable. The Spanning Tree Protocol is used to prevent this situation.

Brief history of Spanning Tree Protocol (STP) and Rapid STP (RSTP)

The Spanning Tree Protocol (IEEE 802.1D) was designed to solve the fundamental problem of traffic loops. The key idea in STP is to prune (looping) links in order to reduce the network topology to that of a tree. The resulting tree “spans” (i.e. connects) all switches, but eliminates loops. The steps in order to best accomplish this process are:

1. Allow all switches to send messages to each other that convey their identity and link “cost”.

2. Elect a single switch, among all the switches in the network to be a “root”, or central switch.

3. Let all other switches calculate the direction and cost of the shortest path back to the root using messages received from switches closer to the root. Each switch must have only one "best" way to forward frames to the root.

4. If two switches servicing the same LAN exchange messages with each other, the one with the lowest cost to the root will service the LAN. The other switch will discard all frames received from that LAN, thus opening the link and blocking a traffic loop.

The STP protocol has proved to be the tried and tested method for providing path redundancy while eliminating loops. The STP protocol does suffer from a number of drawbacks that limit its applicability, namely:

- STP has lengthy failover and recovery times. When a link fails in STP, a backup link to the root requires at least 30 seconds to recognize that it is the best (or only) path to the root and become usable.

- When a failed link returns to service, information about the "better" route will instantly cause a backup link to start blocking. But the portion of the network below the link that is returning to service will be isolated (for about 30 seconds) until that link becomes forwarding.

- Another problem with STP is that it requires that all links must pass through a lengthy period of address learning, even if the link is a point-to-point link to a device such as an IED (e.g. Relay, RTU, PLC).

Enter RSTP (IEEE 802.1w)

RSTP solves STP's problem with failover time by a number of means. Whereas STP switches store only the best path to the root switch, RSTP switches store all potential paths. When links fail, RSTP has pre-calculated routes to fall back upon. Additionally, unlike STP switches, an RSTP switch will respond to another switch that advertises an inferior or incorrect route to the root switch. This information allows the switch with incorrect information to be rapidly trained.

RSTP solves STP's problem with lengthy recovery time by introducing a new procedure called proposing-agreeing. Proposing and agreeing works after a better path to the root is restored by “shuffling” the restored part of the network one hop at a time towards the network edge. This method also enables the network to come up quickly at inception.

RSTP also introduces a method for quickly bringing up ports at the edge of the network, while still protecting them against loops. If the port is designated as an “edge” type of port, RSTP will continue to send configuration messages out the port (in order to detect loops) but will allow traffic to flow as soon as the port rises. In the event of a loop, some looped traffic may flow before RSTP quickly seals the network. PC’s, IEDs and RTUs connected via edge ports can send traffic without the extensive delays imposed by RSTP.

Rings

A ring topology offers built-in redundancy and is often the most economical in terms of interconnection costs. Two popular methods of implementing rings are collapsed backbone and

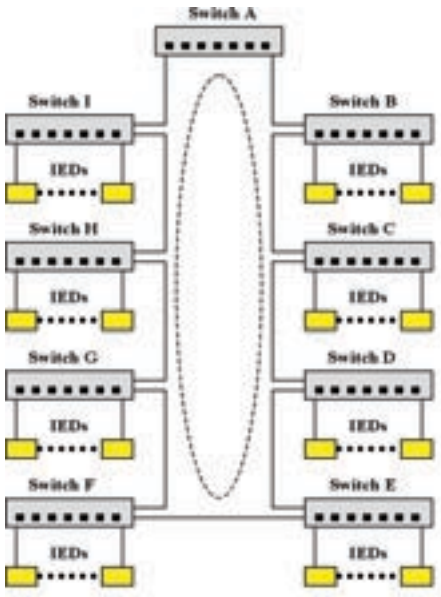


Figure 1: Simple Ring Architecture

distributed switch. The distributed switch method, or simple ring (**See Figure 1**), is employed when network connected IEDs are geographically distributed. The IEDs at each location are aggregated onto switches, which are organized into a ring. The connections between switches in the ring may be made using dual redundant links to obviate the possibility of failure at a fiber, connector or port level. The collapsed backbone method (**See Figure 2**) is usually employed when a large number of network connected IEDs are located in close proximity to one another. The IEDs are aggregated onto switches, the switches organized into a number of rings and all rings terminated in a common root node. Quite often the network topology is a mixture of both methods, such as a ring of rings. Traffic in a ring tends to be balanced. The ring

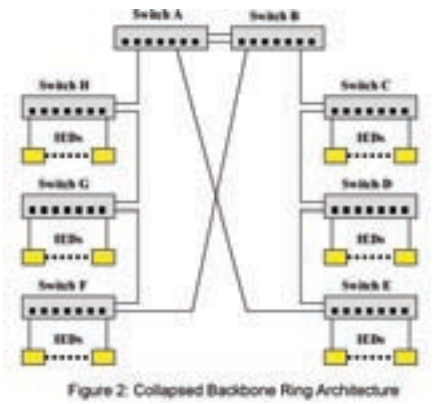


Figure 2: Collapsed Backbone Ring Architecture

will open itself with an equal number of switches on either side of the root switch given an odd number of switches in the ring.

Latency in ring networks tends to be greater than in tree networks (**See Figure 3**) as there are usually more hops to pass through in order to go anywhere useful. The worst case occurs when switches on either end of the blocked link at the "bottom" of the ring need to forward to each other. In this case traffic must flow through every switch in the ring.

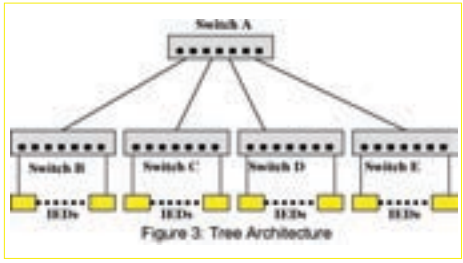


Figure 3: Tree Architecture

Ring networks offer only slightly slower failover and recovery times than tree networks. The worst case link failure in ring networks occurs on a port at the root. In this failure case half of the switches in the ring must retrain themselves to face their root port in a completely opposite direction after a link failure or recovery. The other half of the network must reverse the direction of transmission to switches in the failing half.

The size of the ring is in theory limited by the RSTP switch diameter, which assumes a pessimistic transit delay of one second per switch. In practice the maximum number of switches in an optimized ring occurs when the number of priority switch levels has been exhausted. This limits the size of the ring to 31 switches. Rings of more than 31 switches are still possible but will failover and recover in a slower fashion.

Failover Performance In Rings

Figure 4 presents a network of nine switches organized in a ring topology. The figure details the sequence of steps to heal the ring after the link between switches A and B fails.

Initially, switch B has information only about root switch A. All information about the root switch flows towards the break between switch E and F. After link AB fails switch B recognizes the failure and must concludes that it is the root switch, propagating the information towards C.

The information will continue to propagate around the ring until it reaches the portion of the network that is still aware a path to switch A exists (i.e. switch E).

Switch E propagates correct information towards switches D, C and B. Since these switches are changing the identity of their root ports, they must use the proposal-agreement process to achieve rapid forwarding.

Typically, each step in the process involves a protocol "think time" and a frame transmission time, the sum of which is less than about 3 milliseconds. This leads to a total failover time for the ring of about 27 milliseconds. There is also the time required to signal topology change to

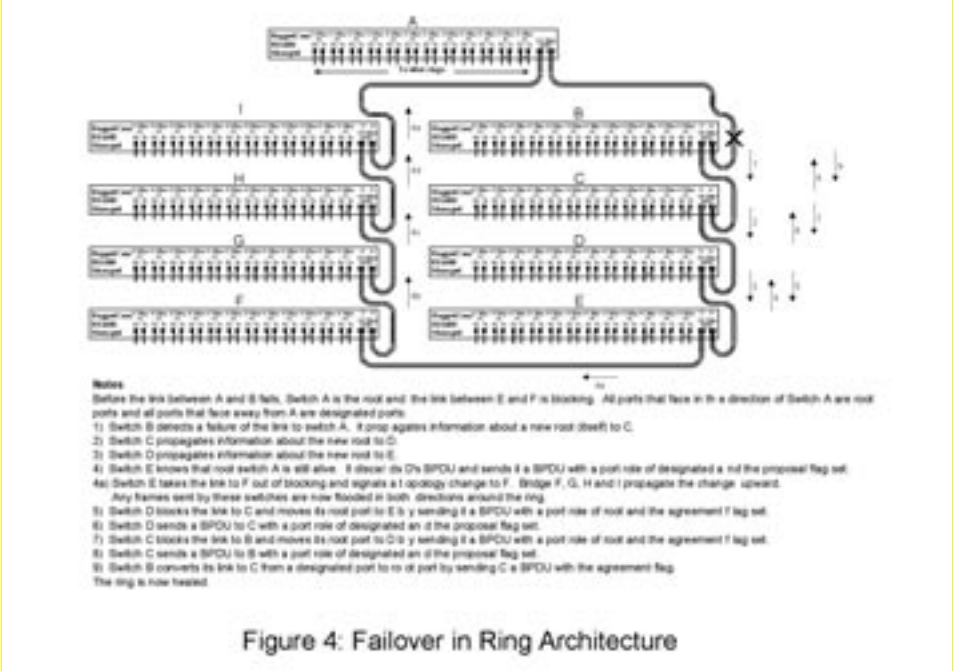


Figure 4: Failover in Ring Architecture

switches F-A. In this example the topology change time is interleaved with the failover process and does not contribute to the failover time.

