Electric ENERGY T&D MAGAZINE

Ensuring a Sustainable Electricity Future

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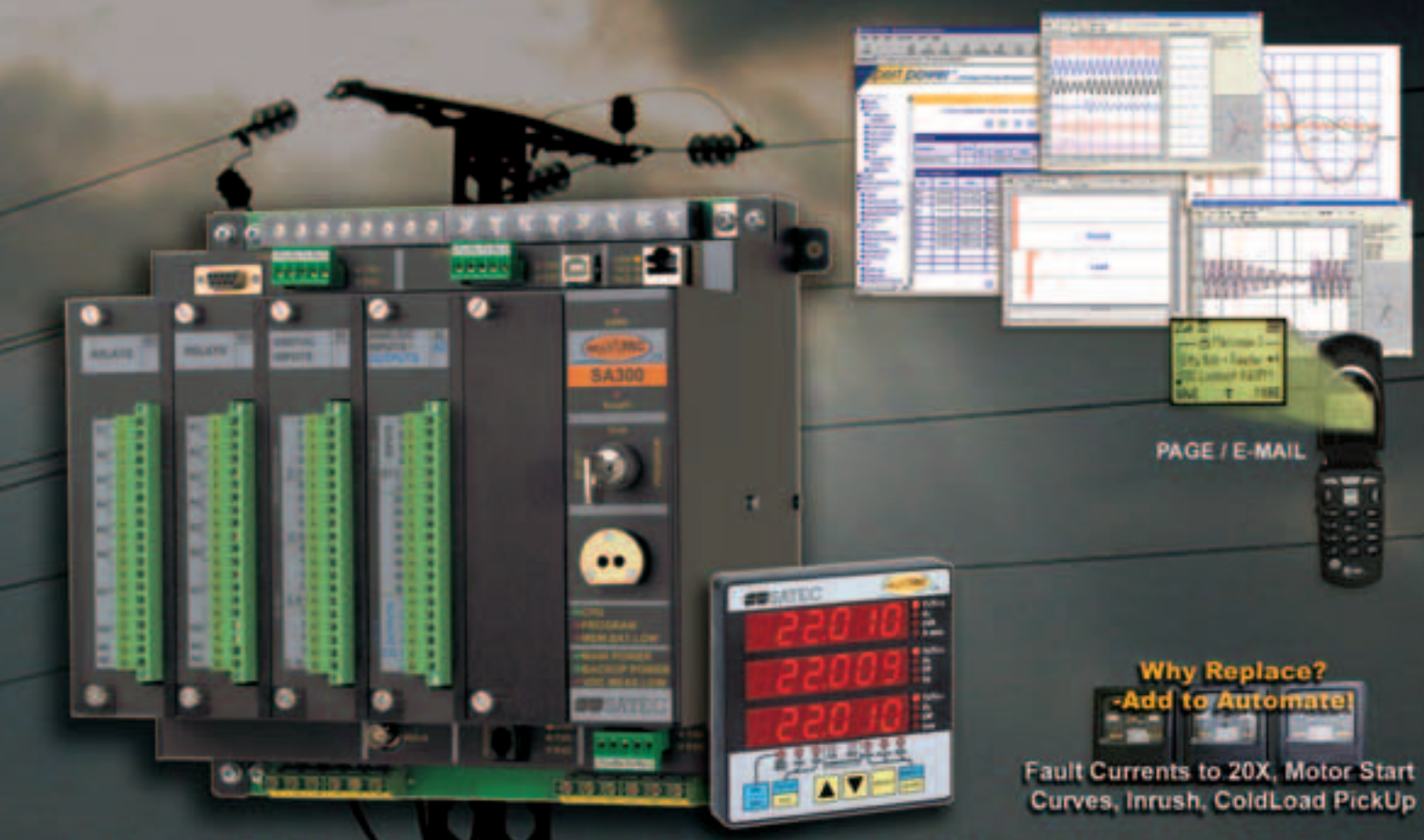
Power Intelligence Unit



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Electric ENERGY T&D MAGAZINE

In this Issue

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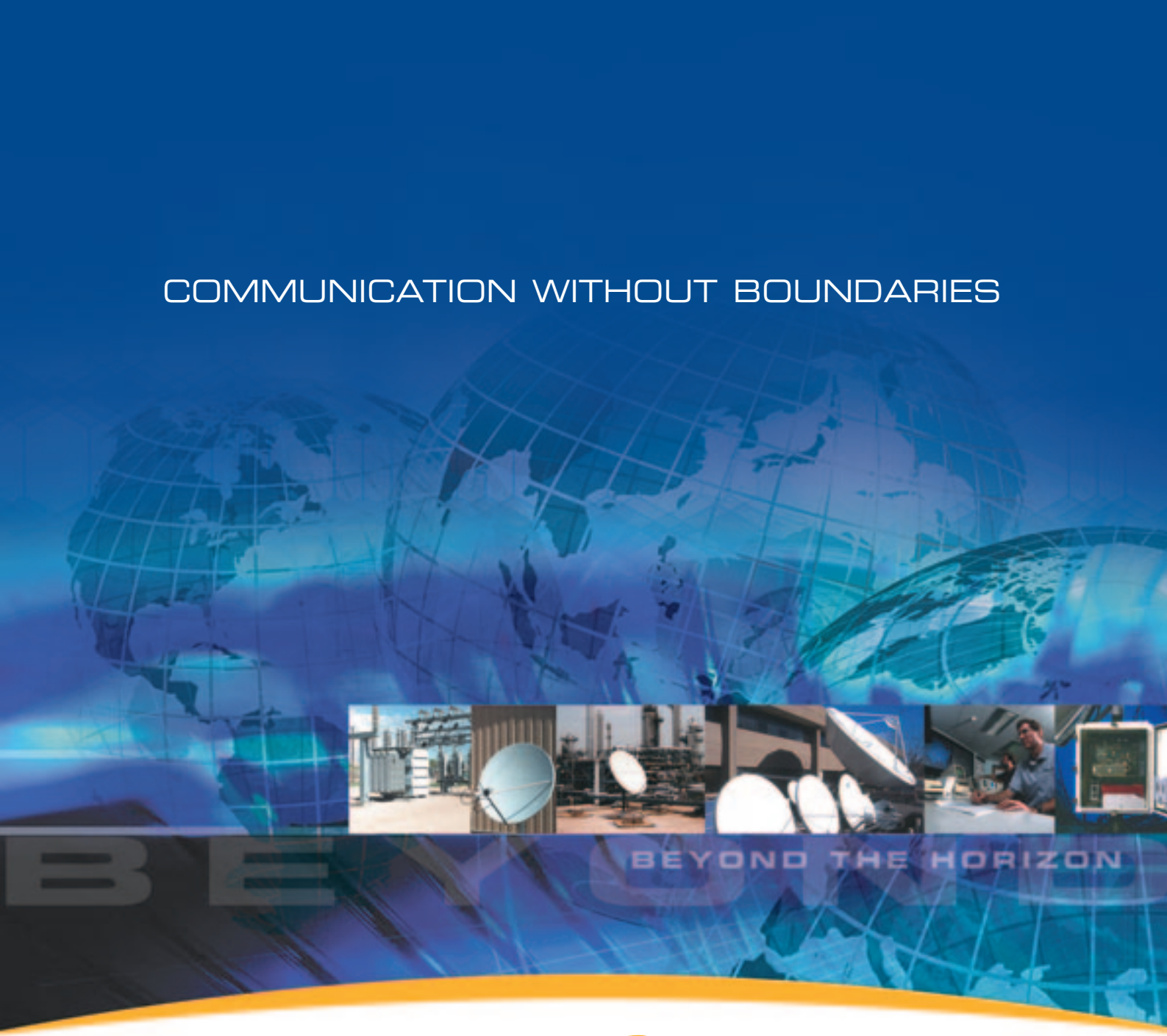
COMMUNICATION WITHOUT BOUNDARIES



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Ensuring a Sustainable Electricity Future

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

Electricity is one of the foundations of the modern economy, accounting for about one-third of all non-transportation energy end-use. Electricity is clean and flexible at point of use but, most importantly, it has no substitute in the majority of applications. The effects stemming from disruptions such as the recent events in California or the 1998 ice storm in Ontario and Quebec clearly demonstrate how dependent we are on reliable electricity supply.

The future economy will likely be more electricity-dependent. Although electricity's share of end-use energy has been stable for a decade, the newest areas of economic activity – the service economy – are most dependent on the interconnected electricity grid, its reliability, and increasingly, on the quality of the power delivered. Some long-term visions of a future of clean energy involve a much higher dependence on electricity in industrial applications, and most importantly, in transportation where electricity would provide the underpinning of the hydrogen economy.

But the generation, transportation and delivery of electricity pose challenges for society. Among the greatest of these challenges is managing for environmental sustainability.

Considerable progress has been made in managing the environmental consequences of electricity production, transmission and distribution. However, some of these consequences are inherent in the nature of the electricity system, including factors such as resource availability, scale, extent and interconnectedness. Some technologies – including the majority of Canada's current generation mix – are virtually free of air emissions. Some can minimize the generation of hazardous wastes. But presently, no technology capable of delivering electricity at the scale required by society and in the way it requires can be deployed without having some impact on land, water, air, habitat, and local communities.

Complicating the equation is the fact that most technologies have some inherent locational limitations and therefore, the optimum choices will often vary from location to location. Different technologies also have different attributes that affect power availability and reliability, potential to be deployed in a decentralized manner, the need for interconnection, and the degree of reliance on other energy systems.

The challenge we face in managing the environmental sustainability of electricity is therefore one of balancing multiple objectives and multiple attributes. In this context, the fundamental question for policy is that of management models which will best enable us to achieve the needed balance.

The Canadian Electricity Association contends that sustainability is most likely to be achieved where there is a high degree of diversity of technologies and business models, where system connections are extensive and redundant, where rules across jurisdictions are highly compatible and where market barriers are minimized. With this as the backdrop, it is possible to envisage the key attributes of electricity in a sustainable future.

Electricity is affordable

Individual Canadians rely on affordable electricity to light, heat and cool their homes, manage their household tasks, and provide power for their information access to the world. In a sustainable world, electricity is available at a cost which encourages consumers to make appropriate choices about energy efficiency and conservation but which does not create undue burdens on the least fortunate.

Canadian business and industry also require affordable power. For some industries, competitiveness is heavily dependent on reasonably priced electricity supplies. In a marketplace interconnected across borders, power prices will tend to equalize, but power costs relative to the rest of the world continue to be a source of competitive advantage in North America.

Part of the affordability calculation is price stability since price volatility creates business risk and provokes consumer reactions with damaging political consequences. In a sustainable future, government policy facilitates investment and system expansion keeps pace with demand. Combined with regulatory and market instruments which help prevent uncompetitive behavior and manage the inherent volatility in electricity markets, these attributes ensure that power consumers are not subject to unreasonable price risk.

Electricity is secure and reliable

The system we have relied on for many decades has consistently ensured a remarkable level of protection against system failures. The system of the future continues to ensure such protection.

The system is built around technology and fuel diversity so that threats to any one source are mitigated in the short and long term by readily available alternatives. Market, regulatory and other policy factors encourage steady technology advancement and addition of new supplies consistent with the growth in demand. The system is highly interconnected with built-in redundancy so that reserve margins for any given interconnected market guard against unplanned outages and weather extremes. The system is effectively protected against threats of attack or sabotage. On an operating basis, effective regulatory structures and business cooperation reach across multiple jurisdictions to ensure reliability. The advancement of technology and effective regulatory systems ensure that very high degrees of power quality are available to consumers who need and will pay for it.

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Electricity production and use is environmentally sustainable

Canadians and their North American neighbours want their electricity systems to be managed so that the environmental consequences are proportionate to the benefits of affordable, reliable power, and so that the consequences are consistently reduced by the effects of better management and better technology.

A growing economy is still accompanied by growing electricity demand but the steady decline in the electricity intensity of the economy allows such growth with ever smaller increases in electricity demand. Emissions which contribute to smog and acid rain or which pose health hazards are substantially eliminated by the application of advanced combustion technologies and related emission controls or by switching to inherently low emission technologies. The electricity industry is steadily advancing towards a very low greenhouse gas emissions profile. Hazardous wastes continue to be properly managed and long-term solutions are found to manage persistent wastes including radioactive waste.

Impacts on land, water and habitat continue to be subject to practical solutions including mitigation and offsetting actions. New, lower-impact technologies, including emerging renewable technologies and distributed technologies, are a growing part of the mix, contributing to the diversity of options. Local communities are fully engaged in finding appropriate solutions to local impacts, and in some cases are business partners with electricity companies.

Realizing the Vision

Today's electricity system embodies many of the above-described characteristics. Where improvement is needed, it appears to be within reach over the next several decades provided that we take the appropriate paths to get there. In some respects we are already on the right path and progress is being made. What is less clear is whether the pace is right and to what degree we risk misdirecting energy and investment through ill-advised policy choices.

Progress Towards Environmental Sustainability

It is a fact that we are making steady progress towards a more environmentally sustainable electricity economy. Where, how and to what degree we can accelerate it is a matter for debate, but the progress is certain.

Air Emissions

The application of technologies to improve combustion, fuel preparation and emissions control, together with a growing share of natural gas in the fuel mix, contributes to improved performance with respect to other air emissions. Such efforts have resulted in a decline in the rate of emission of sulphur dioxide (SO2) and nitrogen oxides (NOx) per unit of power produced in the electricity sector. As better measurement and control technologies are steadily deployed, similar results can be expected for particulate matter and mercury, two of the other key emissions from the sector.

Hazardous Materials

Over the past decade, the effective management of hazardous materials and wastes has become the norm for electric utilities. Until the early 1980s, polychlorinated biphenyls (PCBs), were routinely used as insulating oil in electrical equipment. Although this practice has been discontinued, significant equipment contaminated with PCBs remains in service. Utilities have been aggressively removing PCBs from their systems for a number of years, and have plans in place to continue this practice until they are PCB-free. Likewise, the electricity sector is addressing the issues associated with managing treated wood found in wood utility poles. The sector has taken a lead role in Environment Canada's Wood Preservatives Strategic Options Process (SOP). Implementation of the SOP recommendations will ensure that wood poles are used, stored and disposed of in an environmentally sound manner.

Impacts on Habitat

Reducing impacts on habitat – especially aquatic habitat – has become a core part of the business of all generators, and hydro generators in particular. Habitat management is an essential element in the building and operation of hydro generation facilities. Flow regimes are closely regulated to ensure that habitat is neither flooded nor exposed. Hatcheries are under management by utilities to contribute to fishery development. Intake screens are closely monitored to keep fish juveniles from harm. Water-use planning programs are under development in several jurisdictions, and joint research efforts between government and industry continue to evolve.

Technology Diversity

Technology diversity is growing and set to accelerate. Wind power is starting from a small base in Canada compared to other countries but is on a growth trajectory. Installed capacity in Canada is now just over 200 MW, and response to the federal government's recently announced wind power production incentive suggests that that capacity could grow dramatically over the next few years. The growing presence of independent power producers and the actions of traditional utilities are bringing on new biomass and natural gas fired cogeneration.

A New Contract for a Sustainable Future

For the long term, CEA believes that it is essential for industry and government to find new ways of doing business together. More often than necessary, industry and government are at cross-purposes in the short term even though their longer-term objectives are essentially compatible. We need to build a better dialogue leading to a new contract. To start the process, we offer several concepts that should underlie such a contract.

- Environmental sustainability is only one part of the sustainability equation; at each decision step it is essential to consider the full range of economic and social ramifications.
- Investment occurs in a context of business and market realities; therefore, while industry needs to adapt to environmental needs, environmental rules need to be built with business realities in mind.
- Effective environmental policy needs to take both relevant environmental and economic geography into account.
- Any fundamental transformation that is sought will require a large societal investment in technology that will pay off only over several decades.
- Incremental progress has to be made in short time frames and unnecessary delay and uncertainty slow environmental as well as economic progress.
- Technology and fuel diversity create both environmental and economic choices and reduce both environmental and economic risk.
- Commitment on behalf of industry and government needs to be based on shared understanding, on ensuring that issues are managed at a strategic level, and on the timely and responsible sharing – and use – of essential information.