The recovery process for this example is quite straightforward. When link AB is restored, switch A will transmit a BPDU down it. Switch B will change its root port towards A, and then signal a topology change. Switch B will propagate the new root information towards switch C. Switch C will change its root port and will train switch D. Switch D will train switch E. Switch E will attempt to train switch F but switch F will see a lower path cost from switch G and will discard the BPDU from E. At this point the network will be healed.

When switch A receives the topology change from B it propagates the topology change towards switches I-F. During the recovery process switch A will continue to forward a number of frames for switches B-E in the direction of switch I. At some point these frames will encounter a newly blocked link on switch C-E. Fortunately, switch A will use the topology change to start flooding frames, as will switches I through F. Switch A will lose about 2 milliseconds worth of frames, switch I 4 milliseconds, switch H 6 milliseconds, switch G 8 milliseconds and switch F 10 milliseconds worth of frames.

NOTE:

The performance levels were achieved using RuggedCom's RuggedSwitch™ family of managed switches employing RuggedCom's implementation of the IEEE 802.1W RSTP standard. Enhancements were made in the implementation to optimize performance for ring architectures while maintaining interoperability with other vendors.

Dual Link arrangement

Figure 5 presents two switches protected by a dual link arrangement, and the series of events that occur after a link failure.

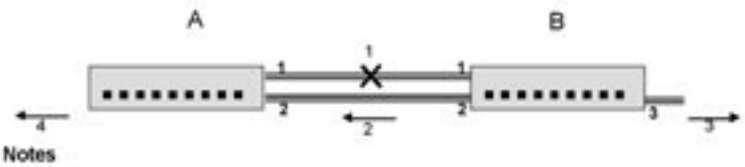
Both switch's detect failure of link 1 simultaneously and immediately age out the learned MAC address entries for these ports.

Switch B has been receiving periodic transmissions of Bridge Protocol Data Units (BPDUs)1 on link 2. This information allows it to evaluate link 2 as its best path to the to the root switch. Switch B immediately sets its root port to 2.

RSTP procedure requires a topology change when adding a path to the topology. Switch B "sees" the new root port as an added path and floods topology changes out its ports. Though not strictly necessary in this case, they cause no ill effects.

Including the time to recognize the link failure (an process that takes less than a millisecond) the switches failover to link 2 in less than 5 milliseconds.

The recovery process for this example is quite straightforward. When link 1 is restored, switch's A and B will transmit BPDUs on it. Switch A will ignore the BPDU from switch B. Switch B will use the switch A BPDU to place its link 2 in blocking and then change its root port towards A. Afterwards, switch B will signal a topology change to switch A. At this point the network will be healed. The recovery process introduces an outage of less than 5 milliseconds.



Notes

Before the link between A and B fails, Switch A is the root and link 2 is blocking at B. Both of A's ports are designated. Port 1 of Switch B is root and port 2 is an alternate.

1) The link fails.
2) Switch B transmits a BPDU to A on link 2 signifying it has c hanged it's port role from Alternate to Root. Switch B places the link in the forwarding st ate. At this point connectivity is restored. The BPDU also has the topology change bit set.
3) Switch B issues BPDUs with the topology change bit set to any of its designated ports
4) Switch A issues BPDUs with the topology change bit set to any of its designated ports

Figure 5: Dual Link Failover

NOTES:

1 – BPDU (Bridge Protocol Data Units) messages are used by managed Ethernet Switches on the network as defined in the IEEE 802.1W Rapid Spanning Tree protocol.

Conclusions

- RSTP may be employed effectively in tree type or ring type network architectures to provide redundancy and fault-tolerance.
- Practical rings should be limited to 31 switches.
- A useful rule of thumb is to budget 3 milliseconds of recovery time for every switch in the ring (based on RuggedCom's RuggedSwitch™ performance).
- Dual link arrangements (where one link serves as a hot standby for another) provide rapid failure recovery, typically in less than 5 milliseconds (based on RuggedCom's RuggedSwitch™ performance). ■

About the Authors:

Michael Galea is a senior software developer at RuggedCom Inc. which designs and manufactures industrially hardened networking and communications equipment for harsh environments. Prior to joining RuggedCom Mr. Galea was involved in the development of Frame Relay/X.25 Switches and IP/IPX Routing/Bridging technology. Mr. Galea graduated from the University of Toronto, Toronto, Ontario in 1983 with a Bachelor of Applied Science degree.

Marzio Pozzuoli is the founder and president of RuggedCom Inc. which designs and manufactures industrially hardened networking and communications equipment for harsh environments. Prior to founding RuggedCom Mr. Pozzuoli developed advanced numerical protective relaying systems and substation automation technology. Mr. Pozzuoli graduated from Ryerson Polytechnical Institute, Toronto, Ontario in 1986 with a Bachelor of Electrical Engineering Technology. He holds multiple patents related to advances in communications, protective relaying technology, and automation technology. He is also an active member of the IEEE and is involved standards work as a member of the IEEE Power Engineering Society Substations Committee task force C2TF1 working on developing a standard for communications networking devices in substations.

References:

1. *The Switch Book, Rich Seifert, Wiley*
2. *ANSI/IEEE Std 802.1D, 1998 Edition*
3. *ANSI/IEEE Std 802.1W, 2001 Edition*

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By:
Carl Potter
Potter & Associates International, Inc.

Make Safety a Personal Thing

Frankly, safety is a personal thing. Throughout my career I have observed companies trying to determine why their accident rates are high. To lower the accident rates, they hold safety meetings and more safety training programs. Moreover, they conduct team building sessions hoping to improve team work that will result in a safe work team. All of these are important, but they are not the most significant contributors to a safe workplace.

What is the number one contributor to a safe workplace? It is each and every worker's personal involvement in and commitment to workplace safety. It is what you and everyone you work with does – or does not do – to promote personal safety. It's about having a Safety Mind. One of the most powerful ways to increase personal safety is to be an example. People will tend to follow those who "walk their talk," and not those who just talk. Walking the talk is the mark of a true safety professional.

What actions can you take to become a "safety professional?" You must (1) Get involved in promoting a safe workplace, (2) Be committed to learning and (3) Exhibit safe behavior to create your own Safety Mind.

1. Get Involved

How involved are you in your company's safety processes? Do you consider yourself a "safety professional?" These are just a few questions to ask yourself to determine if safety is a personal thing for you. No matter how you answer the question, you are involved in safety. Being involved may mean that you are merely a statistic. Yep, like it or not, you are involved. If you work safely, then your safe behavior has a positive effect on the overall safety of your company. If you have a workplace accident or even a near miss, you impact those around you and your company's safety statistics. Furthermore, if you have a fatal accident or a life-changing accident, there is a dramatic effect on you, your family and your fellow workers. That is why I constantly tell people that OSHA's safety guidelines are written in blood. OSHA guidelines come about because of safety trends. I'm sure you would rather be a part of a positive trend than a negative one.

Creating a safe workplace is impossible without the active participation of everyone in the organization. This is the reason there must be a constant effort to create and maintain a workplace environment of trust, one in which every person is encouraged to speak up about safe work practices and contribute to the overall well-being of the organization. Such an environment promotes each worker taking personal responsibility for safety.