The member companies of the Canadian Electricity Association are taking action to move Canada's electricity industry further along the road to environmental sustainability. We are working with many departments and agencies in all governments to accelerate progress and we count on government and other stakeholders to work with us to build the new contract needed to underpin these efforts. ◆

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Industry News

RES 521 Terminal for Synchronized Phasor Measurement

A MAJOR STEP TOWARDS IMPROVED PERFORMANCE

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

The RES 521 terminal provides you with:

High measurement accuracy

The ready-to-use RES 521 offers unrivaled measurement accuracy for estimating the precise power system state. It enables you to keep your assets constantly at optimum use.

Reliable and proven technology for phasor measurement

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

Remote communication based on standard protocols

RES 521 has communication capabilities for standard protocols on TCP/IP: IEEE 1344 in streaming data or PC37.118 synchrophasor format. This ensures openness and enables the use of standard communication components. And what's best – because the terminal features both protocols, you can choose which one you use!

Enhanced power system efficiency

Through RES 521 you can reach a higher transmission capacity without the need to invest in additional transmission lines. In the case of evolving power oscillations, system stability can be retained using our new real-time measurements for preventive disturbance monitoring, efficient emergency actions based on system-wide data, load shedding, etc.

Take a major step forward in increasing your power flow by optimizing your asset utilization with the help of the RES 521 Phasor Measurement Terminal. ●

www.abb.com/substationautomation

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W.I.R.E. Services/ Manitoba Hydro

Winnipeg, Manitoba Canada—W.I.R.E. Services, an initiative of Manitoba Hydro, is pleased to announce that LiDAR Services International (LSI) of Calgary, Alberta will be the exclusive provider of airborne LiDAR (Light detection and ranging) surveys for transmission line rating and re-rating services to Manitoba Hydro and 3rd party electrical utilities.

LSI owns and operates the HELIX LiDAR system, a helicopter based unit, designed and manufactured by their team of highly qualified engineers. HELIX integrates a custom built scanning laser with GPS, IMU (inertial measurement unit), Nadir profiling laser, digital video and high-resolution digital imagery, all in a portable, rugged survey system.

"Combining LSI's expert knowledge and LiDAR experience with Manitoba Hydro's experience and expertise in transmission line design and re-rating technology has produced a 'Full Service' solution provider, with a unique UTILITY Perspective" says Jim Koop, General Manager of W.I.R.E. Services.

Being born out of the utility environment, W.I.R.E. Services understands the needs of electric utilities when it comes to line capacity and rating issues. It was these issues that sent Manitoba Hydro looking for innovative solutions back in 1998 when their first LiDAR project was initiated. Based on highly successful results, LiDAR has become the standard for both new route planning and upgrade projects.

W.I.R.E. Services has the UTILITY experience and expertise to confidently provide Airborne Data Collection, Thermal Rating Verification and Re-Rating Solutions to other Electric Utilities. ●

For more information on W.I.R.E. Services, visit them online at www.wireservices.ca

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Workflow Automation: A Benefit to Every Organization

Workflow Automation, sometimes referred to as Business Process Automation, is a must in today's marketplace. In order to gain the competitive advantage, organizations must streamline their business processes. The faster and more reliable the product or service comes to market, the more competitive an organization becomes. Most organizations today overlook the importance of Workflow Automation. Every day organizations lose significant amounts of money due to unstructured business processes that lead to bottlenecks. Cycle-times can be dramatically decreased with the implementation of electronic Workflow Automation. Document Imaging Solutions, Inc. has seen cycle-times go from 128 days to 34 days by implementing Workflow Automation. With a complete audit history of every Workflow process, an organization can quickly identify and eliminate bottlenecks.

Most organizations spend a vast amount of money purchasing tools that can be used to increase employee productivity. Tools such as word processors, e-mail, spreadsheets, project management applications, etc. are utilized on a daily basis to increase the productivity of an individual. What most organizations fail to realize is that it isn't necessarily the productivity of the individual employee that causes bottlenecks, but the productivity of a group of employees working toward a common goal. The ability of an organization to be productive and profitable is directly related to the ability of its employees to be productive as individuals and as a whole. Many organizations have or are beginning to implement electronic Workflow Automation as another valuable tool.

A set of tasks/events completed to achieve a common goal is called a business process. These tasks or events can take place as a series of steps, or can run in parallel with steps of another process. These steps can be a person, a group of persons, or a predetermined logical process performed by a computer or application. Without the full understanding and analysis of the current manual business process, Workflow Automation will fail. It is not until the organization is able to clearly define a process and eliminate unnecessary steps or bottlenecks that the impact on the bottom line will be realized.

There are certain criteria that must be met in order to determine if a process would benefit from Workflow automation. A clearly defined logical structure must be in place through which the process flows. The process must flow towards a result or goal, and there must be a set of individuals or events involved in performing the steps.

Workflow Automation can increase productivity, throughput, and efficiency, while at the same time decreasing cycle-times and costs associated with a process. There are numerous benefits to implementing Workflow Automation in your organization. Certain factors have varying impacts on an organization depending on the business processes being automated, but generally all of the following are definite benefits of Workflow Automation:

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- Elimination of Bottlenecks and Unnecessary steps
- Reduction of cycle-time
- Increased profitability
- Increased efficiency of knowledge workers
- Complete audit history of every step in the process

Some examples of Workflow Automated business processes are as follows:

- Accounts Payables Reconciliation
- Work Order Processing
- Purchase Order Approval
- Engineering Change Order Approval
- New Hire Approval
- Employee Grievances
- Contract Approval/Expiration

If your organization could decrease the amount of time and resources spent on everyday processes and have a positive impact on the bottom line, wouldn't you explore the possibility of Workflow Automation? ●

Circle **37** on Reader Service Card

Ongoing Contract Wins Bring Miner & Miner's ArcFM Solution to Additional Utilities

Miner & Miner and its Business Partners Extend User Community

Fort Collins, Colorado — Miner & Miner (M&M), the ArcFM Solution developer and a world leader in the implementation of GIS software for utilities, is pleased to welcome the 14 following clients to its ever-growing customer base.

Domestically, M&M has added large utilities, municipals, co-ops, and water departments to its customer base. Among the additions is Alabama Gas Corporation (Alagasco). Servicing more than 470,000 customers, Alagasco selected ArcFM and Designer to be deployed by MESA Solutions throughout Alagasco's seven divisions. MESA is also providing services to Southside Electric Cooperative, Virginia, replacing their existing GIS with ArcFM.

M&M also welcomes Honolulu Board of Water Supply, one of the 10 largest water utilities in the country. EMA is providing ArcGIS implementation services, while M&M consults on the ArcFM 8.2 implementation. Space Gateway Support LLC, the "City Manager" at Cape Canaveral Spaceport, selected the complete ArcFM Solution to support interfaces to power systems analysis software, SCADA, and water system modeling and analysis software.

The City of Orangeburg Department of Public Utilities is integrating ArcFM, with the help of Advantica, to support data sharing to all departments. Advantica will also assist Mid Carolina Electric Cooperative, Inc. (MCEC) in migrating its GenMap data to an ArcFM/ArcGIS Geodatabase. When complete, MCEC will go live with ArcFM, Designer, and Network Adapter interfacing to SynerGEE Electric. Truckee Meadows Water Authority, Nevada, is implementing ArcFM and ArcFM Viewer to improve maintenance and management of its water facilities.

For the Georgia-based Dalton Utilities, M&M will provide migration services from ArcFM7 to ArcFM8. Ultimately, the utility will link SCADA, GIS, OMS, and planning systems to dramatically improve the quality of service. Muscatine Power and Water, Iowa, will implement ArcFM with the help of MJ Harden. Sawnee Electric Membership Corp., among Georgia's largest rural electric cooperatives, will deploy ArcFM with support from POWER Engineers.

In Costa Rica, two utilities are implementing the ArcFM Solution: CNFL, an energy utility serving 350,000 customers and ESPH, an electric and water distribution company providing services to 256,000 customers. In Canada, POWER is providing migration services for the City of Medicine Hat Electric Utility, migrating from Tellus to ArcFM. Thunder Bay Hydro is also implementing ArcFM.

"On average we are adding at least one user per week to our large user community," said Jeff Meyers, M&M's president. "These latest wins are evidence of a well-matured software solution that provides immense benefits to a diverse set of clients." ●

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Meter Devices Company Achieves ISO 9001:2000 Registration

CANTON, Ohio — Meter Devices Co. announced that its ISO-9001 certification has been upgraded to the 2000 Standard. The certification was granted by Underwriters Laboratories.

"We are pleased to have achieved ISO-9001:2000 certification," said Meter Devices Manager of Marketing John Gagnon. "This new ISO standard requires many changes from the old 1994 standard and is an overall tougher quality standard to achieve. We are particularly proud that we achieved certification in near-record time".

"To our customers, the new certification means that Meter Devices Company remains committed to supplying the finest quality products and has achieved a quality level unmatched by anyone in our industry," Gagnon explained.

The company received its initial ISO 9001 certification in 2001.

Meter Devices Company, a member of the Brooks family of companies, serves electric utilities internationally and electrical contractors nationally with metal enclosures, meter warm-up boards and meter/relay test switches and accessories. E.J. Brooks Company, founded in 1873, manufactures high-security seals and locking devices for utilities, transportation companies, financial institutions and government. ●

For more information, visit Meter Devices Company's Web site at www.meter-devices.com

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Silicon Energy Provides Scalable Solution for Con Edison to Reduce Usage in Peak Power Demand

EEM Suite™ Manages Demand Response Programs

ALAMEDA, Calif. – Silicon Energy Corp., the leader in enterprise energy management, today announced that Consolidated Edison Company of New York, Inc. (Con Edison), completed seven demand response events during the past year to successfully reduce peak demand usage and ensure that adequate supply and integrity of the transmission and distribution system remained intact.

Con Edison and Silicon Energy began working together in early 2001 to meet the Public Service Commission mandate to reduce peak demand usage. Con Edison's demand response programs for commercial and industrial customers are designed to:

- Reduce electric load and mitigate energy price fluctuations
- Ask customers to reduce at least 100kw
- Provide financial incentives for customers participating in the program

Silicon Energy provided an Internet-based, highly scalable EEM Suite™ solution that delivers advanced energy information and incorporates New York Independent System Operator (NYISO) data for day-ahead and real-time pricing. With it, Con Edison can efficiently manage its load reduction programs by participant, program type, settlement method and baseline. This capability enables Con Edison to generate settlement compensation reports for both users and operators. The software automatically generates curtailment baselines using a customer's usage history plus an array of algorithms.

A key goal for Con Edison is to reduce electrical load during curtailment events. Con Edison achieved this goal and demonstrated an important way to provide reliable, continuous power to all customers. Participating demand response program customers include several Fortune 500 companies. In partnership with Silicon Energy, Con Edison will

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Utility Products

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continue to promote participation in demand response programs by offering programs that educate customers about how they are using energy and can best reduce costs and load. ●
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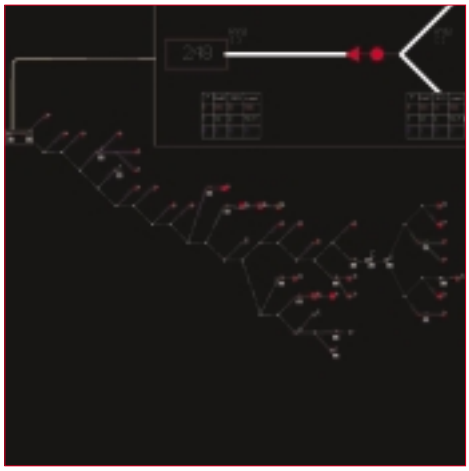

JCMB Technology Inc,

JCMB Technology releases LineView™ 1.0— a one-line diagram generator that is based on Microsoft® .NET technology. It provides a one-line schematic visualization of circuits and feeders. Operators or QC technicians can visualize circuits in congested areas and circuits spanning long distances, in a simplified and uncluttered view. Features include Entity Queries, Load Summary and Device Annotation. As well, LineView 1.0 provides a tight integration with Adelette™, JCMB's intelligent connectivity viewer. All of which help accelerate the correction and maintenance of the source data pertaining to the Distribution Network Model. ●
Web: www.jcmb.com
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Another innovation for NDB Technologies inc.

NDB Technologies inc. announces the release of a new tool: the PDS (Partial discharge scanner). This product, an XLPE insulation leak locator for electric power installations, revolutionizes the field of partial discharges detection by its cost effectiveness and simplicity of operation.

Insulation problems are an important factor in degradation and lifetime reduction of electrical networks. This translates into raised exploitation costs and questioned reliability, while today, economic performance and reliability have become key criterions in the appreciation of an electricity supplier.

The PDS is used to detect and locate insulation problems in XLPE-insulated cables, joints and other insulated installations. It serves as a quality control device to evaluate condition of existing or brand new power installations, thus playing a key role in preventive maintenance. Its operation is quick and easy and it does not require any electrical contact with the conductor itself, since its sensor works with capacitive and inductive effects.

NDB has acquired a solid expertise in various fields such as electricity and control. Electrical applications, for example, 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 applications 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 standardization. ●
For more information visit www.ndb.qc.ca.
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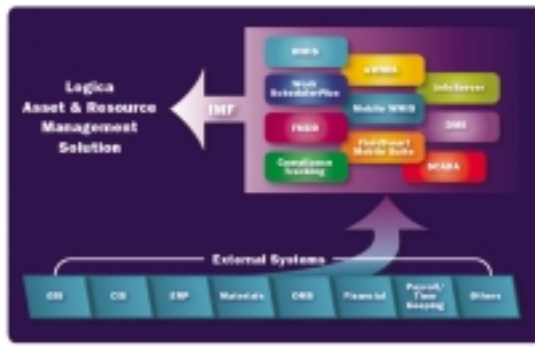
Logica Unveils New Enterprise Asset and Resource Management ("ARM") Offering at Distributech

Southwest Gas Corporation and Washington Gas to implement Logica's new integrated ARM product suite to improve customer service, reduce operating costs, increase systems reliability, and extend the useful life of existing assets

Logica will unveil its new enterprise Asset and Resource Management offering — "ARM" — at the upcoming DistribuTECH Conference to be held February 4-6, 2003 in Las Vegas, NV and at the GITA Conference, March 2-5, 2003, San Antonio, TX.

This fully integrated product suite provides an enterprise-wide solution for transmission and distribution organizations. ARM includes the systems and processes that manage a utility's physical assets and human resources to achieve operational excellence.



ARM enables utilities to streamline business processes, manage the entire work stream, improve resource scheduling, control operational costs, manage maintenance and regulatory compliance activities, extend the useful life of existing assets, increase systems reliability, expand performance and analysis reporting capabilities, and improve customer service.