I worked for several years with an individual who demonstrated how one worker can personally influence a safe work environment. Mike was a first line supervisor who ran a construction crew. My job called for me to show up on his job site to check out newly-installed equipment. When you arrived on Mike's job site, you had to be ready to be safe or you were going to hear about it. Many times I heard, "Get that hard hat on." Mike's interpersonal skills left a lot to be desired. But Mike didn't care if you were the CEO or a college intern. If you were on his job site, you were going to be safe. If Mike had taken the time to learn how to communicate his message better, he would have been an even more effective safety leader. Because Mike was consistent and sincere and because he led by example, his message was taken seriously. Everyone knew that safety was a personal thing to Mike.

What is your attitude about safety at your job site? Are you constantly on the watch for unsafe working conditions? Is your personal safety attitude limited to the job site? For example, what is your "safety attitude" when you

are shopping in a grocery store and see a slippery hazard on the floor? How you handle safety on and off the job site is a measure of your personal safety attitude. Safety professionals behave in a safe way, encourage trust in the organization and take a personal interest in others' safety. In addition, they are constantly learning.

2. Be committed to learning

How do professionals become professionals? They study. They learn. If you need open heart surgery, would you want a doctor who learned how to operate by just showing up to watch others? What if that doctor depended on others to tell him what to do? I bet you would rather have a doctor who is constantly learning everything he or she can about the most up-to-date techniques and procedures for successfully performing open heart surgery and one who applies what he is learning. In the same manner, would you trust your workplace safety to everyone else knowing that they may not know everything they need to know? I can't encourage you enough to read and learn your organization's safety procedures. They have been created for you and for your safety. It is up to you to know them and apply them – every day.

When I began working at a utility company in 1977, my boss handed me two things – a yellow safety book and a piece of paper. The yellow safety book was full of safe work procedures and safety guidelines. These were created from the accidents, injuries and mistakes of the workers who came before me. I was asked to sign the piece of paper that said that I had read and understood all the pertinent safety rules. Ha! What a deal! I didn't have to read it, I just had to say that I had read it! A better attitude would have been for me to realize that those rules were there for my safety and the safety of others with whom I worked. I would then have been more attuned to the importance of learning and applying the rules and guidelines.

First and foremost, learn the safe work procedures detailed in your safety and training manuals. Safe work procedures that have been developed by your organization and industry are the result of the knowledge and experiences of others. As I mentioned earlier, most of the safe work practices, guidelines, rules and regulations are written in blood. Make sure that your blood is not used to write the next one.

I have attended many a boring safety meeting. Most often we just took turns reading the safety guidelines. However, just like in Sunday School, often the words went in one ear and came out the other. If you want to be a professional in your industry and live a long successful career, learn all you can about your job's safe work procedures. Encourage safety meetings and briefings that engage and teach. Find ways to help yourself and others learn the procedures.

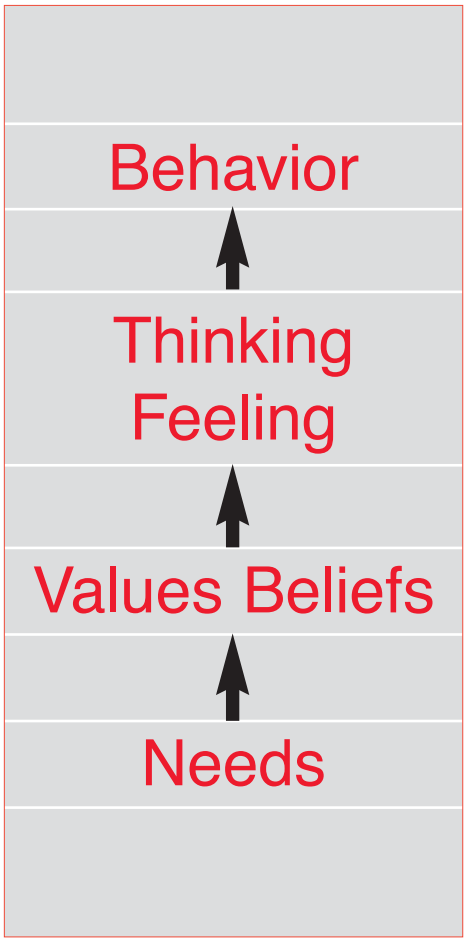
Being a professional is to take personal responsibility to "Learn, Learn, Learn!" One way to do this is through teaching or instructing. Instructors, teachers and safety professionals learn because they are accountable for the learning of others. Always remember, whether you are formally teaching or not, others are always watching and learning from your example.

3. Exhibit safe behavior to create you own safety mind

Actions that are observed by people are known as behavior. Behavior is like an iceberg floating in the ocean. What is showing or can be seen is the tip of the iceberg, but what is below the water line causes the whole iceberg to move or react to the surrounding environment. Outward behavior is like the tip of an iceberg. There is much under the surface that affects a person's behavior. A person's behavior is affected by five things that are not seen: what they think and feel about something, what they value and believe about it, and what their need is at the time. So if a person acts or behaves unsafely, what are they thinking, feeling, valuing, believing or needing?

I observed an employee who was checking the voltage at an electrical cabinet, and he was not wearing electrically insulated gloves. This is an unsafe act. I observed another employee parking a company vehicle. Instead of backing into the designated parking space, the driver just pulled into the space, ran inside the building to retrieve some material and then jumped back in and backed out without doing a walk around. This is another observed unsafe behavior. Every hour of every day we can observe different tasks being done unsafely. Do the people doing these unsafe acts know better? Yes, they do in most cases. Then why do they behave this way? What can be done to change the behavior? What would safe behavior be? To deal with these questions we have to explore what causes behavior, both safe and unsafe.

Behavior is the activity that can be seen by others. Each job or task has a safe behavior tied to it. Consider safe vehicle operation. One of the safe behaviors for operating a vehicle is the use of seat belts. When I worked for the utility company a new seat belt rule came into affect. "Wear your seat belt when operating a company vehicle. If you don't, you will be disciplined." In an attempt to get his employees to behave and wear seat belts my boss would tell us to "do it… or else!" This became a challenge to many of us. Personally, I would "make it click" while I was on company property and then release the buckle as soon as I was off company property. Why? Because I didn't think I'd have a wreck! I thought, "It will never happen to me." My feeling was the company was imposing a rule on me that was my choice. Seat belts didn't have much value to me. If I did have a wreck, I believed I would be trapped and unable to get out of the vehicle if there was a fire. I didn't have a need to wear seat belts. However that has changed. For years I have worn my seat belt when I am in a moving vehicle. Why? Because the safe behavior of wearing my seat belt has become a result of what I think and feel, value and believe, and need. What changed?



Creating Your Safety Mind

There is no way to guarantee that an employee will not be injured in an accident. However, each individual can decrease the possibilities of injury by becoming individually accountable for safety. The key is personal action. How will you act toward safety? How will you talk about safety? How will you perceive your industry safety standards? What will you personally do about safety on and off the job? Will you create your own safety mind?

No one can make anyone accountable; it is up to the individual. Accountability comes when you set standards for yourself. When you begin to involve others who can hold you accountable, your awareness is raised. Professional sports athletes are held accountable by their coaches and other teammates. Additionally, they sign a contract that holds them accountable. What if that same accountability were to be used in the development of your safety mind?

Companies spend many thousands of dollars each year to equip and train the workforce. It is the responsibility of each employee to put the equipment and knowledge to work. When personal responsibility is put into action, accidents and injuries will decrease. What can you do to create your own safety mind? ■

About the Author

Carl Potter is a Safety Professional who works with companies that want to put safety first in the minds of their employees so that everyone can go home every day without injury.

I don't remember the name of the speaker, but a company I worked for purchased tapes produced by a former California Highway Patrol officer with a passion for getting people to wear seat belts. I watched one of his videos for the third or fourth time when I decided to change my behavior. The speaker said that racecar drivers never intend to have a wreck, but they wear their seat belts so that they can remain in control of the vehicle during an emergency. I began to think, "Hey that's a good idea!" My feelings changed because I began to feel that it wasn't a rule, but a good idea to wear my seat belt! This same speaker talked about and gave examples of situations where seat belts would have saved lives and instances when seat belts did save lives. It was then that the value of seat belts became clear. In addition, my belief about seat belts changed. My needs were met when I realized that I could live through a wreck if I wore my seat belt and if I remained in control of a vehicle, a wreck might be avoided.

Unsafe behavior will change not because of a new rule, but as a result of a change in the way a person thinks, feels, values, believes and in their understanding of how safe behavior can fill their needs.

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Louisville, KY

September 23-25, 2003

Seminar Agenda

Tuesday, September 23, 2003

What Now for HDD?