Logica's ARM solution includes:

- WMIS, the Work Management Information System
- eWMIS, web-deployed WMIS
- Mobile WMIS, field deployed WMIS
- Work SchedulerPlus, a constraint based scheduling tool
- FMDR, the Facilities Management Data Repository for Asset Management
- Compliance Tracking, a solution to manage inspection and maintenance work
- FieldSmart™ Mobile Suite, a map-based field solution that is fully integrated with WMIS, supplied by Logica's solution partner MapFrame
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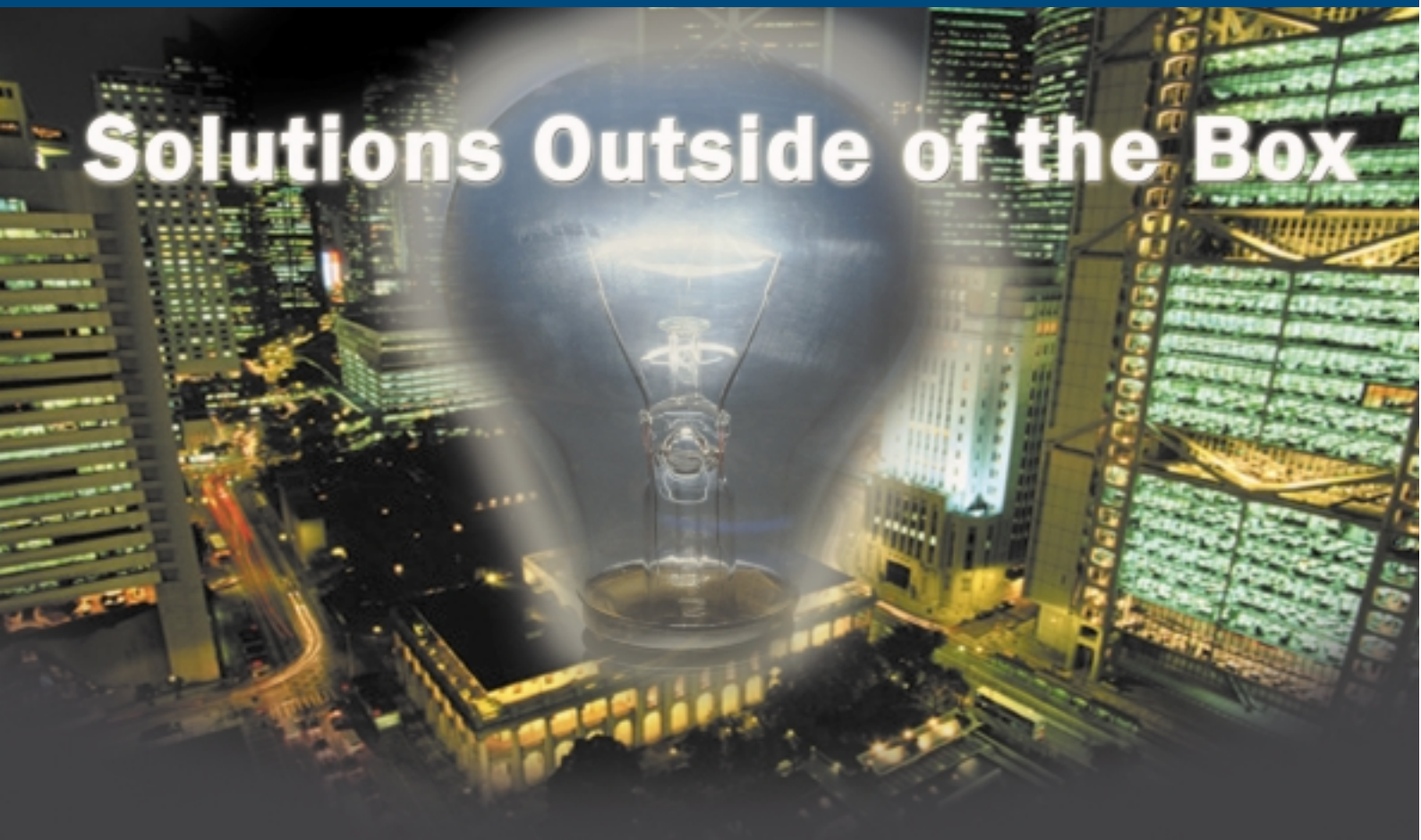

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By:

John McDonald
Senior Principal
Consultant and Manager,
Automation, Reliability
and Asset Management
KEMA Consulting

Successful Integration and Automation Relies on Strategic Plan

Automation Requires Integration

Electric distribution utilities frequently ask the question, "Can we afford to automate?" Given the potential cost, the question is certainly reasonable. But in the era of deregulation and ever-increasing regulatory pressure, the question really ought to be, "Can we afford not to?" The truth is that if you don't spend the money to automate in the near future, your competitor probably will. And from that point on, instead of competing head-on, you will be playing catch-up in a marketplace geared toward competition. In that light, it's best to consider distribution automation as an investment rather than an expense.

The cost-saving advantages of automation are well documented – systems operate more efficiently with fewer outages, assets are better utilized and maintained, and personnel safety improves. These add up to reduced costs and greater reliability, which ultimately wins customers and pleases regulators.

But there is another equally important, yet less tangible, pay-off from automation — information. It's the commodity of the 21st century and it's what will provide the competitive edge in the utility industry from now on. Implemented correctly, automation puts information about the distribution system — and your customers — onto the desktops of every department in the enterprise for analysis.

Suddenly, the guys in marketing are brainstorming with the engineers about how to create and sell customized services. When accurate information is available quickly to personnel at all levels, everyone starts making better decisions, and that benefits the entire organization.

Better yet, automation positions a utility to serve real-time information directly to the customer. Several savvy distribution companies already are publishing detailed system reliability information and up-to-date customer usage data on their web sites. Voltages, currents, megawatts and outage history are all right there on the Internet for existing and potential customers to see.

For consumers who have grown accustomed to immediate online access to bank balances and credit card statements, such web-based information is more than a nice feature. It's a benefit that can attract and retain them.

As is true with many high-tech innovations, utility automation requires proper implementation to deliver the advertised benefits. In the distribution network, a correctly implemented automation project does not stand alone. Automation devices must be integrated into the architecture of the distribution system itself, most effectively at the substation level, drawing data from every piece of equipment and subsystem.

Secondly, integration and automation require communication links between the computerized devices and the rest of the utility enterprise. There are at least three distinct paths that can be exploited for data from the substation to travel within a distribution utility. This is how automation data is shared for simultaneous access and analysis throughout the company.

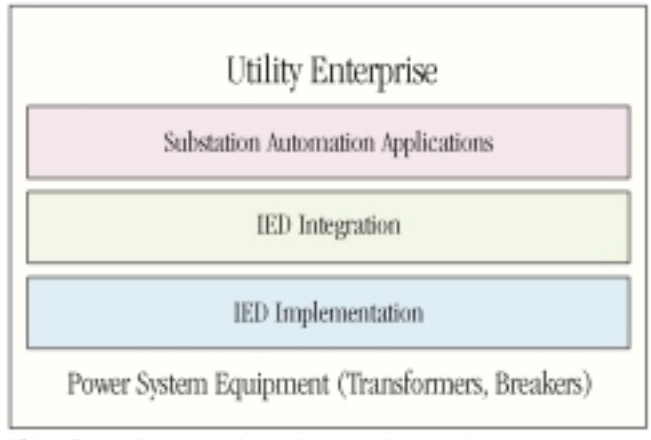

Fig. 1 Substation Integration and Automation Levels

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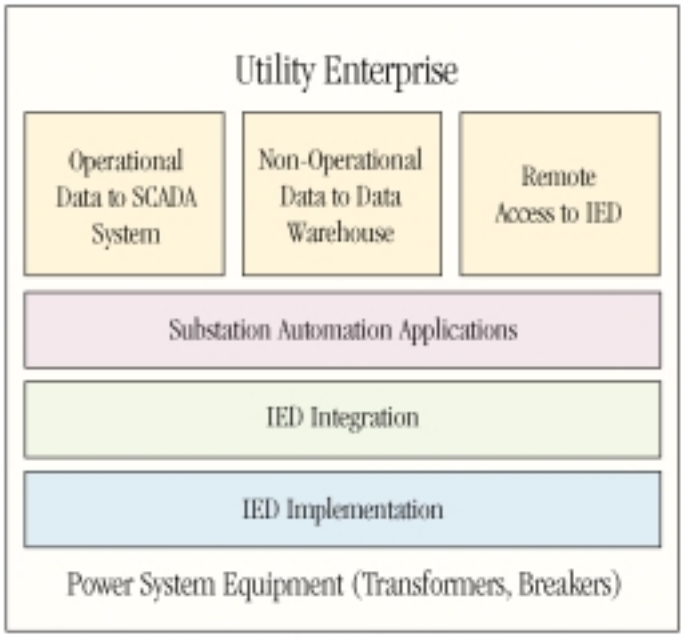

Fig. 2 Three Functional Data Paths from Substation to Utility Enterprise

Ensuring that automation and integration proceed hand-in-hand guarantees a quick return on investment. Making it happen requires a strategic plan and a commitment to carry out that plan as it was designed. And in all cases, communications infrastructure must be sufficient to successfully support the automation.

What is Distribution Automation?

In a distribution utility there are three areas where automation can be implemented – at the customer location, on the feeders and in the substation. Each has pros and cons, but substations are the typical focal points because they are the greatest source of information.

Every utility has varying needs for automation depending on the age of its infrastructure, service area demographics and degree of existing automation. For this reason, all three sources of distribution automation should be considered in developing a strategic implementation plan. Here is a quick overview of the benefits, and possible pitfalls, of each:

Customer Automation – Automatic Meter Reading (AMR) technology and services associated with it, such as automatic connect/reconnect, are gaining in popularity. AMR periodically records meter readings and relays this information back to a utility office. Installed at the customer location, AMR replaces a human meter reader. It is especially effective in high-crime neighborhoods where utility personnel may find themselves in danger.

The primary expense involved in AMR is not the meter itself. Rather it is the communications link, usually a wireline (telephone) or wireless connection, that transmits to the utility office from each individual user location. For large commercial and industrial customers who use a lot of power, this expense is quickly repaid. But for tens of thousands of residential customers, the cost is difficult to justify for simple meter reading.

A related service that can pay for itself is automatic connect/reconnect. In cities with rapid population turnover, several utilities have found it is cost-effective to remotely disconnect service every time a customer moves rather than send a crew to do it manually. But this may be the exception in regards to AMR pay-out.

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However, just because AMR might not be cost-effective or improve utility personnel safety, it should not be discounted from an automation plan. The reason is that AMR requires the utility to make a live communications link with each customer, and that link may serve as the conduit through which other valuable services can be offered.

Once two-way communication has been established to a residential user, the utility has opened the door to offering such lucrative services as remotely monitored home security, high-speed Internet access and cable television. But the key to providing these services is including them in the strategic distribution automation plan at the outset so the appropriate telecommunications infrastructure can be installed.

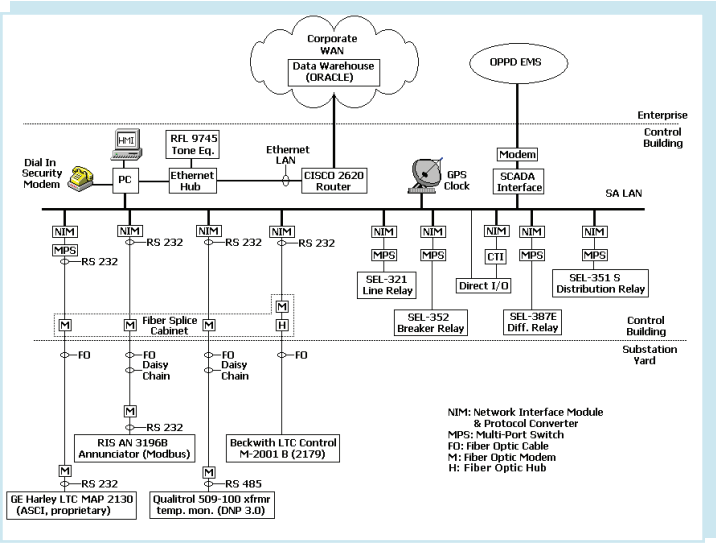
Feeders – Automating feeders typically entails installation of sectionalizing devices, or switches, along the feeder. When there is a problem with the feeder, data will be fed back to the substation or control center for analysis. Once the problem has been identified, a technician can remotely activate the switch to isolate the segment causing the trouble and reroute service to sections on either side of the problem, or this process may be done automatically.

The financial challenge of feeder automation is similar to that of AMR – feeders are numerous and are spread over large geographic areas, making installation and maintenance of two-way communication an expensive proposition. As a result, feeder automation is often limited to the 10 or 15 worst performing feeders.

By concentrating on problematic feeders, utilities spend less money and can guarantee their automation investment will pay off in reduced duration and frequency of outages. This sort of targeted feeder automation is likely to remain standard procedure in distribution automation projects.

A typical initial step in implementing feeder automation is to install a tie switch on a feeder between two substations. Often referred to as using half switches, the method provides the capability to shift feeder load segments from one substation to another .

Substation – Integration and automation typically focus here because the substation is where all of that valuable operations and customer information resides. Whether they know it or not, most utilities already engage in the first level of substation automation – intelligent electronic device (IED) implementation. <see graphic>



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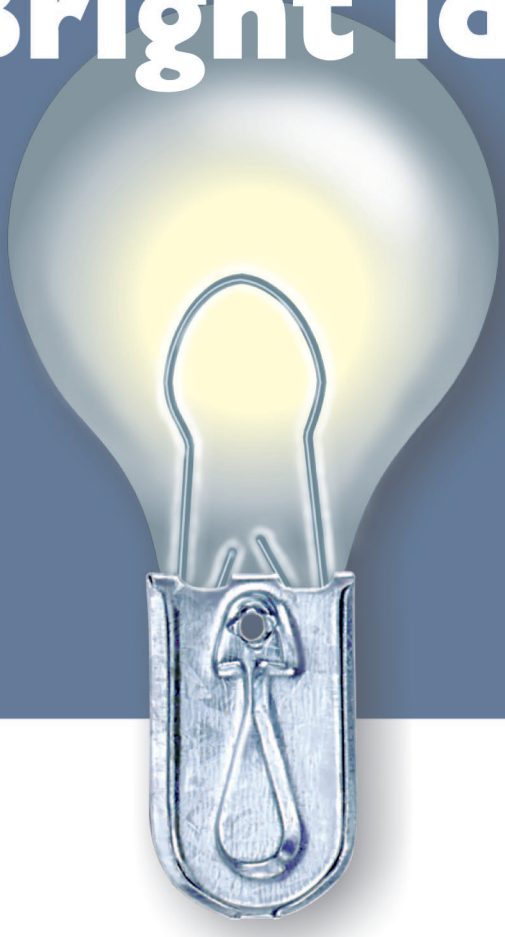

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Since the late 1980s, advancements in microprocessor technology have eliminated single function electromechanical equipment in favor of multi-function IEDs. These single-function electromechanical devices have given way to multi-function electronic devices with built-in two-way communications capabilities.

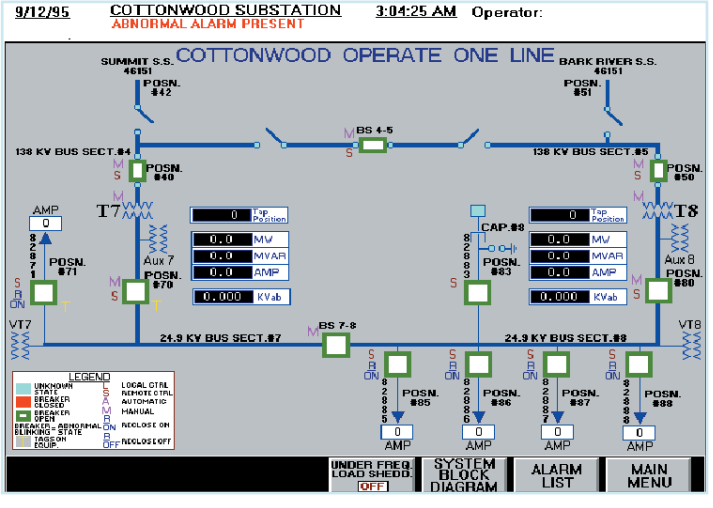
Years ago, separate electromechanical relays were required for overcurrent and undervoltage protection. Today, one microprocessor-based device does that and more. They not only protect the power system, but they can also perform calculations of energy in a circuit breaker and store historical data in their memory. Microprocessor-based relays can identify when a fault occurred and the series of events that resulted from it.