The telecom bust and economic downturn have severely hurt the horizontal directional drilling industry. But directional drilling is here to stay, and it's taking new paths. The key to the future for HDD is diversification. There still is telecom work to be done, but other established utility markets provide continuing demand, and new growth markets offer opportunities for small and large diameter work. This session explores the evolving HDD market and what it will require to be successful in the future.

Overhead Transmission Assessment and Inspection Methods and Guidelines

New EPRI guidelines are aimed at consistency of approach when inspecting overhead transmission equipment and assessing maintenance needs in order to optimize the operation, reliability, and life of overhead transmission lines. Another major objective is developing a comprehensive program to improve training of personnel. This timely seminar explains content of the guidelines.

Cutting-Edge Tools for Managing Equipment Fleets

Today's technologies allow equipment owners to plan ahead to utilize their machines smarter, faster, more productively, and safer than ever before. This session will cover the latest GPS, wireless data collection, and commercial software systems available to fleet managers. The link between better field productivity and increased up-time will be addressed as well as understanding how to reduce overall vehicle and equipment costs.

Preventing Damage to Buried Utilities

Recent changes in one-call procedures and other programs are making locating and marking buried utilities easier and more accurate. Some of the most significant developments include three-digit dialing to connect callers to One-Call agencies, publication of one-call statistics, and establishment of regional Common Ground Alliance partnerships. Find out how these programs and the initiatives of the national Common Ground Alliance are helping protect our underground utility infrastructure.

Wednesday, September 24, 2003

Locating, Potholing, and Mapping for Subsurface Utility Engineering

Owners of major projects are turning to SUE to avoid utility conflicts and eliminate costly damage and construction delays. Locating existing utilities, including visual confirmation by potholing with soft-excavation equipment, and accurately mapping buried infrastructure, are critical elements of the process. Representatives of the Port of Seattle and a locating contractor explain how the work is being done at Seattle-Tacoma International Airport.

Installing Special Overhead Conductors

ADSS, SSAC, T-2, and other special conductors require uniquely different installation techniques. Take advantage of this opportunity to get updated on the specialized tools and equipment to properly install these conductors, and hear about provisions of the latest IEEE guide covering their operation and maintenance.

HDD Makes the Grade for Sanitary Sewer Projects

The sewer market is considered a primary growth area for the directional drilling industry, but the requirements for making on-grade installations for gravity-flow sewers are much more precise than most other HDD applications. What does it take for a HDD contractor to succeed in this specialized market? zWhat information do contractors need in order to educate project owners about the benefits of directional drilling? Get the answers at this informative session.

The secret to making the right equipment purchase is in the ICUEE Advantage…

It's feeling the precision of the power, the hum of the horses, the effortless operation. It's comparing metal to metal, testing the toughness by your standards. It's the increased efficiency, the decreased downtime. It's the smirk and swagger at the end of the day, "I did the demo, I purchased my way."

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That's right. Manufacturers will allow you to climb aboard and prove to yourself if their equipment is the right fit for your fleet.

Registration is now open!

Seminar Agenda (Continued)

Erosion and Sediment Control Rules and Regulations: What Contractors Need To Know

Learn what is necessary to comply with recently-enacted Phase II regulations for storm water on construction sites, including permitting and documentation. This session, conducted by the International Erosion Control Association, explains what has changed with the new regulations, who regulators hold responsible for compliance, and what erosion and sediment control inspectors look for.

Thursday, September 25, 2003

Recovery of the Telecommunications Industry... When Will It Happen?

What Will It Mean for Contractors and Suppliers? Suppliers and contractors who depended heavily on telecommunications construction during the booming '90s, continue to suffer the effects of the telecom meltdown. Is recovery finally on the way? How will consumer demands impact new installations? Who will be the major players? What are the prospects for outside plant construction? An expert industry analyst provides insight to these and many other questions about telecom's boom-to-bust to build-again environment.

The Vacuum Excavator... Utility Construction's Multi-Purpose Construction Package

Vacuum excavators have become standard equipment on many directional drilling sites for removing excess drilling fluids and digging potholes with their soft-excavation capabilities. Now it is clear that these systems' value extends far beyond drilling projects. They add value to equipment fleets with their ability to serve many markets, including sanitary and storm sewers , plumbing, natural gas, landscaping, and many others. Learn about the scores of utility, industrial, and commercial applications vacuum excavators are performing

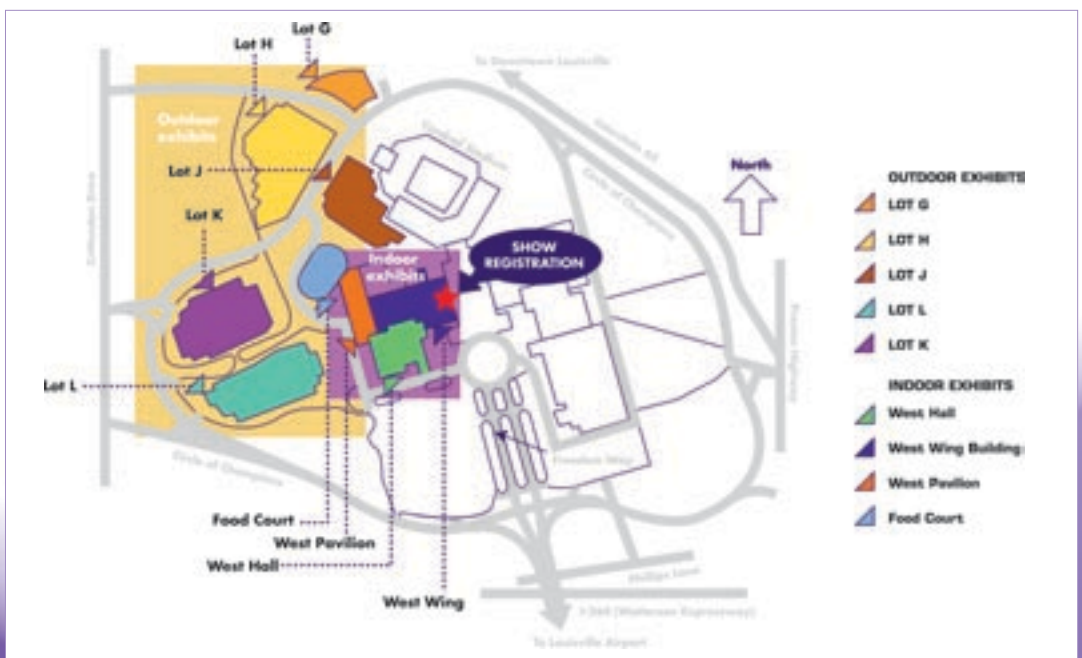
Safety Equipment and Protective Gear

Safety devices protect workers on aerial jobs; safety clothing and gear provides flash protection and reduces the risk of injury from other hazards; barriers and traffic control equipment protect both construction workers and the public. Hear about the latest safety products at this panel session.

Changing Options for Leasing Equipment

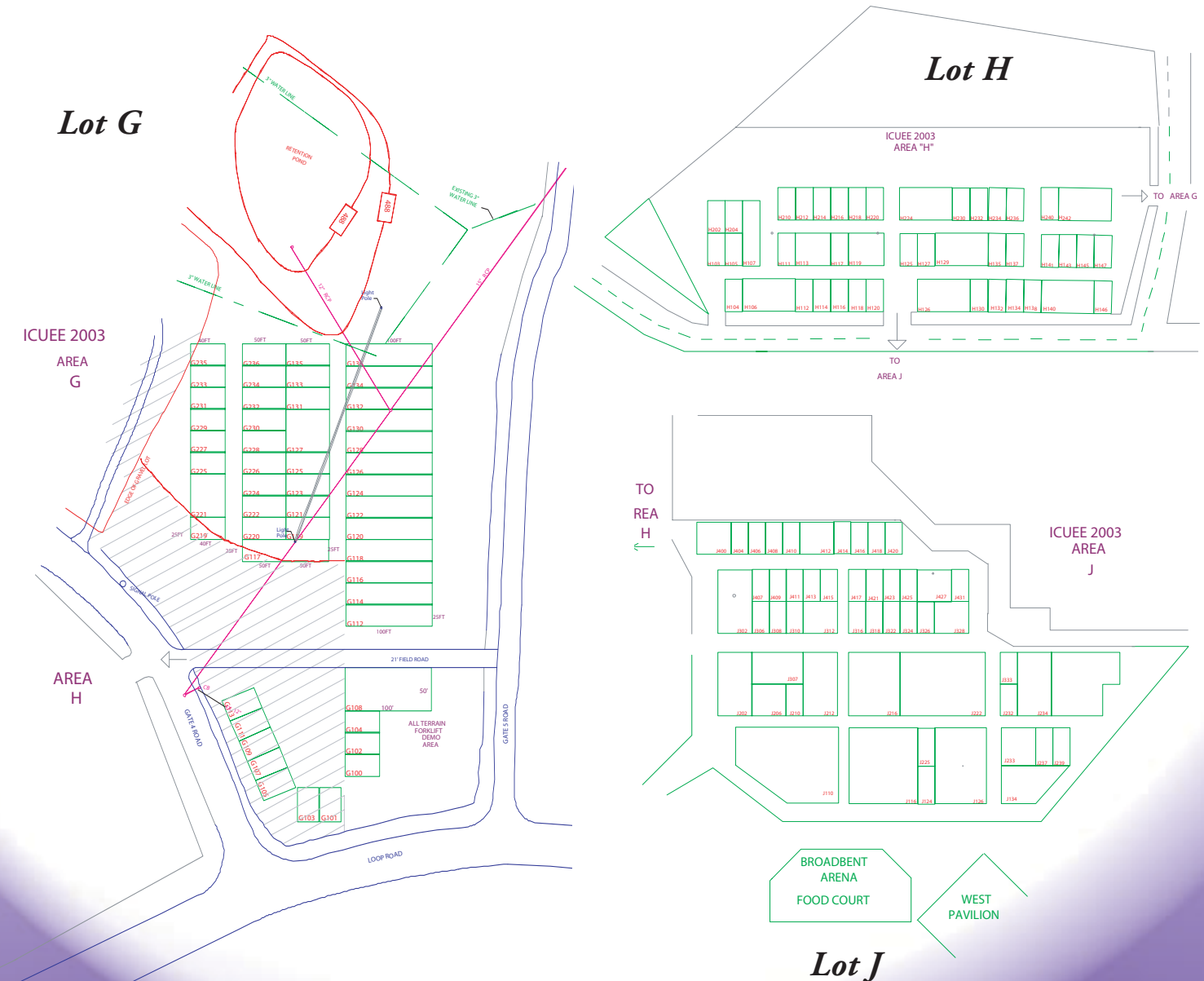
Why are large corporations leasing construction equipment with increasing frequency? Leasing offers some attractive tax advantages and provides job-specific equipment solutions. Leasing makes sense for small- and medium-size contractors, too. Learn what leasing options are available and the questions to ask to help select the best deal for your situation.

Outdoor Exhibit



Outdoor Exhibit

Overhead



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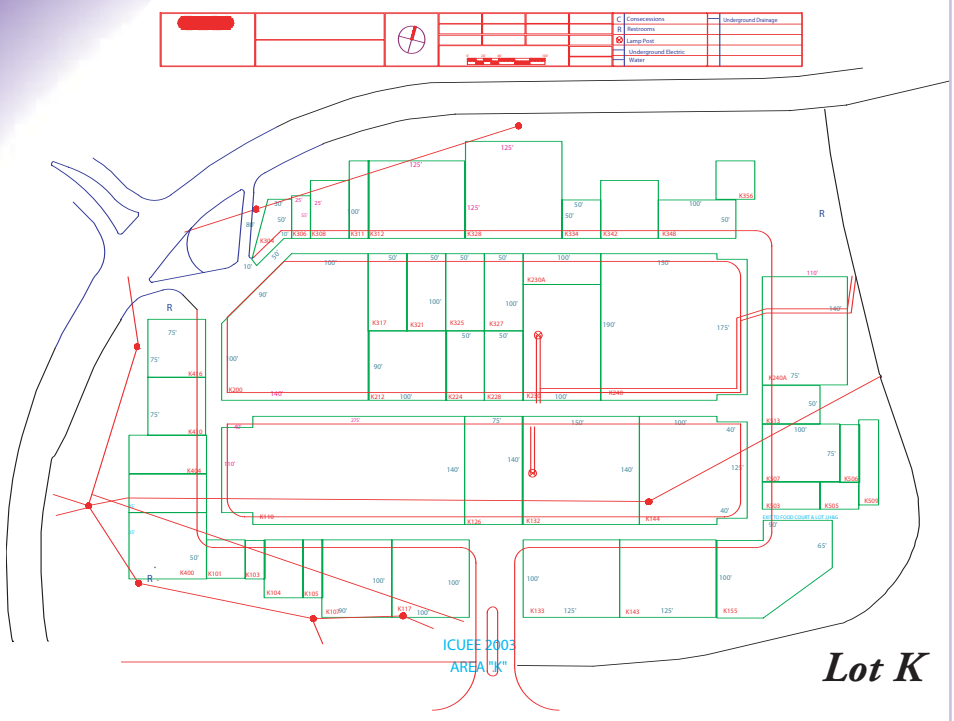

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ABS National Auto Services Inc	619
ADB Company	541
ADI Hydraulic Pruning Tools, Division of TOL Inc	1521
Adrian Steel Company	L236
AEM-Milwaukee	3006
AEP (American Electric Power)	3015
AeroLift	L282
AG Tracks Inc	H140
Aircraft Dynamics	L125
Akkerman Inc	G108
Alaskaug Inc	K224
Alcoa Conductor Accessories	H220
Alliance Equipment Company Inc	527
Allied Construction Products, LLC	K342
Allison Transmission	L126
Allmand Bros Inc	K317
Altec Industries Inc	L263-L321
Alturnamats Inc	1311
Aluma-Form/Dixie	1721
Alum-Line Inc	L356
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ArmLift Div of TG Industries Inc	J302
ARNCO Corporation	L241
Arnco SuperFill	747
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ASA Hydraulik of America	3344
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Asphalt Zipper Inc	L120
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Braden Winch	1835
Brand FX Body Company	L143
Brand Hydraulics Co	3024
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Bronto Skylift	J234
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Cembre Inc	1259
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Clifford Mfg Inc	1244
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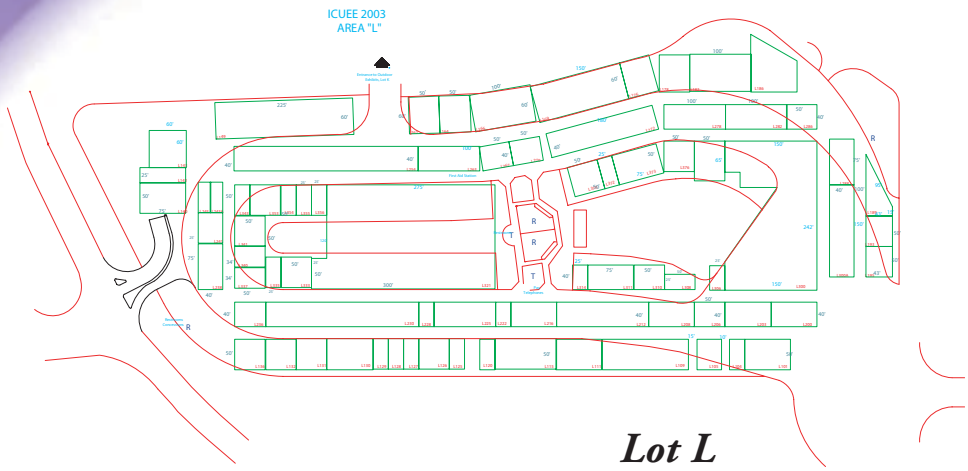
Outdoor Exhibit



Lot L

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CommScope	3250-G220
CommScope	G220
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Conduit Repair Systems Inc	820
Condux International Inc	L193
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Connectra Fusion Technologies LLC	1850
Construction Equipment Guide	1406
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Contemporary Products of Texas Inc	841
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Cooper Hand Tools	1514
Cooper Power Systems	1715
CR Brophy Machine Works Inc	529
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Custom Composites Inc	1606
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Cyndrus Inc	1620
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Danzer Industries	J431
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Elastometall Kentucky LLC	3444
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Fleet Electrical Service Inc	L228
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Flo Draulic Inc	3127
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GFI Inc	956
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Ground Heaters Inc	3230
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Williams Machine & Tool Co/ Energy Mfg. Co TEXTRON Co.	1142
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Indoor Map

ICUEE 2003
Indoor Exhibitors

September 23-25, 2003
Kentucky Fair & Expo Center
Louisville, Kentucky

Lightning Protection and Weather Forecasting:

How the Two Work Together

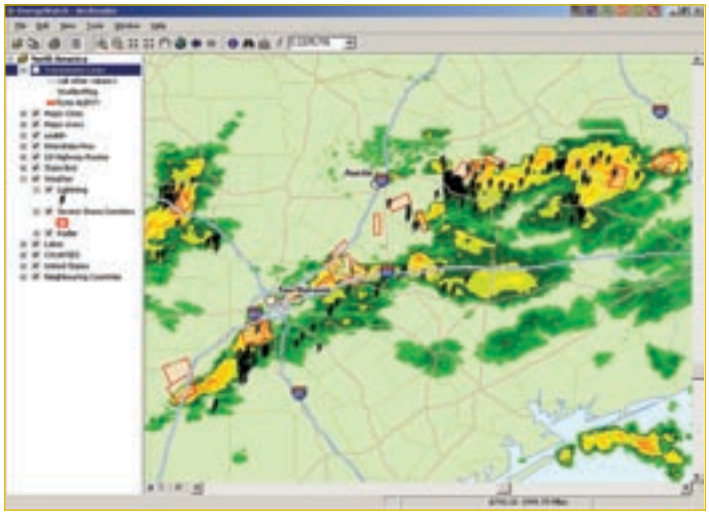
By:
Rich Wilson
Director of Energy Services
Meteorlogix

Predicting Lightning and Weather Information: Then and Now

Lightning results when rising and descending air within a thunderstorm separate positive and negative charges. Water and ice particles affect the distribution of the charge, with lightning resulting from the buildup and discharge of electrical energy between the positively and negatively charged areas.

Science started seriously studying lightning in the 1960s with the advent of the space program. Properly understanding lightning was necessary in order to help protect passengers and crewmembers from electrical damage. Just as it is important to protect passengers and crewmembers in space from lightning, it's equally important for electrical utilities to protect its employees and business assets from lightning activity.

In the past, when an electrical utility wanted to predict weather events such as lightning, utility managers had to keep an eye to the sky and look to recent history in order to generate a prediction. Today, with the help of new and improved satellite technology, NEXRAD radar and (GIS) Geographical Information System systems, electrical utility mangers around the world are receiving complete lightning and weather solutions. With these advances in technology, utility managers can now receive customized lightning information,



up-to-the-minute weather forecasts and targeted weather alerts which draws their attention to developing weather conditions that have the potential to impact their service area. If lightning poses a threat to your transformers or power lines, a state-of-the-art weather system can help you pinpoint where a problem may occur and thus help you reduce the time it takes to get service back up and running. The proper weather forecasting system can even take a utility one step further, helping to budget and plan ahead by looking at energy consumption levels and predicted use.

Since an electric utility's primary responsibility is to deliver energy while keeping service interruptions at a minimum for its customers, major weather events like lightening, heavy storm systems, tornadoes and ice all stand to increase a utility's susceptibility to power outages. Deregulation provides extra incentive for a utility to do its best to keep energy use constant and customers satisfied. To be able to do this, electrical utilities need to quickly dispatch crews to repair power lines after lightning events and reduce power outage times before customers begin to seek out other providers.

Keeping Crews Safe and Service Constant

Proactive weather planning allows for the adequate staffing and positioning of repair crews and supplies in time for lightning strikes and severe weather. Having advance notice of potential lightning activity and large – scale weather events also helps utilities protect the safety of their crews from exposure to hazardous working conditions. That advance knowledge also saves the company money in areas like paying for medical costs, disability insurance and potential lawsuits should severe weather injure an employee.

Forecasting For a Positive Budget

Accurate and timely weather forecasts are crucial in assisting utilities plan for appropriate load allocation. Sudden changes in temperature and the rapid development of high-impact storms can disrupt even the best-made plans. To assist in estimating load allocation, seasonal weather information should be utilized on a consistent basis to help a utility keep costs under control. Purchasing electrical cable for power lines and utility poles and obtaining climate trend information all can be done to help a utility prepare ahead of time for the "where" and "when" of lightning and severe weather. This type of planning directly translates into cost savings. A utility that saves five or ten percent in their budget might find that it equates to hundreds of thousands of dollars in savings.

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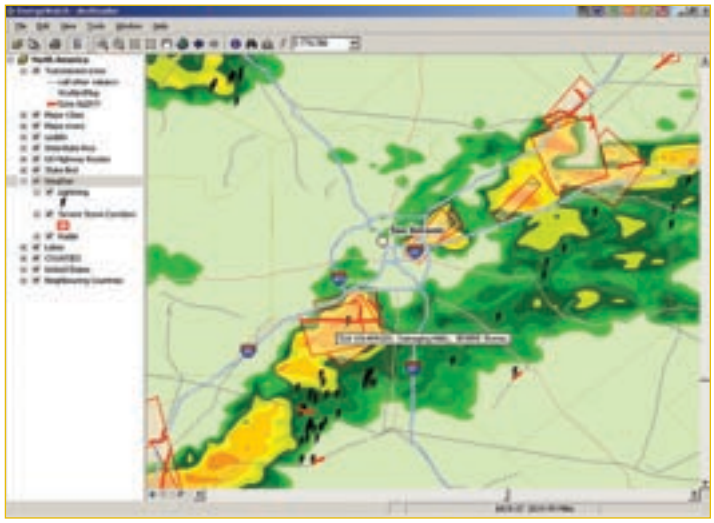
Utilizing weather systems also allows an electric utility to plan for more immediate weather concerns. With proper weather information and enough advance notice, a utility can either mobilize an entire service area – or a portion of that area – that's expected to be hit the hardest. Then, as severe weather develops, the utility can send poles, lines and crews out ahead of the storm. Advance weather information also can help a utility predict how much overtime it will need to pay employees. The end goal is always the same – restoring service to customers faster, while keeping employees safe and working efficiently.

Forecasting and Load Accuracy

Load forecasting is critical for utilities. Especially when you figure that 20 percent of all weather makes up 80 to 90 percent of a utility's revenue. Properly forecasting for a utilities' needs entails looking at the amount of energy a utility estimates that it will use, and then factoring in what it can produce in-house and what it needs to buy on the market from other utilities. Utilities should evaluate their needs upon weather information, looking at weather patterns on a seasonal basis, and weekly basis as well as daily and real-time.

Weather forecasting also has a direct impact on load accuracy for electric utilities because even a two-degree change in temperature can have a substantial impact on load. By paying close attention to customized weather, energy traders can help ensure there is an adequate energy supply to meet demand or decide ahead of time that they should be looking to the market to either purchase more energy or sell their excess.

Meteorlogix, the world's largest commercial weather services provider, generates timely, accurate weather information that enables electric utilities to manage weather-related power outages, work more efficiently and stay profitable. To assist in making these types of important decisions, a weather system such as Meteorlogix's MxInsight EnergyWatch™ is employed. The weather system is displayed on an easy-to-use PC format that delivers real-time, GIS-enabled weather data showing weather information such as lightning strikes, areas of high wind, ice and snow.



Where Lightning and Weather Detection Information is Headed

The MxInsight EnergyWatch weather system is a good example of the type of next generation weather tools that are now available for electrical utilities. While no existing weather systems can predict lightning before it happens, MxInsight EnergyWatch is a complete solution for outage management and GIS mapping. The system combines GIS weather data and decision support tools designed for managers of utility companies. MxInsight EnergyWatch allows utility managers to integrate up-to-date weather information into their own operational maps, thereby seeing in real-time a utility's stationary and mobile assets and the current weather that's occurring.

One example of an electrical utility that has embraced GIS technology is the Tennessee Valley Authority (TVA). TVA is one of the largest electric power providers in the country and serves Tennessee and parts of Georgia, Alabama, Mississippi, Kentucky, North Carolina and Virginia. TVA has successfully utilized GIS capabilities to map all of its power lines. As a result, utility managers at TVA can access information on a specific pole based upon location coordinates. GIS-based information then provides the utility with an actual photo of the pole and a history of its maintenance work, finds the current temperature and determines its height. Then, if severe weather is expected to have an impact, the weather system provides TVA with an automated warning when severe weather is within a mile.

The true benefit of working with a complete weather solutions provider is the ability to integrate the information into areas that expand beyond weather. A utility based in South Carolina uses GIS capabilities to automatically reserve hotel rooms for its utility crews during hurricane season. Area hotels are mapped into the GIS system based upon their latitude and longitude coordinates, and when the surrounding climate meets severe weather criteria, the system automatically reserves a predetermined number of hotel rooms located just outside the eye of the storm.