That's incredibly valuable information. Too bad so few utilities use it. This is because most have not tapped the two-way communication capabilities in these devices to access and integrate the data they hold into the information flow of the enterprise. The average utility is realizing about 10 percent of their investment in a $5,000 microprocessor-based relay.

A substation integration mistake made most commonly is not creating and following a strategic substation integration and automation plan. Too often an engineer gets excited about a vendor's substation integration and automation architecture and has it installed. Next, a different vendor offers a substation integration and automation architecture with different features, and that one is installed too. The next thing a utility knows, it has 12 substations operating with substation architectures from five different vendors. No utility has the resources to use and support such a variety of equipment and architectures.

Integrating the Substation

The key to capitalizing on the capabilities of automated devices is integrating the devices and linking them to the utility enterprise along three data paths. <see previous graphic>



Substation integration systems are a combination of software and hardware to meet the needs of an individual utility. These integration systems are offered as products by companies well known to the industry – Tasnet in Clearwater, Florida; Hathaway in Hunt Valley, Maryland; GE in Calgary, Alberta, Canada; ABB in Allentown, Pennsylvania; and Siemens in Raleigh, North Carolina. Each integration architecture is different, but all exploit the three data paths into and out of the substations to take advantage of IED installations.

Often referred to as the operational data path, the first is between the substation integration and automation system and the SCADA system. The SCADA can be programmed to scan automated devices in the substation every few seconds to retrieve instantaneous values on voltage, current and other data. The operational data path is established for a continuous feed of data.

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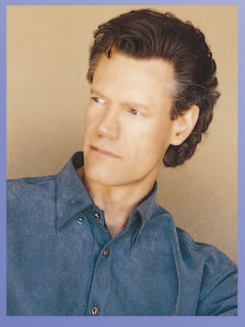

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Several factors must be considered in leveraging this path. First, substation integration and automation systems must have the capability to interface with older SCADA systems and their proprietary protocols. Secondly, the bandwidth of the communications infrastructure chosen for this path must support requirements of the SCADA and the substation integration and automation system.

The second data path is more of a challenge. It involves gaining access to the non-operational information in the IEDs. Non-operational data includes fault event logs, harmonic information, and power quality information such as voltage sags and swells, information that needs to be transferred to a corporate data warehouse where many users can retrieve it into their desktop applications for analysis.

Each different device in the substation typically operates with a different protocol for this non-operational data path. The data on this path is on-demand, non-periodic, which means protocol issues are more complicated. Usually the demand is for a large file or a burst of data, necessitating a bandwidth of at least 56 kbps on a frame relay or fiber optic network.

Non-operational data is transmitted back to the corporate data warehouse. This warehouse is typically a series of centralized servers for redundancy that incorporate all business and operations information from around the utility for enterprise-wide access. Because not all utilities currently have such a data warehouse, installation of one is often included in an automation project.

The third path is remote access, which allows a user at a location outside the substation to access the IEDs. With proper security and access privileges, the user might review device settings or actually change parameters, as well as download non-operational IED data for analysis.

Often called pass-through or loop-through, this communication path is typically a dial-up phone line or dedicated fiber optic connection. The user dials into a secure modem, which then calls the user back if his or her phone number is approved. The user then dials a code to specify which device the communications link should be established with. Data flow between the caller and the device is two-way.

By integrating IEDs into the architecture of the substation and linking the flow of data from the substation to the enterprise, the utility truly realizes the potential in the investment it has made in the IEDs.

Creating a Strategic Plan

Successful integration and automation projects require a strategic plan, or a blue print for how and when various IEDs and integration architectures will be installed. The first step is to examine the integration and automation functions available and perform a cost-benefit analysis to determine if a specific utility will benefit from the implementation of that function. Not all will.

Matching the needs of the utility with available technology is critical. As odd as it may sound, sometimes automation technology is not yet available to accomplish what the utility needs. Off-the-shelf products are always preferred over customized ones simply because of the cost involved. Customization may completely destroy a return-on-investment estimate.

The next step is developing a phased-in approach for implementation of integration and automation. Few utilities can afford to pay for a large-scale implementation in one year, so the project may be spread over five or more. But it is critical to stick with the original plan and determine how implementation of integration and automation should proceed to ensure the utility begins experiencing benefits immediately.

Keep in mind that communications is the enabling technology of integration and automation. This means that existing communications capabilities must be compared with what will be needed for the planned project and for future automation.

As mentioned at the outset, most utilities can't afford not to integrate and automate. With a simple substation pilot costing around $50,000 to $100,000 per substation, the benefits typically are far greater than the costs, especially since the IEDs are already installed in the substation.

Measuring Success

In terms of substation integration, look for positive operational changes to see if benefits of specific functions are being realized. For example, in the successfully integrated substation there will be smaller control panels, reduced wiring and elimination of many conventional displays as computers replace mechanical devices. The result is that utilities begin building much smaller substations at significantly less cost. With respect to cost/-benefits, the advantages of these changes quickly impact the bottom line.

Even enterprise-wide integration and automation projects pay off in one to three years, but utilities and their stockholders want to see quantitative results immediately. The best measurements to use in assessing the success of any size distribution automation project are the industry standard indices of reliability – System Average Interruption Frequency Index (SAIFI), Momentary Average Interruption Frequency Index (MAIFI) and System Average Interruption Duration Index (SAIDI).

These are the same indices regulatory agencies use to measure utility performance, and as deregulation progresses the typical residential customer is likely to become savvy in their meaning too. In the near future, we are likely to see these numbers like report cards on publicly available web site. And you can be sure the utilities with the scores that show steady improvement are the ones that have invested in automation and integration. ■

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By:

Steve Mueller
President and
Chief Executive Officer
Survalent Technology Corporation

Golden Spread Electric Co-operative

Introduction

Golden Spread Electric Co-operative members supply electricity to most of the rural Texas and Oklahoma Panhandle.

Organized in 1984 to provide electric service for its 11 rural distribution co-operative members, Golden Spread historically purchased power for its members from Southwestern Public Service Company, from West Texas Utilities Company, and the 486-megawatt gas-fueled combined cycle Mustang Station. Golden Spread owns 50% of the Mustang Station.

Electric utility merger and acquisition activity and the pending Texas deregulation caused uncertainty as to where Golden Spread would purchase its power for its members in the future. Complicating this dilemma is the volatile irrigation load requirements of the Golden Spread member users. With antiquated reporting techniques, the trending of the load was performed much later than the actual required load was known. Golden Spread needed immediate reporting of metering information in order to adequately operate in the changing electric industry.

Taking action:

All of this required Golden Spread to take action to obtain immediate metering information. Golden Spread worked with C.H. Guernsey & Co., their consulting engineer, to evaluate and formulate a plan to resolve the issues and problems of this situation. The problem was solved with a SCADA system.

The challenges seemed overwhelming for a project of this scope, technical complexity, and short timeframe required for implementation.

To summarize, Golden Spread and C.H. Guernsey & Co. sought a SCADA supplier to meet the following requirements:

1) Obtain metering information from Points of Delivery from 9 member co-op locations (76 Points of Delivery, with no field devices yet installed).
2) Obtain information from 3 member co-ops that have existing SCADA master stations.
3) Send all information to Golden Spread SCADA master station in Amarillo, TX. Member co-op locations are from 10 to 250 miles from Amarillo, TX.
4) No existing communications infrastructure was in place.
5) Provide the means and capability for Golden Spread to place a backup master station anywhere in the Golden Spread system.
6) Publish desired SCADA information on Golden Spread's website for the member co-operatives to view.
7) Send required SCADA information to ACES Power Marketing, Golden Spread's selected power marketer.

The Solution:

Golden Spread and C.H. Guernsey & Co. teamed with a SCADA supplier to formulate a solution that was both unique, and flexible.

The SCADA supplier provided a dual-redundant SCADA master station that will use DNP 3.0 protocol to communicate between the field devices and the master station. The field devices used were XPPB RTU's. These RTU's are located at the 76 POD metering points and collect the required voltage, amps, and other required parameters and report the information back to the master station located in the Guernsey office in Oklahoma City, OK.

In addition, this system is designed to be able to communicate directly with IED's without the aid of an RTU.

The most difficult portion of the system was the communications system. The flexible part of the solution is that it does not matter what communication system is used. Leased line, spread spectrum radio, microwave, or fiber, the RTU's and master station will perform in any communications environment. The unique part of the solution is the communication system selected to be used – the public Internet.

Note that the Internet was selected because of the economics and time restraints of the project. The system could very easily be implemented using spread spectrum radio, CDPD, microwave, etc., or a combination of any of these.

System description:

The XPPB RTU's were placed at each of the 76 POD metering locations to monitor the POD's for each member co-op. The number of RTU's per each co-op ranged from 3 to 15. These are noted on the diagram in Fig 1. Each RTU group sent its information to the individual co-op headquarters via 900MHz spread spectrum radios.

At the individual co-op headquarters is the master radio that is connected to the co-op's LAN. The signal is then routed to the Internet via a Cisco 1601 router. The router acts as a firewall. Each individual co-operative is set up similarly.

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The master station in Oklahoma City is connected to the Internet to the Golden Spread LAN via a Cisco 2514 router (again, acting as a firewall). The master station at Amarillo is utilizing the DNP 3.0 over TCP/IP to communicate to the RTU's in the field.

Furthermore, there are four (4) existing master stations in the Golden Spread membership that need to report information from their master stations to the master station at Amarillo. At one of these 4 co-op headquarters, the connection to the Internet will be similar as at the other co-op headquarters. The only difference is that ICCP over TCP/IP will be utilized instead of DNP 3.0. ICCP will be utilized to facilitate master station to master station communications. Originally, these 4 co-ops were to be connected over a dedicated line. During implementation of the project, it was determined that these communications were to be over the Internet.

It was recommended that a quality high speed ISP service over DSL, ADSL, or cable be utilized. For redundancy, it is recommended that two connections from the master station to the Internet be made. However, as the project expands in its implementation and use, the redundant connection can be implemented as desired.

With this system installed by Golden Spread, who only needed to gather information, Golden Spread offered each member co-operative the flexibility to implement control through SCADA on their own systems, while maintaining the Golden Spread portion of the system. This can be added at little additional cost.

Issues and concerns

This approach brings up issues and concerns that have historically prevented its use. With today's technology, the risks associated with this approach are mitigated and have to be reevaluated. Briefly mentioned here are the risks considered and the conclusions or alternatives reached.

Risks

1) Speed and delays

The approach is sending only the changing SCADA data through the Internet, not the entire graphics screen, so speed is not really an issue.

2) Reliability and stability

Simply compare using the Internet to using phone lines or radios. The Internet is no worse, and may be even better considering that you may have an alternative path if one path is inoperable. Also, a major part of the Internet is phone line.

3) Security

Security is the main concern of utilizing a SCADA system operating on a public Internet. Most security hacker and virus attacks are thru e-mail and the WWW. What we all keep forgetting, however, is that the Internet is not the WWW.

Also, consider these Security protections:

- Passwords and permissions
- You can tighten the Security Zone (firewalls, routers, intranet)
- Obscurity – You are addressing an IP address (such as 202.321.55.106), not a domain name.
- Encryption can be deployed to heighten security.

4) Viruses

Viruses typically attack Windows-based operating systems. In addition, they find their way to many applications through e-mail and web based applications. Reduce the vulnerability of your system to viruses by using non-Windows based op systems. If a Windows-based system is used, reduce vulnerability by NOT running Microsoft IIS and by NOT installing Microsoft Web server.

Note that what has been discussed here has been Internet SCADA. This is very different than "web-based" SCADA solutions and IED SCADA solutions. "Web-based" SCADA solutions use

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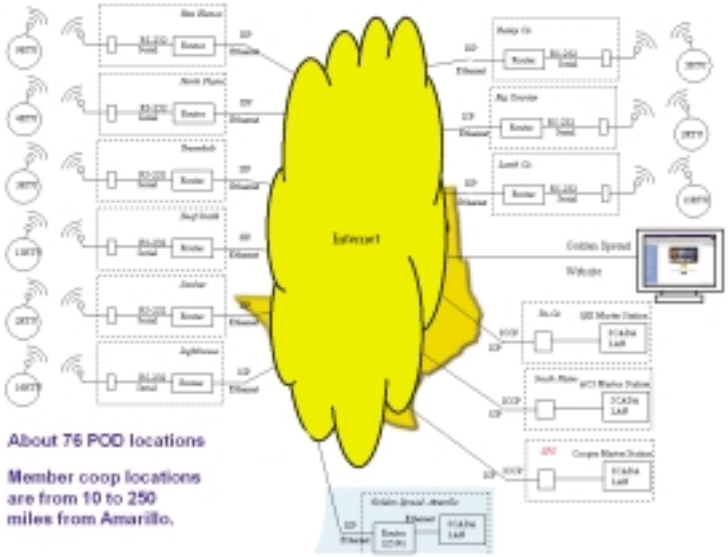


Figure 1

standard web-based applications (java, etc.) that are more "visible" to those looking at them. Most Internet connected IED SCADA solutions have a similar danger associated with them – they are web-browser based.

The Internet SCADA application presented here uses the Internet as a communications medium, passing only certain information through the Internet, not any of the application.

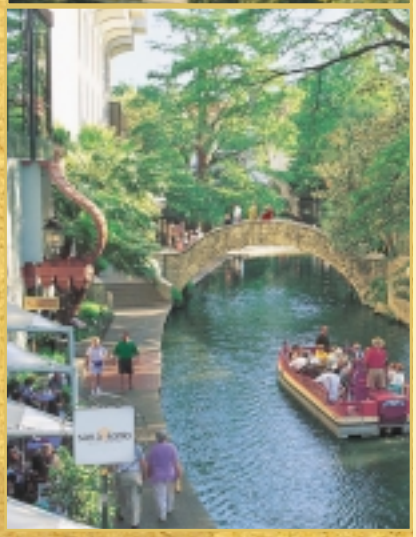
Benefits of the approach

The benefits of using this approach are:

- It is an economical approach considering the complexity and enormity of the project.
- Using the Internet communications is an economic alternative to other communications (leased line, radio, CDPD, etc.). However, as mentioned previously, this solution can use any communication medium, or a mixture of mediums.
- You can use the Internet as a backup if your main communications go down.
- This approach is one way to communicate to a remote station that may be 100 miles away, but you do not have a dedicated infrastructure in place.
- With this approach, it does not matter where the master station is located. In Amarillo, TX, Richmond, VA, or Toronto, Canada, the master can be placed at any site.
- This can be used for a redundant "system" for emergency restoration. ■

About the Author

Steve Mueller, President and Chief Executive Officer of Survalent Technology Corporation, Mississauga, Ontario, Canada, has more than 9 years experience with SCADA systems. The last three and a half-years were spent directing the efforts of Quindar Products Ltd. (previous name of the company now known as Survalent Technology). He can be reached at Smueller@survalent.com. The web site is at www.survalent.com.



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By:

Darold Woodward, PE
Schweitzer Engineering Laboratories

A Primer on Ethernet Networks in Electrical Substations

Today Ethernet is the dominant networking technology used in office and home environments. Because Ethernet networks are inexpensive and fairly well understood, their use is quickly becoming popular for industrial and utility applications including substation automation networks.

Ethernet networks were not developed specifically for operation in substations and other harsh environments. So, why is there so much interest in applying Ethernet networks in these locations? The answer is similar to why personal computers are now used in many industrial and power system applications. Ethernet is so popular in other applications that it is simpler to employ and enhance Ethernet than to create something new.

Only 15 years ago, most Human Machine Interfaces (HMIs) operated on dedicated mainframe computers with terminals rather than the legion of personal computers that is used today. Early personal computer HMIs used custom operating systems dedicated to HMI operation. While dedicated systems are more stable and reliable, today's systems often cost from 10 to 1 percent of the expense of dedicated single-purpose systems.

Both industrial and utility networking experts are moving forward accepting the limitations of Ethernet networks and solving the problems associated with Ethernet networks. Advances in computing power and network technology allow us to take advantage of the popularity and availability of Ethernet networking equipment and solutions.