Complete and Customized Weather Solutions

By using real-time, customized weather information, electrical utilities have the opportunity to select their own parameters and receive targeted weather information. That being said, electric utility managers should focus on choosing a weather provider whose capabilities include lightning alerts, GIS interfacing, storm forecasting and the ability to produce both short-and long-range forecasts. Look for a weather provider that has a staff of trained meteorologists on hand who have access to advanced computer models, therefore ensuring that forecast information is as accurate as possible. The weather tools you employ to manage lighting events and forecast load allocation will directly translate into bottom-line successes. ■

About the Author

Rich Wilson is the director of energy services at Meteorlogix, the world's largest commercial weather services provider. Based in Minneapolis, the company provides weather solutions to help customers oversee weather-related business risks, maximize personal safety and minimize financial loss. Meteorlogix serves leading electrical utilities including: Tampa Electric, Excel Energy, Wisconsin Electric, Tennessee Valley Authority and NSTAR. Meteorlogix serves more than 22,000 customers with a focus on public safety, broadcast media, transportation, energy and aviation industries. Additional information about Meteorlogix can be found on the Web at www.meteorlogix.com.

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Transmission & Distribution Information System:

Improving Performance through Widespread Access to Real-Time and Historical Information

"You can only improve what you can measure."

As true as that oft-heard maxim might be, it's important to remember that there are two key elements to the measurement. One is the ability to capture the data being generated by your processes. In the power generation and transmission businesses, there is no shortage of control and data acquisition systems for doing just that. But the other vital element is the ability to distribute and quickly interpret that data for timely action.

(After all, you can't improve what you can't act upon).

Portland General Electric (PGE) was faced with such a problem several years ago. While our legacy energy management system was generating the data we needed, the mainframe computer we used to store historical data had become a roadblock to improvement. Few of our employees had the skill to extract data from the system, thus creating inefficiencies and reliance on estimates for decision-making.

In response, PGE has created a Transmission and Distribution (T&D) Information System capable of serving up both real-time and historical information to users throughout the company. While only three years old, the PI System has yielded numerous benefits for PGE and is rapidly growing to meet user demands.

PGE is Oregon's largest utility, serving more than 740,000 residential, commercial and industrial customers in Portland, Salem and 49 other surrounding communities. The company employs more than 2,700 people. In addition to owning 2,000 megawatts of generating capacity, the company has approximately 26,000 miles of transmission and distribution lines and related infrastructure.

Approximately four years ago, PGE decided to improve its methods for distributing and using the massive amounts of information generated in the operation of its T&D system. While some of the capabilities were available in our ABB EMSYS energy management system (EMS), we recognized the need to establish a separate system that included a comprehensive historian as well as applications that could utilize both real-time and historical data from the EMS and other systems used in our daily operations. We decided to implement a system based on OSI Software's PI System, a well-established information management infrastructure that turns operations data into a powerful corporate asset and which enables real-time performance management. PI acquires data from automated control systems or other sources and makes it available for interpretation and real-time dissemination through a set of powerful performance-management applications.

Since we established the system, which today has more than 100 users, it has grown from 1,000 tags to more than 16,000 tags, representing virtually every facet of our T&D system. While the PI System draws data from multiple sources in our T&D system, in this paper we will describe the structure, applications and benefits associated with the data obtained from our EMS.

OSIsoft's PI database server resides on a cluster of PCs located at our headquarters in downtown Portland. PI scans the EMS every 30 seconds for data from approximately 100 PGE substations.

The PI server is the data source for five applications:

- PI AlarmView – An application that summarizes PI Alarm server information and displays this data in a hierarchical tree structure to any number of clients, onsite or offsite.
- PI ProcessBook -- A graphics package that allows users to create interactive graphical displays populated with real-time PI data.
- PI DataLink – An application that allows PI to access and deliver data to and from spreadsheets and reporting programs.
- PI System Management Tools — A set of applications to administer the PI System from client PCs.
- PI ODBC – Used to access data from the PI point database to synchronize it with the EMS database.

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Before we could implement any applications on top of the PI System, we first had to establish a database on the PI server. We accomplished this using the PI System Management Tools, which enabled us to create tags and link them to the EMS system. Whereas tags in the EMS can only be 30 characters long, the PI database is much more flexible, allowing longer, more descriptive tags. As a result, we developed a highly structured tag-naming system that facilitates quick identification of company assets.

Since the tag database in the EMS is in constant change, we also developed an automated system using ODBC that enables ongoing synchronization of the EMS and PI tag databases.

The initial applications we established were aimed at assisting PGE distribution field engineers, planning engineers as well as our own SCADA engineers. We later added alarming applications aimed at improving our maintenance activities. Our goal was to provide these users with accurate, detailed, real-time and historical information on the state of our T&D infrastructure and usage so they could quickly act to prevent potential problems, resolve problems that already occurred and accurately plan for future T&D system improvements. Using PI ProcessBook, we spent about a 1 1/2 years designing displays so users would have easy access to precisely the information they need without the clutter and distraction of unwanted and unneeded data. Listed below are some of the applications we created to benefit PGE, our employees, and our customers.

• **Equipment Loading –** Like any utility, PGE strives to maximize equipment utilization factors without causing overload conditions that could shorten the life expectancy of our equipment. Consequently, establishing a system whereby we could be aware of the real-time loading of our equipment was a top priority. We designed a series of one-line diagrams containing all of the critical operating data at each substation, including megawatts, megavars, mva, phase currents, bus voltages, ambient temperatures, etc.

In addition to acquiring and displaying the directly measured values, we also used them to create calculated values which have proven extremely useful. For example, we calculate the percent loading for each transformer and feeder by determining an ambient adjusted rating using an averaged ambient temperature from each of our four geographical regions. Using color-coded status indications on PI AlarmView screens (blue for over 90 percent loading; yellow for over 95 percent loading; red for over 100 percent loading) users are able to quickly discern the level of loading on each transformer or feeder and take the appropriate action if they are approaching an overload situation. Usually, this involves dispatching operators or maintenance personnel to ensure that cooling equipment is working properly on transformers or shifting load to adjacent transformers or feeders to reduce the loading to acceptable levels.

Being able to monitor and react quickly to equipment loading situations has increased our equipment utilization factors without lowering equipment life expectancy, thus resulting in fewer customer outages.

• **Watching the Watchdog –** PGE has implemented a "watchdog" in each of its substations to constantly monitor the status of communications between PLCs, relays and meters. They also monitor the status of voltage on distributed I/O, PLC batteries and other variables critical to substation communications. These watchdogs, which essentially are software counters, are intended to alert users that the substation data might be inaccurate due to an equipment or communications failure.

• **More responsive maintenance –** In recent months, we have begun scaling up the T&D Information System for use by PGE maintenance personnel. The result has been the ability to reduce the time involved in creating work orders, scheduling crews, and ensuring maintenance personnel are aware of matters that require their attention in a timely manner.

Prior to implementing the T&D Information System, we did not have a way to notify users that the information was inaccurate. However, through the use of calculated tags in the PI System, we are able to determine whether the counter is actually active. If a counter stops, an alarm message appears on the PI display indicating substation data may be inaccurate. As is the case with transformer loading, the ability to "watch the watchdog" through the T&D Information System has enabled us to become aware of equipment and communications problems and respond quickly to fix these problems. It also ensures that engineers and technicians have accurate real-time and historical information regarding system performance.

Prior to implementing the T&D Information System, alarms in the EMS system would trigger a multi-step process. Dispatchers from the operations center would have to call maintenance personnel who then would have to generate a work order and then initiate the repairs or replacements. Since the maintenance personnel now have access to the PI AlarmView screens, they receive the alarming information directly, thus ensuring all maintenance alarms are attended to appropriately and in a timely manner.

We have designed the alarming screens by equipment groups, so that not only are maintenance personnel alerted quickly to problems, they are able to send the appropriate personnel and equipment when responding to the specific problems.

PI AlarmView has proven very successful in applications were we have a personal computer dedicated to displaying the alarms. On the other hand, we discovered AlarmView was not suitable for typical ProcessBook users due to the time required to initialize the alarm groups when the application is first started. Since users did not like waiting for AlarmView to initialize, we developed Visual Basic scripting that allows users to view the alarms in the one-line diagrams rather than through AlarmView.

These are just three of the applications that we have implemented in the T&D Information System; there are numerous others that are allowing us to continuously improve T&D operations and asset management. In addition, the growing number of users within PGE has created a growing appetite for applications that meet their needs. For example, we recently created displays summarizing breaker lockouts for each of our four regions, so that during extreme weather conditions, such as intense windstorms, we will be able to quickly identify feeder breakers that are locked out and begin restoration efforts.

Summary:

The ability to see and measure the status of your systems is only half the battle when it comes to improving real-time performance. Achieving higher quality requires a means to distribute the information to those who need it in a timely manner and having the tools to visualize that data, both in real time and historically, so it becomes actionable. At PGE, our PI-based T&D Information System is proving to be the foundation for continuous improvement. ■




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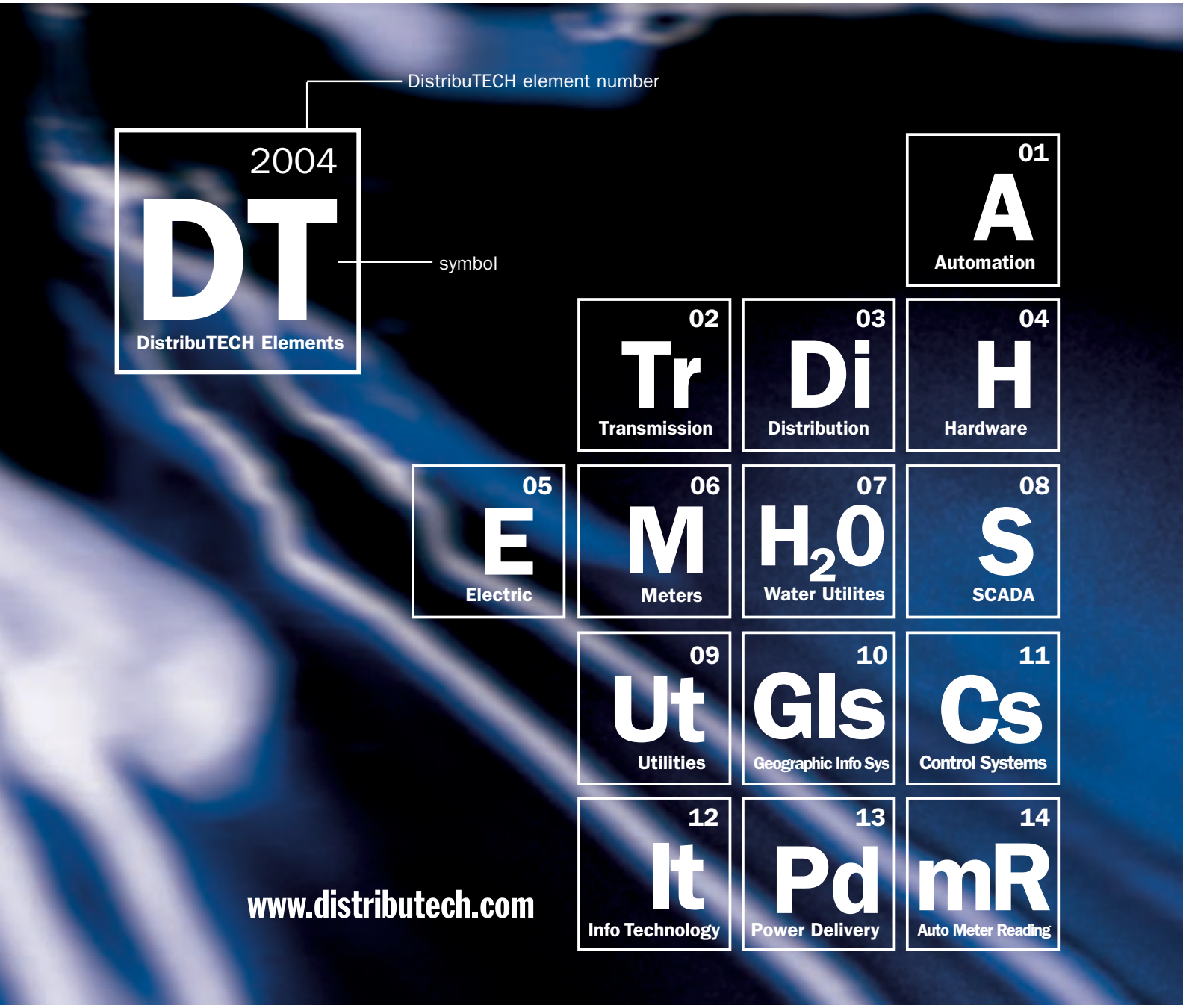

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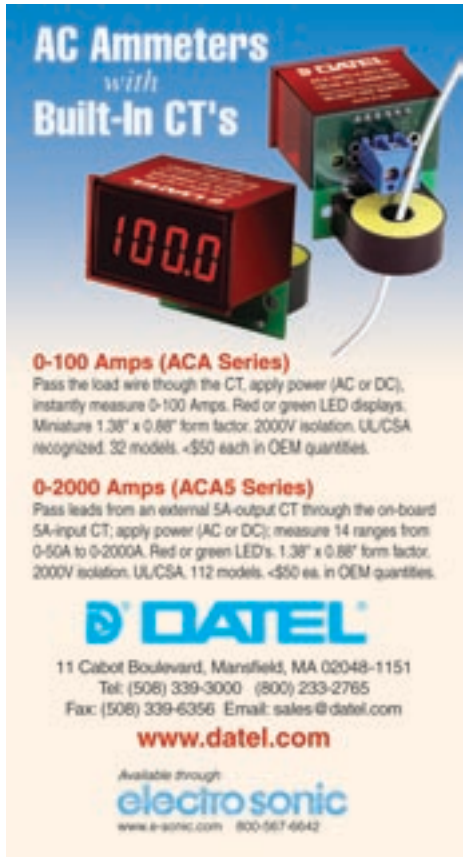

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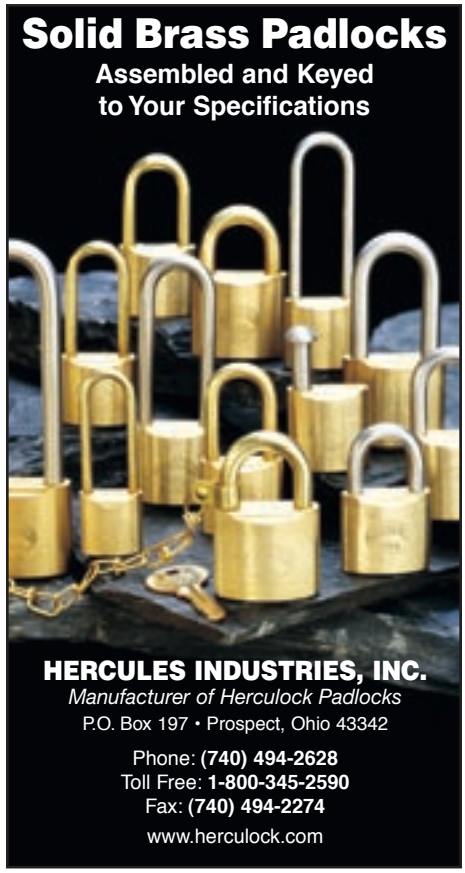

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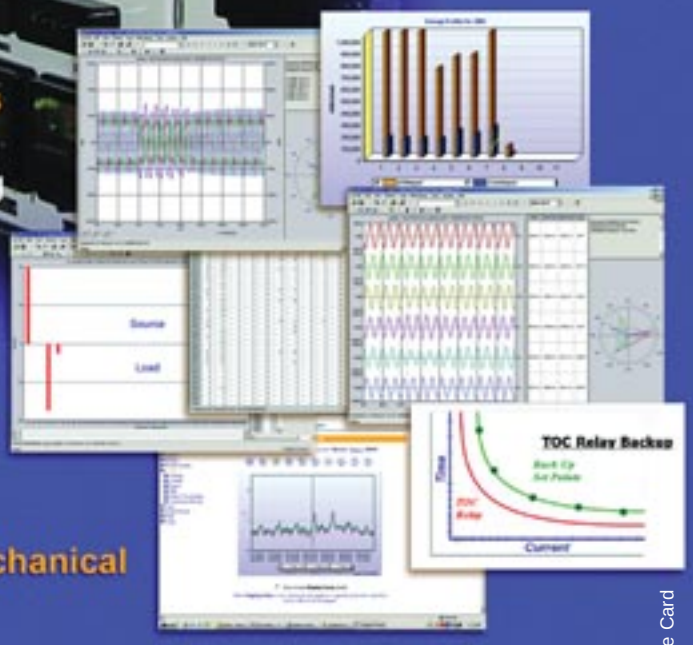

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