Ethernet Physical and Data Link Layers

Each standard physical layer and corresponding data link layer has a designator (e.g., 10BASE-T) that identifies the layer specifications. The most popular physical and data link layer combinations for Local Area Networks (LANs) within a single building are fiber optics (10BASE-FL and 100BASE-FX) and twisted-pair metallic (10BASE-T and 100BASE-TX). For general use networks, 10 Mbps and 100 Mbps are the most popular data transmission speeds. As data demands on networks have increased, 100 Mbps networks have become more popular. The actual network loading for a given offered load is about 10 times lower on 100 Mbps networks than on 10 Mbps networks, reducing collisions and network latencies.

The first generation of Ethernet networks used coaxial cable wired in multidrop topologies that were expensive and difficult to modify after installation. The present generation of Ethernet standards uses twisted-pair wiring or fiber optic cables in a star network topology. A star network topology employs a central node (hub or switch) to connect the individual network segments. The star network is more robust and less expensive to install and modify than multidrop network topologies.

Improvements on the hub including switches and routers enhance network performance. Twisted-pair network standards allow unshielded twisted-pair wiring (UTP) similar to that required for telephones. Sites can be prewired using multiple cables of the same type to each anticipated node location. The cables can then be used for telephone or network operation as required, increasing the flexibility and decreasing the cost of twisted-pair networks.

Unfortunately, while UTP cables are inexpensive and simple to apply in an office environment, they can be a problem in other environments. For example, offices typically do not contain strong sources of radio frequency interference (RFI) because of the shielding provided by office buildings and the lack of strong RFI sources within the building. Utility and industrial installations, however, often contain strong internal sources

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(hand-held radios, variable frequency drives, welders, etc.) and may not be well shielded from external sources including radio transmitter towers. Substations also include control wiring that typically is not shielded and can induce voltages in adjacent wiring.

Also, it is critical to note that you should never run any type of metallic communications cable from the substation control house to equipment in the substation yard. The ground potential differences experienced during a fault in the substation can subject equipment to damaging voltages and currents, especially in cables with shields that are grounded at both ends.

In a substation control house, many of these risks are decreased, but the noise from control and instrumentation circuits and circuit breakers in metal-enclosed switchgear can disrupt networks. Even with shielding and physical separation from other cables and wiring, metallic cables with shields provide paths for current to flow from ground potential differences, DC faults, and other stray electricity. The only sure protection from these problems is a cable system that is unaffected by electrical and electromagnetic interference.

Fiber-Optic Cable

Fiber-optic cable systems provide two principal benefits. First, the signals within fiber-optic cables are immune to RFI and electrostatic interference that can disrupt communication on metallic cables. Second, fiber-optic cables can have an all-dielectric (nonconducting) construction. This means that you can run fiber-optic cables outside of the control house to provide robust and reliable communication without the threat of damaging critical equipment at the ends of the communications circuit.

Where twisted-pair wiring uses two pairs, one for transmit and one for receive, fiber-optic cable systems use a pair of fibers, one for transmit and one for receive. Fiber-optic cable systems also require a central node or hub that combines the point-to-point fiber-optic cable segments into one logical network.

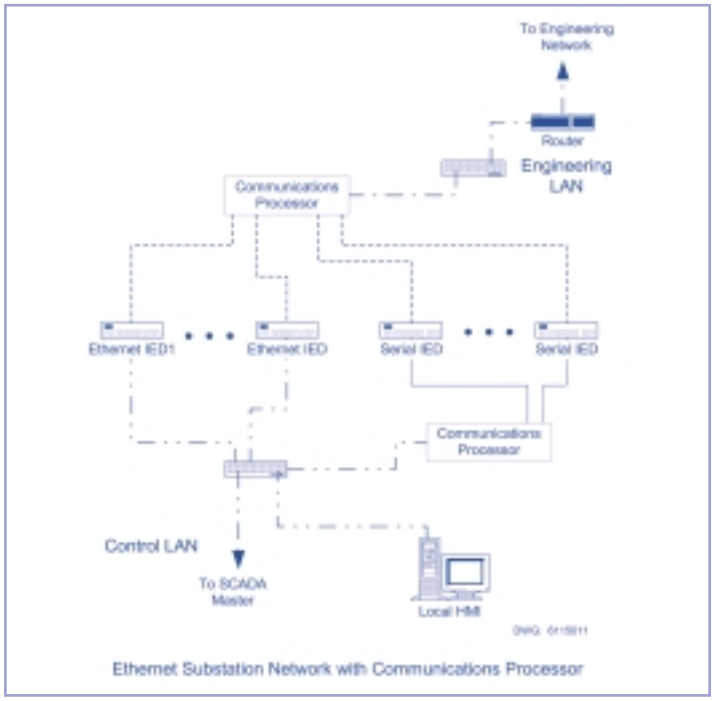
The most popular fiber-optic Ethernet network standards are 10BASE-FL and 100BASE-FX, 10 Mbps and 100 Mbps, respectively. Fiber-optic cable is more expensive than metallic cable. However, shielding measures for twisted-pair cables and installation labor are significant construction costs. You must consider the installed cost of the network to properly evaluate the impact of your choice of network physical medium.

Industrial Protocols

Several of the most popular industrial integration protocols are either running over Ethernet networks or are being prepared for operation over Ethernet networks. For example, Modbus TCP is Modbus for use over TCP/IP networks. Other industrial protocols, including ControlNet®, Profibus, and Foundation Fieldbus, are migrating to Ethernet networks. It is important to consider this work when you plan to use Ethernet in power system applications. The office environment has made technologies inexpensive and available for industrial applications and in cases where office-grade equipment is not adequately robust or rugged. Office-grade equipment provides a foundation for the understanding and development of appropriate industrial Ethernet network components.

Ethernet Network Topology

It is very popular to characterize Ethernet networks (and other substation automation networks) as a magic bus that connects all devices and solves all problems. However, the magic bus concept is only partially correct, even in a logical sense. With an Ethernet network that contains a hub, the network is actually wired as a star that functions logically as a bus. If a switch is the central node, each segment between a switch and a node operates independently with the switch buffering and directing traffic to reduce collisions and decrease message transmission delays.



Ethernet Substation Network with Communications Processor

You may want to connect your network as a simple star topology with a switch or hub, but there are several additional considerations. External access from an engineering network requires an entry point to the substation LAN, typically through a router. You should consider whether engineering access and potentially mission-critical data should travel over the same network segment.

Engineering networks are also often connected to corporate networks and ultimately to the Internet. If you connect a mission-critical LAN to the engineering network, you have provided a path (if a hacker defeats security measures) from the Internet to your mission-critical substation LAN. A simple denial-of-service attack within your corporate LAN could jeopardize the substation LAN.

Environmental Robustness

Substation control houses typically are not environmentally controlled spaces. There is often a minimum of heating (perhaps to 50°F) and no cooling. There is also the possibility that the control house may be without power. During this time, the station battery maintains protection operation and other essential functions, but does not provide a backup electrical source for heating and cooling.

Office-grade network equipment including transceivers, hubs, and switches are often unsuited to environments without adequate heating and cooling. The mission-critical nature of protective relays has led to several environmental requirements including RFI, ESD, operating temperature, and vibration. As such, you should carefully evaluate whether Ethernet is a mission-critical component of your substation and select equipment accordingly.

Engineering Access

One of the places where Ethernet networks can be the most helpful is for engineering access to station IEDs. There are three primary reasons that engineers communicate with relays:

1) Communicate directly for diagnostics and status information;
2) Retrieve file-based data including oscillography and SER reports;
3) Manage and manipulate relay settings.

It is possible to connect Ethernet networks so that relays in the substation become accessible from desktop engineering workstations in the central office. This type of architecture must be implemented with care, as there are numerous system administration and security issues that require attention.

However, it is vital that you address network security issues in designing any system that allows access to station IEDs from outside the substation; otherwise, this could become a path that would allow either inside (an employee) or outside (from the Internet) access directly to mission-critical protective devices. ■

SEL produces protective relays and instrumentation products for utility and industry that monitor power systems, collect equipment and system operation data, and initiate system protection operations. SEL also produces innovative communications products for use with SEL equipment as well as communications interfaces for many SEL products. SEL Ethernet products include communications cards for protective relays and Communications Processors, a serial-to-Ethernet converter, and integral Ethernet interfaces in several products under development. For more information on SEL products and services, including Ethernet solutions, visit www.selinc.com

Biography

Darold Woodward has a B.S. in Electrical Engineering from Washington State University. He is a member of the Instrument Society of America (ISA). He joined Schweitzer Engineering Laboratories in 1998 in the position of System Integration Engineer. He was with the consulting firm HDR Inc., for six years where he participated in design and commissioning projects for electrical, automation, and instrumentation systems in water, wastewater, and hydroelectric facilities. Before joining HDR Inc., he was with R. W. Beck and Associates assisting with the design of electrical and instrumentation systems for substations, wastewater, and hydroelectric facilities.

By:

Barry Halvorson
Marketing Manager
MiniMax Software Corp.

Automating the Work Order Process – the Final Step to Pulling Utility Systems Together

Automated staking improves the design, staking and work order process from initial design to final close out.

Perhaps the last process to be automated at a utility is the design, staking and work order process. This article highlights common problems involved in the traditional staking and work order process and makes a case for implementing a work order automation system as a solution.

Generally one of the most inefficient utility processes is the design, staking and work order process. Utilities have traditionally relied on the pen and paper method of staking work orders, a practice that is time consuming, prone to error and burdened with inefficiencies. In response to market pressures to streamline operations, utilities are looking to eliminate manual processes and automate workflow. While most utilities have spent large amounts of time and money implementing robust CIS and GIS systems, frequently the design, staking and work order process remains a manual, paper-driven procedure.

Figure 1 illustrates how a work order automation system can reduce the time required to complete a typical, medium sized work order. Time savings are realized both in the field and back at the office. Based on these numbers, utilities typically find a return on investment within 8-18 months. These figures are simplified as percentages in **Figure 2**. Using these percentages gives utilities a ballpark estimate of how a work order automation system will help save time and money.

Utilities stand to gain much by automating this crucial process. Not only can the manual staking and work order process be automated in and of itself – tasks such as sketching designs and printing staking sheets – but it also serves as the front-end data source for the CIS, GIS and other systems. This automated process can serve as the final link in completing the digital workflow chain throughout the entire utility, saving time and money.

Work Order Automation
Estimated Time and Cost Savings

Work Order Task (minutes)	Medium (15 Station) Job Manual	StakeOut
Travel	30	30
Customer Relations	60	60
Drawing job	90	70
Survey/retire existing system	60	40
Design new system	90	70
Verify calculations	15	10
Legibly re-sketch job in office	15	0
Complete staking sheet	45	15
Tabulate unit data	15	5
Key data (Estimates, Units, etc)	30	5
Update maps	30	10
Reduced error rates	20	10
One Call Locate Request	15	1
Closeout and final clean-up	30	25
Totals:	9.08	5.85
	$317.92	$204.75
	Savings:	$113.17

Figure 1

Savings Realized When Deploying a Work Order Automation System	
General Work Category	**Savings**
Design Work	20-30%
Mapping Updates	20-50%
Paperwork, Permitting, etc.	10-30%
Accounting and Closeout	20-50%
Total Labor Savings	20-35%
Payback	8-18 months

Figure 2

Problem of Traditional Design, Staking & Work Order Practices

The design, staking and work order process typically begins in the field, where a staking technician designs a proposed change to the distribution system. The staking technician will typically travel to the work site and draw a sketch from scratch using a pencil and paper. The staker must draw all background information needed by the construction crew and sketch in all existing and proposed new construction. From this sketch

a staking (construction) sheet is created. The staking sheet is sometimes drawn on-site, but more often back at the office. On each page of the staking sheet is a grid for units, conductor spans, poles and any other unit information pertaining to the design. Often times each page of the grid includes a small section for re-drawing a section of the design pertinent to that page. As one might imagine, drawing a proposed design and filling out staking sheet grids is time consuming and subject to human error.

Creating accurate staking sheets can also frequently require extra trips to the field. Lost or inaccurate drawings and incomplete field notes are obstacles to creating an accurate design inventory back at the office. Likewise, entering this data into the CIS/accounting system proves to be time consuming, tedious and often inaccurate. Someone must manually key in a large amount of data, which must often times be entered into more than one system.

In short, several problems plague the traditional work order process:

- **Limited access to information.** Paper staking sheets and other records limit employee's access to work order information across the utility. Relying on paper records prohibits more than one employee or department access to information, unless duplicate records are created, which is wasteful and problematic.
- **Redundant data entry/re-entry.** A work order typically moves through a rather long process from initial design to final close out. Data entry occurs several times throughout that process: into accounting, inventory, CIS and mapping/GIS.
- **Prone to mistakes.** Data re-entry and maintaining multiple records wastes time and increases the chance of error.
- **Information prone to loss, fire, theft, etc.** Paper records are not only fragile and prone to loss, but also bulky and expensive to store. Digitizing the process cuts down on paper consumption and storage needs.

Work Order Automation as a solution

As utilities deal with an increase in work orders due to growth and pressure to streamline operations, it becomes increasingly clear that automating the staking and work order process can yield significant benefits and cost savings. Just a few of these are:

- **Quicker data entry.** By using mobile, pen-based tablet computers in the field, stakers don't need to hand-tabulate unit, pole and conductor information – they simply drop them in and let the computer perform the calculations.
- **Less work back in the office.** Using an automated staking system in the field eliminates the need to re-sketch and re-tabulate staking sheets back in the office. Once a job is designed a staking sheet is printed automatically.
- **Reduces chances for mistakes.** An automated staking system guides the user through the design, prompting for missing units and alerting users to design flaws that violate a rule-base.
- **GPS and laser rangefinder connectivity.** The use of a mobile computer allows the staker to collect GPS data for each station and calculate spans between stations using a laser rangefinder.

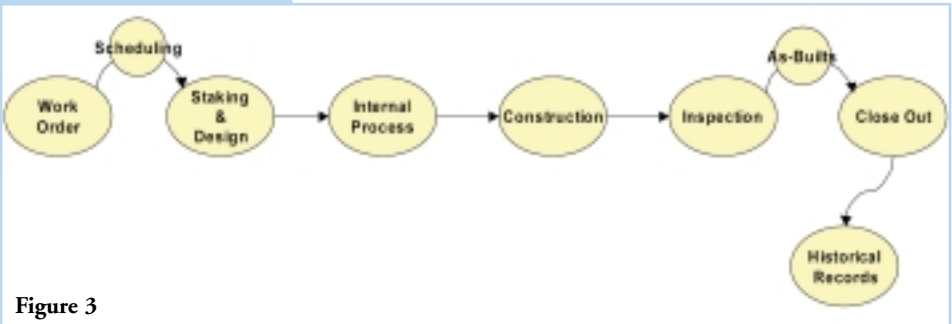


Figure 3

- **Neater and cleaner staking sheets.** Staking sheets, along with unit and material lists, fax-locate forms, cost-estimates and any other forms can be generated in the field for customer reference, or back in the office.

The Work Order Process as a Whole

Automating the staking process is just one piece of the entire work order process. In addition to increased efficiency in staking and design processes, utilities realize the greatest gain in time and money savings when automating the entire work order process. **Figure 3** shows a how a work order moves through the work order process at a typical utility. A work order automation system can maximize efficiency at each point throughout the process.

To focus specifically on the scheduling, staking and design steps, **Figure 4** illustrates how a work order's scheduling and design are dependent on a number of inside (departmental) and outside (customer and supplier) influences. Implementing a work order automation system helps manages these influences by sharing crucial work order information between the groups shown, as well as by tracking where in the process the work order resides.

Figure 4

In addition to these features, some of the key benefits of implementing a work order automation system are:

- Integrate with mapping/GIS. Utilities often spend very large amounts of money implementing a mapping/GIS system, yet struggle with the issue of keeping that data up-to-date. Interfacing with an automated staking system allows the field staking processes to act as a front end to the GIS, resulting in updated maps and better background data on the staking sheets.
- Eliminates data re-entry into CIS. All unit, pole and conductor data is tabulated automatically by the staking system. When tied to the CIS, a simple file transfer eliminates the time consuming and error prone process of re-entering that data.
- Allows reporting options. Database-driven technology allows the utility to analyze staking trends and forecast for future needs. This benefit becomes increasingly useful as the utility amasses multiple years' worth of staking and work order data. Managerial reports can be run on that data to help the utility make informed decisions relating to productivity, cost of goods and forecasting.
- Reduce the cycle time of a work order from initiation to final close out.
- Increases access to information. Utility-wide access to digital work order information results in improved responsiveness and communication between departments.

How it Works

An automated staking and work order package uses a variety of components that work together to automate the whole work order process from initial design to final construction.

In the field stakers use handheld pen tablet computers to perform their design work. This process involves drawing from scratch or staking directly in top of an imported background map. Using a pen-based computer allows the staker to design the work order using a familiar methodology – with a pen – while simplifying the design process. Mobile technology also allows for seamless GPS data acquisition and use of laser rangefinders for calculating backspans and GPS offsets.

Once the design is completed in the field a large portion of the back office work order process is already complete. Instead of manually filling out staking sheets the staking technician simply prints them out instantly. Likewise, unit reports, material lists, cost estimates, permits and countless other forms can be readily generated from this data and accessed by work order clerks, construction crews, engineering managers and anyone else involved in the work order process.

The work order may pass through any number of departments until final approval, construction and close-out. At each step along the way the work order automation system will assign different job statuses in a manner fitting the utility's work flow process. In this way, the work order process becomes centered around the sketch-driven data entry in the field. Once the job has been designed digitally, no data re-entry is necessary, the job is tracked throughout the process and the associated GIS and CIS systems are updated efficiently.

Automated staking and work order automation tools are technologies that provide utilities substantial return on investment by decreasing operating costs, improving productivity and increasing communication of important work order data throughout the utility. As utilities look to improve efficiency and bring the work order process into the digital age, the technology ecists to meet that goal while tying together other systems and completing the digital work flow chain. ■

About the Author

Barry Halvorson is a marketing manager for MiniMax Software Corporation, a software development company located in St. Paul, Minnesota. MiniMax is the leading provider of automated staking and work order automation tools to the electric utility industry. Its flagship product, StakeOut, automates the design, staking and work order process from design to construction.
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The 2003 edition of DistribuTECH is being held from February 4 – 6 in Las Vegas, Nevada, USA at the Las Vegas Convention Center. Major technology areas covered include:

- Substation Automation
- Distribution Operations Management
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- Metering, AMR & Data Management
- Mobile Computing

DistribuTECH kicks off with the Keynote Address on Tuesday, February 4th. Featured Speakers are Walter M. Higgins III, Chairman of the Board, President and Chief Executive Officer, Sierra Pacific Resources, and Wanda Reder, Vice President, Engineering and Planning, Commonwealth Edison Company.

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

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

Schedule 2003

This schedule is a partial schedule
For the complete schedule visit: www.distributech.com

Sunday, February 2
8:00 a.m. - 5:00 p.m.
Utility University Courses & Workshops

Monday, February 3
8:00 a.m. - 5:00 p.m.
Utility University Courses & Workshops

Tuesday, February 4
9:00 a.m. - 11:00 a.m.
Keynote Address
11:00 a.m. - 6:00 p.m.
Exhibit Floor

Wednesday, February 5
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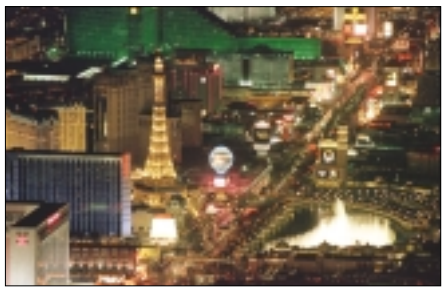

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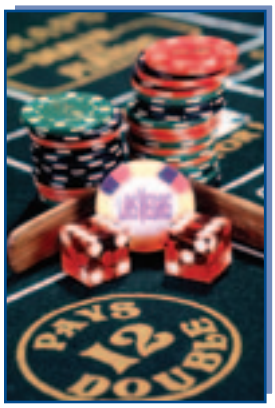

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AMRA	852
Amrel Systems LLC	245
Applied Metering Technologies Inc.	440
Applied Systems Engineering Inc.	558
Arbiter System	231
Austin International Inc.	551
Automated Energy, Inc.	1738
Automation Technologies & Services LLC	338
Axiom Corporation (Mobility)	435
BARCO Control Rooms	1625
Beckwith Electric Company	630
BLP Components	753
Bow Networks Inc.	453
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Christie Digital Systems	525
Clarity Visual Systems	238
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Data-Link Group	133
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Dataremote Inc.	854
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LiveData	745
Logica	101
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Landis+Gyr ...Beyond Measure

It is my pleasure to announce the official transformation from Siemens Metering, Inc. to Landis+Gyr Inc., effective September 26, 2002. As a part of this change in ownership from Siemens AG to Kolberg Kravis Roberts & Co., we have adopted one of the most famous names in our business: Landis+Gyr. KKR & Co. has the financial resources and commitment to help us execute our strategy and further our growth. This purchase gives Landis+Gyr the ability to invest in the products your customers will need in the future.

Since 1896, Landis+Gyr has stood for innovation, leadership, vision, competence, and quality. We pride ourselves with the knowledge that we have delivered these qualities for over 100 years and we will to continue to deliver these qualities in the future. In addition, we are committed to a new vision that focuses on you. We will provide speed in delivery, quality service, and simplicity in all realms of our business.

Our objective is to be the supplier of choice for solid state, residential, AMR metering products. To reach this goal, we are launching the FOCUS family of metering products to provide the utility industry with a reliable, quality, solid state, AMR meter platform that easily adapts to various AMR technologies.

FOCUS KWH technology includes digital multiplication measurement, L+G ASIC, microprocessor, non-volatile memory, selectable metrics, flexible display functionality, optional KYZ output, configuration port, factory programming option, and is designed for 15+ year life.

Like our other solid state meters, FOCUS is available in multiple meter forms including 2S, 2SE, 4S, and 2K in 240V, 1S in 120V, 3S in 120V and 240V, and 12S and 25S in 120/208V.

The FOCUS specifications meet and exceed industry standards. The specifications include a temperature range of – 40 C to +85 C, load performance accuracy class of .2%, starting load of 20mA or 5 watts, and a burden of < 1.8 watts. The meter meets ANSI standards for performance and utilizes ANSI protocol.

FOCUS will be showcased in the coming months and will be proven the unparalleled residential metering solution in the coming year. You asked for it, we answered.

The company's Landis & Gyr Converge™ AMR solution is a modular "meter-to-bill" energy information system that is scalable to millions of meter points. Designed with flexibility in mind, Converge combines a wireless C&I data acquisition engine with advanced information processing capabilities. Using the system's meter data warehouse to collect, process and store meter information from multiple collection systems and data streams, a utility can create one central repository and data distribution engine for all meter data. Expandable via a wide variety of value-added features, such as EDI connectivity and web presentment, the Converge meter-to-bill solution offers the flexibility, scalability and adaptability to meet a utility's changing business and regulatory environment.

Landis+Gyr also partners with business and technology companies to offer Information Management Hosting and to provide the best metering solutions in terms of capabilities and affordability. Our meter platforms have a proven track record in the real-time electric metering (RTEM) market at blue-chip utilities across the nation. Our strength as a meter systems provider lies in:

A History of Innovation – For over a century, Landis+Gyr has developed "intelligent" and innovative metering tools, systems and services.

Our ability to integrate with "best" partners for best technology offerings – We have the depth of industry knowledge and experience to evaluate new technology and integrate disparate applications into seamless solutions and systems operations.

Our business understanding and "guaranteed" solution delivery – Landis+Gyr stays abreast of changing technology, regulatory, meter and business conditions and is able to plumb the resources of our world-wide market leadership position to fully satisfy our customers.

The most cost-effective solution available – We help customers maximize their business case with the continuous market introduction of the most cost-effective metering solutions.

Our Project Management Strength – Landis+Gyr assumes the role of overall project manager for each of its proposed C&I metering systems and ensures that they meet or exceed all customer expectations.

A focus on customer satisfaction – We are committed to providing the best metering solution in terms of capabilities, technology and affordability. By uniting our global experience and technology with that of our partners, we provide metering solutions that cover all utility needs from the home to the power plant.

We cordially invite you to experience FOCUS and the Metering Systems solutions, along with our complete line of metering products at DistribuTech 2003 Las Vegas. Visit us at booth 149.

Landis+Gyr

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SchlumbergerSema Electricity Metering
Metering Devices

SchlumbergerSema provides electronic, solid-state metering devices, software, and open protocol platforms for residential, commercial and industrial, as well as generation, transmission, and distribution markets. The modular design and open protocol engineering of these devices provide great flexibility for various telemetry communications modules to meet the changing needs of the markets. It is a proven technology that meets today's needs with a design for tomorrow's challenges.

CENTRON® Meter — Today's choice. Tomorrow's power

Provides utilities with an exceptional platform for the future at a cost that makes sense for today's residential market. Its technology and components match residential needs, while addressing reliability, serviceability and investment cost considerations. Take a closer look at the CENTRON and discover the features – and the flexibility – that's perfect for the present and ready for the future:

QUANTUM® Q1000 Meter — Maximize your measurement intelligence.

As the most advanced billing meter on the market today, the Q1000 includes many features that maximize your flexibility, enabling you to gather the intelligence you need to manage your business. Its flexible input and output capabilities for high speed communication and its open protocol systems allow easy integration into existing systems.

SENTINEL™ Meter — A Solid State of Mind. Keeping Watch Over Your Information

A highly adaptable business tool for today's competitive market, the SENTINEL meter provides flexible data communications, input and output capabilities, and a wide range of software options. Its platform flexibility allows for ease of upgrade and downgrade while in the field. The meter provides additional flexibility with a variety of communication boards. The SENTINEL meter lets you effectively manage the information requirements of today, while providing the flexibility to meet the challenges of tomorrow.

UtiliNet® Radio — Wireless Without Limits

The UtiliNet network combines the best of three important technologies: spread spectrum, packet switching, and a connectionless mesh network architecture. These three technologies work together to ensure that UtiliNet networks are fast, operate transparently, and deliver data messages with the highest security and reliability.

EnergyAudit™ Software — The Power to See

Now you have the power to see and manage the data you need. EnergyAudit is a powerful set of tools that you can use to acquire and analyze volumes of load profile, register, and power quality data.

Handheld And Drive-By Meter Reading Systems

In addition to metering devices and meter software, SchlumbergerSema provides complete route management software and data collection devices. It uses the DAP PC9800 Handheld with the HR2580 HHIU and the SchlumbergerSema Drive-By Data Collection (DBDC) unit that reads R300s, R900s, and electric ERTs.

DAP PC9800 — As an integral part of reading systems, the PC9800 handheld with the HR2580 HHIU works with route management software to provide a complete meter reading solution with advanced functions for electric utilities. Its features and durable construction are perfectly suited to address meter reading applications and to interface with most common meter adaptors and probes.

Drive-by Data Collection Unit — The SchlumbergerSema RoadMAPS drive-by data collector is a rugged, compact, portable, easy to use, multi-energy meter reading device that can be securely placed in the passenger seat of any vehicle with a standard set belt while being powered by the cigarette lighter receptacle. It is designed to greatly reduce the man-hours required to collect and process meter reading data while increasing meter reader safety and efficiency.

RouteMAPS® Host Software — From exchanging files with the utility mainframe to sending route information to the handheld or drive-by computers, the host software manages the entire meter reading process.

SchlumbergerSema

SchlumbergerSema - Utilities
313-B North Highway 11
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USA

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Fax: 864-638-4950

COR-GEN-0034-04.02

Today's electric utilities need accurate information more than ever.
You need intelligence about the generation,
transmission, distribution and consumption of energy.

Depend on SchlumbergerSema for the Measure of Power.

The Electricity Division of SchlumbergerSema has been developing energy management technologies for over 100 years—we understand your needs to operate profitably and efficiently. We help you optimize every aspect of your operation to maximize your success. Our metering solutions provide accurate, reliable data to help our customers conduct their business with flexibility, functionality, and cost efficiency.

SchlumbergerSema is a leader in intelligent metering:

- CENTRON®
- SENTINEL™
- QUANTUM® Q1000

Our wireless radios deliver reliable data:

- UtiliNet®
- CellNet®

SchlumbergerSema software solutions provide a powerful set of tools to explore the essentials of meter management:

- PC-PRO+® 98
- EnergyAudit™
- RouteMAPS™

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SchlumbergerSema

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Hunt Technologies, Inc. is engaged in the creation, development and marketing of power line carrier based communications systems for utility industry applications.

At the heart of Hunt Technologies' product offerings is patented Ultra Narrow Bandwidth power line carrier technology. This technology allows for the remote collection of usage data over the utility's existing infrastructure without the use of additional line conditioning equipment. The system transmits at frequencies below 60 hertz and is therefore highly resistant to interference allowing it to transmit information over long distances.

The Turtle System

The company's flagship product, the Turtle System, remotely reads electric and water meters. The Turtle System offers an inexpensive solution to simultaneously read all meters and provide comprehensive data that is utilized for billing services, distribution system maintenance, customer service, and line loss prevention. To date, over 2 million endpoint transmitters are deployed at over 400 utilities worldwide.

TS2

The most recent addition to Hunt Technologies product offering includes a bidirectional broadcast communication system called, TS2. This system also utilizes power line carrier communication, and is designed to facilitate bi-directional flow of information to all endpoints simultaneously. This allows utilities to send commands, reconfigure endpoints, accommodates switching, and facilitates plug and play installation of endpoints.

Unique Bi-direction and One-Way Systems

Both the Turtle System and TS2 can operate on the same distribution system. This allows utilities to selectively deploy the systems based on the features needed at each endpoint, ensuring the most cost effective solution for deployment is achieved at each utility. Each endpoint communicates on its own channel, providing for continuous and simultaneous communication at all endpoints.

EPIC™ - End Point Information & Control

Hunt systems are used by utilities, to gather endpoint information for use in utility operations. The system provides all the meter data activity needed for accurate and timely billing, including time of use data from each meter. Plus, it stores usage profiles to solve billing disputes, report power outages and maintain the entire power system – all from every customer, every day. It is this collection of endpoint specific data that provides an even greater return on investment than simply gathering a monthly meter reading. Hunt brings reliable, endpoint specific data, into an open architecture environment that can be easily integrated and analyzed. While each utility selects information systems to meet specific needs, the benefit of data integration is evident. Hunt's goal is to simplify system integration with endpoint data collected by the Turtle System so that it can be distributed throughout your organization.

Your EPIC Solution

The greatest return on investment can be obtained by your utility through the selective deployment of both one-way and bi-directional technology.

Hunt Technologies delivers innovative and economical solutions:

- Easy to install and maintain
- Highly flexible to serve all your customers' needs
- Utilizes utility owned infrastructure
- Economically scaleable
- Continuous data transmission – one-way and bi-directional
- Proven, Patented Ultra Narrow Bandwidth technology
- Simplified data integration via open architecture design

Hunt Technologies has a proven reputation for quality, durability and reliability. Hunt Technologies offers a money back guarantee on the trial system and an 18-month warranty and extended service agreement for all products. To support you in implementing your system, Hunt Technologies holds more than 50 regional training sessions per year that cover every aspect of the Turtle System, from installation to maintenance and software operation. In addition, Hunt Technologies maintains an award winning customer support call center available to answer any questions you may have. On site assistance is also available through the field technical support team.

Take a closer look at EPIC, TS1 and TS2 – and unleash the power of endpoint specific date through your utility organization. Call our sales department today to receive additional information or to schedule a sales visit, 800-926-6254.

Hunt Technologies, Inc.

6436 County Road 11
Pequot Lakes,
MN 56472

Phone: 800-828-4055
Website:
www.turtletech.com

Smarter endpoints are just the beginning.

TS2 is an exciting new AMR system that brings the power of endpoint specific data to your entire organization. Not only does it bring the information to you, TS2 also allows you to communicate simultaneously with each individual endpoint, giving you unparalleled bi-directional control.

TS2 is the heart of the EPIC™—End Point Information & Control—solution from Hunt Technologies. Using our proven Ultra Narrow Bandwidth technology, TS2 revolutionizes power line carrier based AMR systems.

TS2 provides the ultimate in flexibility presenting endpoint data that can easily be imported into a variety of utility applications. Imagine the benefits to your utility operations: enhanced customer service, reduced system outages, improved system maintenance capabilities all translating to increased bottom line results.

Take a closer look at TS2—you'll see the difference. Contact Hunt Technologies at 800-926-6254 or visit us on the web at www.turtletech.com.

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TS2®
from Hunt Technologies, Inc.

Circle 68 on Reader Service Card

An engineering review of new metering-point products

Quality, innovation & technological breakthroughs for safety, security and operations efficiency at utilities

By:

Steven Rios
Utility Products
Marketing Manager
E.J. Brooks Company

At E.J. Brooks — more choices, more solutions

Brooks Straight Wire Enduro Seal for definitive tamper-evidence.

Ekstrom's low-profile surge-suppression device, MBSA-90

Lexan prewired meter socket endures severe environments

E.J. Brooks Company always strives for product innovation. "We are particularly interested in creating products that address customers' specific needs," says Brooks Special Project Manager Robert Debrody, P.E. "When an electric utility says, 'I have a problem—can you come up with a product to solve it?,' that's what we love to hear."

A case in point is our new Straight Wire Enduro Seal, a new version of the Brooks security classic, the Enduro Seal. Made of durable acrylic plastic, the Straight Wire Enduro Seal is equipped with a straight-wire hasp end instead of the traditional hook-shaped hasp end. The stainless steel wire is easy to maneuver through apertures as small as 1/16" (1.78 mm) diameter.

The Straight Wire Enduro Seal features a unique fishbone-shaped insert embedded in the clear seal body. Once locked, the insert "bones" rigidly engage notches in the wire hasp. Any attempt to withdraw the wire will cause the bones to fracture, thereby providing visible tamper evidence.

Straight Wire Enduro Seals are heat stamped with consecutive numbers and company name/logo. As an option, a company name can be molded into the insert. Inserts are available in a range of colors.

At Ekstrom R&D, a history of innovation

Ekstrom Industries features products that enable utilities to upgrade existing technology through new and improved methods. It's their specialty to help utilities stay on the leading edge. Since Ken Ekstrom designed his first meter socket adapter 47 years ago, this Brooks subsidiary has introduced more than 4,000 new products.

Ekstrom is known for creating products that feature improved performance at lower cost. For some products, that means Ekstrom focuses on ease of use, says Darrell Robinson, P.E., Engineering Manager at Ekstrom. "Take MBSA-90—Ekstrom's surge suppression device. The product's improved longevity means you don't have to change it as often—and that's added value to the utility."

Robinson explains: "When it comes to creating solutions for utilities, Ekstrom engineers ask —how can we save the utility if they use our products versus the competitors? Let's say we've refined the product to its simplest form, at that stage, you start asking, can we save them labor on installation? We continually ask how can we improve function and design every day in new product development."

At Meter Devices—newer, better designs

Meter Devices always has several projects in the design mode; each is geared towards meeting customers' needs. "We pride ourselves in finding ways for our customers to accomplish their goals," says Meter Devices Engineering Manager Tom Archer. "Whether it's designing a new product or tweaking an existing design, we make it happen in the least amount of time possible."

One example--MD's 3000 Series Transformer Rated Meter Sockets, engineered to help utilities save time and money while ensuring accuracy. Series 3000 sockets can be pre-wired with test switch and wiring harness. Sockets are built to precise specifications, ready to install.

For customers looking for a corrosion-free alternative to the standard steel and aluminum meter socket, MD designed the Lexan Non-Corrosive Prewired Meter Socket. This new product will endure harsh conditions in coastal areas, refineries, chemical plants, fertilizer plants and other caustic .

Meter Devices knows how to fast-track projects without sacrificing on quality. "In years past, it took an engineer five days to make drawings for a meter socket. He sat in front of a drawing board and made all his drawings by hand. With the changes in computer technology and in the introduction of 2D CAD, that five days dropped to two days. But now with 3D CAD design, a meter socket can be completed in hours, not days," Archer says.

About Brooks, Ekstrom Industries & Meter Devices

E. J. Brooks is an international supplier of security seals and locking. The company is based in Livingston, N.J. and has 13 operating units worldwide, including locations in Mexico and Canada. Meter Devices with metal enclosures, meter warm-up boards and meter/relay test switches and accessories. Ekstrom Industries, Inc. is the leading manufacturer of meter socket adapters and metering test equipment. All companies are registered to ISO 9001.

BROOKS
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MD Meter Devices Company, Inc.

Utility Products Group

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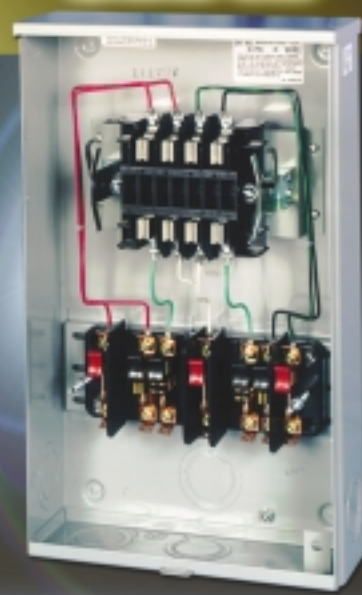
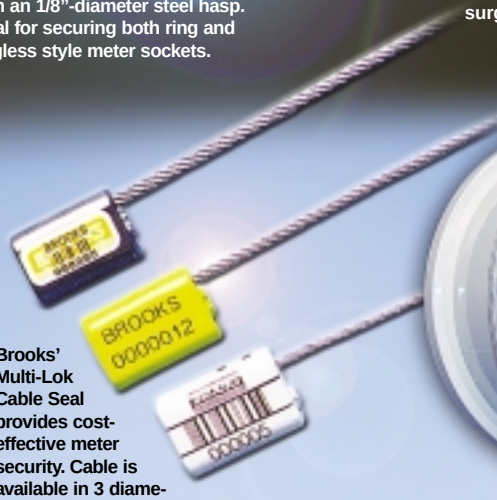
Enhance Security
Solve Problems
Reduce Costs

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

The profile of Ekstrom's LP Series extender adapter is only 1.2"; 4-8 jaw models; accepts phone lines for direct access, MOVs for surge protection, relays for load controls.



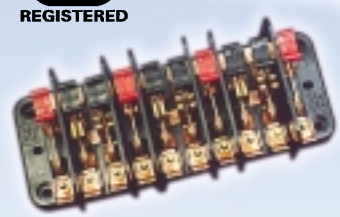
Meter Devices transformer-rated meter sockets are prewired to specs with provisions for test switch and wiring harness.



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

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

ISO 9001 REGISTERED



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

BROOKS

EKSTROM INDUSTRIES, INC.

MD Meter Devices Company, Inc.

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

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The sky is not the limit

In the Automated Meter Reading technology, we found that our best assets are our craftsmanship and our flexibility.

What did NERTEC develop through its concerted relationships:

- Largest range of products of all AMR providers
- Open architecture management system
- Customize and own the data monitoring system or choose the Nertec assistance
- Risk-free guarantee that products will meet your specifications
- Project development follow-up through all the process
- Product customizing participation
- Inter-operability of differing systems (water, gas, electricity)
- Completely separate or centralized data management
- Upgradeability – prevents from obsolescence
- Two-way communications
- Wire or wireless communication

And all your projects on which our Engineers and Technicians teams are working on

Fast and easy access increases choices

NERTEC's web-enabled solutions offer seamless integration with existing meter data collection and storage systems.

- Minimized communication costs by accessing data without customer inconvenience;
- Proven reliable SerView software;

Our customer focus brought us where we are

NERTEC is an Automated Meter Reading (AMR) products and systems provider. Founded in 1985, NERTEC has focused solely on AMR systems and products.

NERTEC designs and manufactures a variety of AMR products to meet the needs of electric, gas, and water utilities for residential, commercial and industrial applications.

NERTEC systems use the public network infrastructure, both wired and wireless, to eliminate the need for utilities to maintain a communications network, and to allow targeted implementation in virtually any utility environment.

NERTEC's AMR devices and automated systems provide a foundation for valuable data collection and valued-added services. NERTEC is recognized as a North American leader of AMR solutions for gas, electric, and water utilities.

Being ahead translated in Leadership

In its many years of operation, NERTEC has developed a wealth of expertise in metering and telecommunication technologies. For the last ten years, NERTEC has been actively involved in the standardization process of ANSI C12, AMRA/IEEE SCC31, and Industry Canada's Task Force on Data Communications Protocols for Electronic Metering Devices. By focusing on and contributing to these new and upcoming standards, NERTEC was the first AMR provider to introduce a software tool that is compatible with the Utility Industry End Device Tables (ANSI C12.19-1997, IEEE 1377-1997). NERTEC's products are all standard approved hardware and software.

NERTEC = Reliability + Efficiency + Low Operating Cost + Flexibility

Some of the features and benefits of NERTEC's AMR solutions include:

Interval Data Collection	*Load Profiling*
Time-Of-Use Metering	*Wired and Wireless Solutions*
Easy to Install and Operate Devices	*Two-Way Communications*
Secure Data Sharing via the Internet	*Daily E-Mail Data Distribution*

Benefit from the Public Communication Networks

NERTEC's AMR system is composed of three (3) elements:

1) The AMR devices, the existing public communication infrastructures, and the AMR Communications Server.

2) The NERTEC AMR Devices communicate via public communication networks that serve as a wide area network (WAN) for our AMR systems. These networks include dedicated wireless packet data networks (Mobitex, Ardis, 1xRTT, GPRS) and the public telephone (twisted pair) networks.

3) Wireless and telephone technologies permit point-to-point, two-way communications to exchange data and reprogram meter parameters.

Commercial & Industrial Metering, Public Wireless Networks

Using the strategy of developing products that run on existing communication infrastructures, NERTEC has developed multiple communication modules compatible with electronic polyphase meters. These modules are designed to interface with the public telephone network as well as public RF networks such as: ARDIS and Mobitex.

NERTEC

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Toll Free: 1-888-463-7832
Fax: (972) 480-8328
Web: www.nertec.com

Since Apollo 11 our stuff is still working like new.

If you're thinking about AMR, you should think about the company that sets the standard. A reputation for reliability that's the envy of the industry. The first company to deploy technology capable of reading and transmitting data on electricity, gas, and water in a single unit. And the company that made a major contribution to the establishment of the first telecommunications protocol for all AMR transmissions. That company is NERTEC. The signal is clear.

NERTEC

www.nertec.com

The standard for AMR

Circle 82 on Reader Service Card

Fueling the Value-Add Revolution: The Datamatic FIREFLY

"Moving targets are harder to hit" goes the saying. It certainly holds true when your target is a strong business case in today's ever-changing economic climate. Beneficial changes have also been taking place in AMR; the industry Datamatic started when it installed the first electronic meter reading system in 1980. Worldwide deployment of increasingly robust and economical technologies are helping utilities compete by cutting costs, increasing operational efficiency and giving access to large amounts of new and useful data.

Let the games begin

Deregulation has raised a number of new business issues. Among the most important is Customer Retention. Deregulation has made it necessary to not only provide reliable services at competitive prices but also to add additional value and differentiate their offering from their competition. Certainly lower costs enable utilities to offer more competitive pricing. But in addition to staying price competitive, what can a utility do to raise the perceived value of its services? This is where the FIREFLY Automatic Meter Reading System comes in.

"AMR Plus"

The FIREFLY makes use of unlicensed RF communications and low-cost mobile/handheld data acquisition. This approach to AMR is proven, very economical and effective, but it is not new. FIREFLY, however, has added some exciting features that raise this proven concept to new levels of sophistication. No longer a just a reading tool, FIREFLY adds broad-based value that transcends the meter shop.

All FIREFLY Meter Interface Units archive usage data at user-definable intervals; a capability called ProfilePLUS. Setting the profile interval to 15 minutes allows the FIREFLY MIU to store the previous 82.6 days of consumption profiles. Data can be retrieved quickly by field service personnel or meter readers with a handheld or laptop computer. Once it is retrieved, ProfilePLUS data can be displayed on a graph, spreadsheet or other meaningful format. Graphs can be printed, emailed or posted to a secure portion of the corporate website. A picture is worth a thousand words and being able to show a customer when they used the power they did adds credibility to your operation and can often jog a customer's memory. For example, the additional power used during a brief and unexpected heat wave can easily be forgotten. ProfilePLUS data can be a helpful reminder to a puzzled customer.

Infrastructure optimization

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

1. Extract ProfilePLUS data from all services using a given transformer.
2. Combine the data from all services over the same period of time, creating a master graph showing total transformer load at each interval.
3. Compare total loads on the master graph to the rated capacity of the transformer and "right-size" equipment accordingly

Peak Demand and Time-of-Use Billing

FIREFLY MIU's transform standard residential meters into demand/time-of-use meters. Each single-phase meter transmits the peak demand intervals for the current and previous 30-day periods in every radio message. And ProfilePLUS data can provide the necessary data for certain types of time-of-use billing. This opens new options for incentivizing customers to adjust consumption and help utilities balance demand.

Pulling Double (or Triple) Duty

So now you're reading your electric meters with the FIREFLY AMR System. Routes are optimized. Your people are experienced. Your cost-per-read is a tiny fraction of what it used to be. You've done it all, right? Nope. It's time to use your FIREFLY AMR infrastructure (AMR reading vehicle, software, handhelds, experienced AMR readers) to read the water and gas meters on your existing routes. FIREFLY Meter Interface Units are available to fit virtually all sizes, makes and models of water and gas meters. And your FIREFLY reading equipment can pick up three reads per location as easily as it picks up one. A partnership with the local water and gas providers can generate new streams of revenue with almost no increase in reading labor costs. It's not rocket science, just the next logical step.

Automatic meter reading is revolutionizing many aspects utility operations. No longer regarded as high-tech black magic, AMR has moved into the mainstream. The problem child has grown into a responsible, productive adult. But now the choices become more complex. Can your utility afford to invest in a "one-trick pony", an AMR system that just reads meters? The escalation of competition in the energy market necessitates a business case with a maximum of available options. More and more utilities are finding that the robust, multi-value technology of the FIREFLY AMR System forms the foundation of their strongest business case.

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TAKE CONTROL

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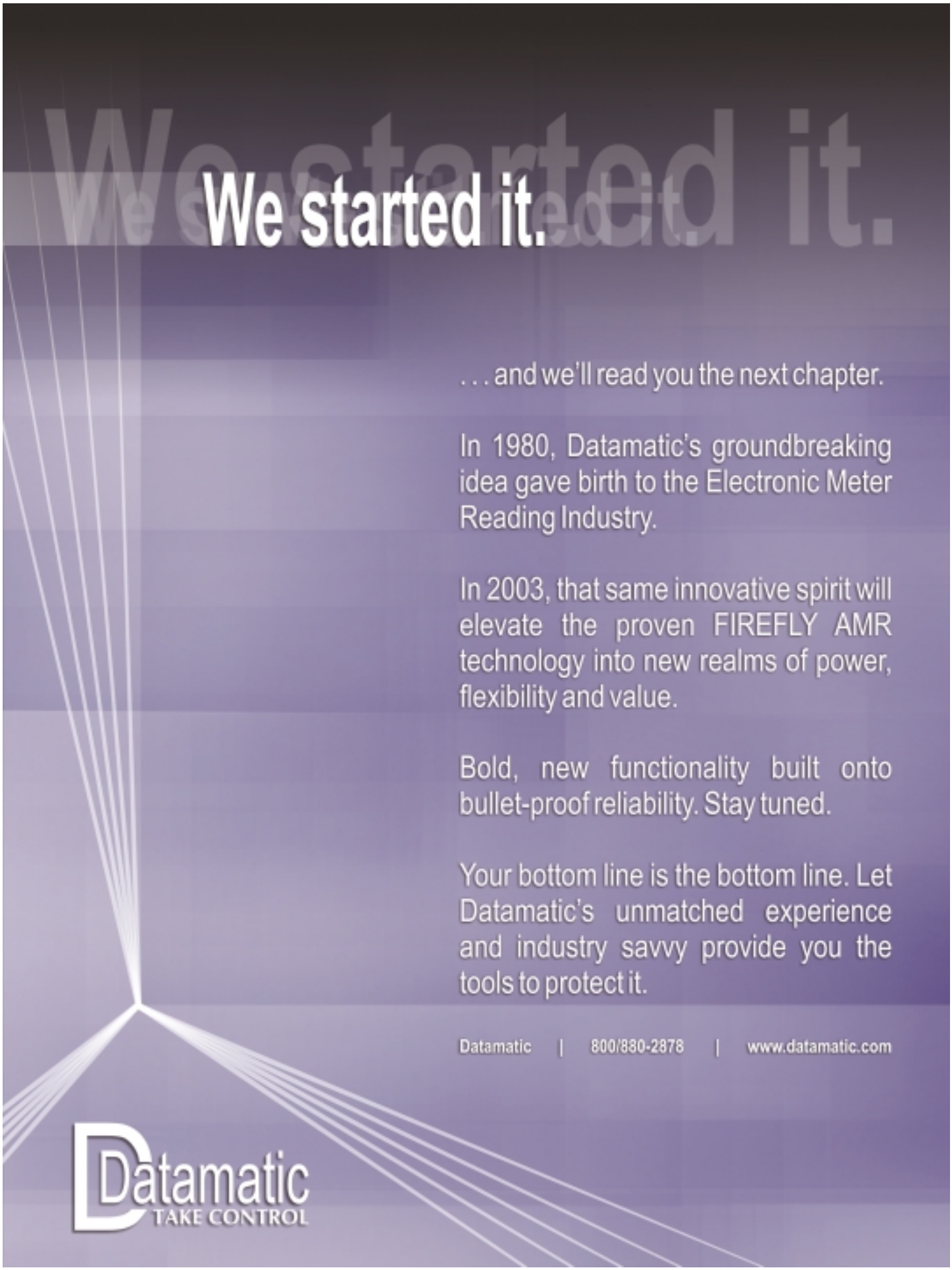

Circle 59 on Reader Service Card

By:
Ron Chebra
Director Comverge
&
Paul Taylor
Senior Director
R. W. Beck

Utility Applications and Broadband Networks

Either Lead or Follow, But Don't Get Out of the Way.

About ten years ago, there was a great deal of interest by some of the leading cable Multiple System Operators (MSO's) to focus on utility applications over a two-way cable network infrastructure. Clearly, for these operators, having utilities as long-term anchor tenants would help build economic justification for conversion of many of their one-way systems to a digital two-way network capability. To foster a consistent view and approach to this opportunity, a loose consortium, known as Cable Utility Communication Services (C-UCS), was formed by the top five cable companies. Among the objectives of this group was the codification of the needs for premise communication for each potential utility application, establish the various technology requirements to support these services, promote suitable technical solutions and standards to deliver these services, and establish both a near term and life span value for each of these services. This study and analysis group ran focus groups, engaged major consulting firms, examined potential areas of collaboration with other organizations, and created a detailed analytical economic model detailing their findings. Various utility needs were examined within the scope of this study.

Some of the many basic utility services considered included:

- Automatic Meter Reading (AMR)– the ability of the network to support utility originated meter register access, either on a scheduled basis, or instantaneously by an authorized agent within the utility.
- Remote connection and suspension of service – on line ability to remotely connect and disconnect commodity* service.
- Outage notification – automatic reporting of power* loss and restoration at the service location
- Tamper detection – notification of an attempt to modify the meter or registration equipment.
- Remote user control of temperature and lighting – ability of the end user to control the environment of the premise from anywhere.
- Direct utility initiated load control – signaling by the utility to reduce certain controllable loads, such as air conditioner cycling, water heater cycling, etc.
- Indirect user prescribed load control – execution of user entered prescribed scenarios based on energy pricing signals.
- User access to energy information – ability for the user to access specific consumption information over a communications channel.

Testing the Hypothesis

Back in 1995, using some benchmarks available at that time, the Cable-UCS consortium projected that the overall economic value offered to the utility (either by an avoided generation cost or the benefit afforded by direct labor saving basis) was not sufficient to cover the capital expenditure of the advanced digital set-top box or utility gateway connected to the cable network, even if the capital expenditure was amortized over a ten-year period. Further, the service expenses for operation and maintenance costs required on an on-going basis to support this infrastructure, further confirmed that there was no positive payback on this investment if the community digital broadband services were to be installed on the basis of utility services alone.

The Paradigm Shifts

However, in the interim, an unanticipated shift in the derived consumer value from a host of cable based communications services has rendered these original projections irrelevant. Today, the National Cable and Telecommunications Association (NCTA) statistics show that there are nearly 74 million cable customers in the U.S., which represents 69.8% of the television households. Nearly 97% of the television population has access or cable service available, (homes passed). The costs of basic cable service have steadily increased over the past ten years from $10.27 to $31.58 per month, while the fees for premium service fees have

dropped from $18.10 to $7.64 per month. Nearly 74% of the existing cable customers have premium services, such as HBO, and this figure has remained steady over the past 10 years. Over 9.2 million cable customers (17.2% of the premium service customers) have a cable-based modem for high-speed access to the Internet, and 2.1 million customers have telephone service delivered over their cable service. Cable modem services contracts, which range from one to two years, often include a cable modem with an average price of about $150.00. These monthly internet access fees range from $35.00 to $50.00 depending on the "bundle" of services subscribed. Often the cost of the modem is amortized over the term of the agreement, with an early termination penalty. This is a model very similar to cellular telephone contracts where equipment costs are "loaded" into the base service fee.

According to research by Kagan and Associates, more than half (54%) of online household viewers watch TV while on the Internet, demonstrating the multi-tasking dimension that we have now come to embrace.

The overall penetration of digital cable has grown steadily. However, this growth is less than what the cable operators had anticipated with a utility's direct participation in their infrastructure build-out plans with utility-oriented services as the primary driver. Interestingly, despite the fact that the total number of two-way cable customers is

smaller than projected by C-UCS, the revenues realized from customers of high speed access and pay-per-view services enabled by this build-out is much greater than the revenue projections that were originally forecast for mass-market utility services.

While major utilities still have an interest in realizing the benefits of remote data acquisition services and some of the advanced features that the two-way cable infrastructure can provide, the digital cable market build-out by the MSO's is being driven by higher speed consumer valued products, rather than the low data rate services the utility needs for their applications.

This approach of having fewer customers paying higher fees for advanced services such as digital multi-channel viewing, pay-per-view, subscription premium and internet access does not displace the revenue that these cable operators can also realize with lower fee utility-based telemetry services provided to the mass market. It stands to reason that the the provision of additional utility services could further enhance the profitability of these cable systems, providing additional users and revenues without the need for significant infrastructure upgrades.

A Gap Emerges

The economics of most organizations are driven by deliberate stratification of their markets, which in many cases factor considerations such as economies of scale and the largest potential for near-term return. This approach has forced many national communications organizations to concentrate only on "tier-one" cities, (or as one provider calls them, "the NFL franchise cities") or "tier-two" cities (Baseball farm team cities).

These strategies overlook most of the rural and suburban areas as non-justifiable, or as areas that are slated for deployment of advanced services at a much later stage, if at all. Co-incident with these decisions, many cable operators are in the process of property trade and sale negotiations, attempting to aggregate service territories into contiguous service footprints. While these approaches make sense for the cable operators' shareholders, they create a significant digital-divide within the population.

Filling the Gap

To take advantage of the gap that exists in these markets, a number of utilities have undertaken bold steps to progress towards becoming providers of a full range of services that include water, electricity, and communications. In many cases these undertakings have been made by municipally-owned organizations, who realize the potential of leveraging customer loyalty, and community sense and purpose to deliver all these services. Although investor-owned electric utilities currently provide electric service to nearly 73% of the population, a significant, and increasingly more vocal, community of need for advanced communication services in underserved areas has emerged, driving some nimble municipal and publicly owned organizations to be more aggressive and innovative.

According to the National Rural Electric Cooperative Association (NRECA) "Consumers have confidence in electric cooperative utilities to provide the power to fuel their needs, including the information revolution." This thinking has given rise to the concept of a municipally owned metropolitan area network. (MAN) satisfy the need of the local community to have better options and competition for cable and communications services. While the aforementioned utility services may not be the leading driver in securing the necessary community support, often these services get an opportunity to "ride on the coattails" of the premier services of telephony, basic cable, premium services and broadband internet access that are offered.

Community communications initiatives such as those offered in Glasgow, KY are prime examples where the competition provided by the municipally owned cable system now provides an infrastructure that supports other utility needs. Other areas such as Grant County Public Utility District are advancing fiber-optic networks to deliver high-speed internet access for consumers as well as Automatic Meter Reading (AMR) for the utility. In a world of convergence, action and results-oriented products are driven by nimble organizations that can quickly and effectively recognize opportunities and successfully execute plans to harvest them. These are some of the characteristics of municipal area network providers who are in various stages of deployment of fiber optic communication services. Whether these be fiber to the neighborhood, fiber to the curb, or fiber to the farm or home, each of these ventures have taken a total holistic view of providing integrated services to the community.

A quick search of municipal organizations shows that well over 30 municipal electrics are in various stages of evaluation, deployment, or operation of metropolitan area communications networks.

So is there a common denominator that has transformed some rural electric providers into communications strongholds? The decision to move forward may not be based on technology or business alone, but also could be rooted in a sense of local community and customer service built over decades of the provision of critical commodity services.

Municipal, rural electric cooperatives and public power authorities have begun to leverage the trusting relationships they have built over years of basic commodity service provision in the electricity and water commodities. This focus has given these long local champions the opportunity to enter into the next stage of service offerings. The addition of metropolitan communication services as part of the utility service portfolio becomes the next logical commodity provision potential for many of these organizations, and often is best received when the promotion of these offerings stresses local benefits that are both economic and cultural in nature.

Before leaping into the fray however, a responsible municipal electric utility contemplating such a move should carefully consider all the ramifications of adding communications to their service options and should put focused effort into developing a solid business case for moving forward. The rewards may be significant but they do not come without corresponding risk.

The rights earned by these local providers to potentially offer these services will only provide a temporary bridge of confidence, because the true test of loyalty will be based on the customer's most current experiences. Even though these services may be provided by a local organization the customers' expectations remain high. The functions and performance of the service must, at a minimum be comparable with what can be expected from a nationally recognized provider. Most importantly, the business venture must be economically viable of its own accord, with care to avoid any cross-subsidization from other services, in order to avoid forcing rate increases for any commodity provision service already established.

So how then should a local utility progress down this path towards convergence?

The Business Case

The following information provides a high level outline of the principle zones of focus that must be addressed in evaluating utility-provided MAN services. Every utility has its own spectrum of expertise and experience to from which to draw. The most important first step in developing the business case is for the organization to objectively assess any gaps in their ability to fully develop such a plan. Any identified gaps in expertise should be addressed prior to moving forward.

Market Assessment and Competitive Analysis

The utility contemplating such a move into community provided communications services has, at this point, probably already determined at least a perceived gap in the competitive provision of such services. The purpose of this initial portion of business plan development is to better capture the extent to which these opportunities actually exist. The analysis should determine:

- ❑ The extent of current service penetration fee structures in place for any competitive offerings;
- ❑ The customers demonstrated willingness to pay for these services and extensions of services (such as Digital Subscriber Loop –DSL services, call waiting, caller id, etc);
- ❑ Identification of any customer perceived gaps in current service offerings or in the quality of current service offerings of incumbent providers;
- ❑ Identification of potential utility services brought about or enhanced by telecommunications infrastructure.
- ❑ Any risk to the firm's position in the community based on the potential for unfulfilled customer expectations.

Product Identification

Next, the firm should use information obtained in the exercise above, combined with insight into their own core competencies, to develop a set of target product opportunities. This set of offerings should be sufficient to satisfy the underserved market without compromising the utility's ability to deliver, and will serve as a starting point for the development of the economic business case. Considerations include:

- ❑ Acceptable price points for services;
- ❑ Complimentary "must-have" offerings;
- ❑ Customer demand for particular services;
- ❑ Estimated "build-out" and operating costs of specific services;
- ❑ Any additional burdens of staff, resources and expertise required;
- ❑ Utility service enhancement opportunities, including:
  - Automatic Meter Reading,
  - Remote connection and suspension of service;
  - Outage notification;
  - Tamper detection;
  - Remote user control of temperature and lighting;
  - Direct utility initiated load control;
  - Indirect user prescribed load control, and
  - User access to energy information,

Economic Model Development

Based on the target offering set developed above the firm should perform a sound economic model of the new venture. The company should be very careful in this stage to avoid any propensity to overestimate revenues or underestimate costs of providing these services. In developing this economic model the following should be considered:

- ❑ The extent of services that will be offered, and at what fee structure;
- ❑ Installation and operational costs
- ❑ Financing costs
- ❑ Any marketing, customer care, and other support area impacts;
- ❑ All ancillary costs items, such as increased back office integration, billing, collections and payment processing requirements.
- ❑ The marketing and promotion program costs
- ❑ Any discounted or subsidized services (schools, library, government, etc.); and
- ❑ Any franchise or license fees.

Miscellaneous Considerations

The following items should be given consideration as well when evaluating these potential service offerings:

- ❑ The organization requirements to install, operate and maintain the system(s), including customer service;
- ❑ The provision of any service level agreements (SLA's) along with applicable penalty factors;
- ❑ Skill sets required to support the operations;
- ❑ Performance monitoring and tracking;
- ❑ Front and back office integration issues
- ❑ A decision about the types of services that will be provided internally and which will be outsourced to third party organizations;
- ❑ Element ownership, warranties and points of demarcation;

Technical Issues

The following technical issues should be considered as part of the overall project feasibility analysis:

- ❑ Network design and topology;
- ❑ Network reliability and serviceability requirements;
- ❑ Direct access [is this in reference to electricity direct access?] levels;
- ❑ Technology stability;
- ❑ Ability and flexibility to upgrade and services;
- ❑ Supplier history and performance record;
- ❑ Customer equipment stability and suitability, and
- ❑ Integration and extension to future services.

Go/No Go Decision

After thoroughly reviewing the economic, technical, and operational ramifications of entering into this new market the utility should have a solid foundation upon which to make its ultimate implementation decision.

These checkpoints only represent a very high-level overview. There are certainly numerous other items that must be detailed, understood, managed and documented in order to perform a solid business analysis.

For many utilities, undertaking such an extensive process may be an overwhelming task. Many firms have found that this process is expedited and facilitated by experienced independent consulting organizations, where clients can benefit from both the breadth of knowledge across these issues and the depth of experience in each of these fields.

In short, while the integrated utility business model popular a decade ago did not prove to be viable on the basis of utility applications, the model has nevertheless seen application where municipal utilities can fill gaps left open by the competitive telecommunications markets. The changing preferences of customers and evolving technologies have created opportunities for municipals to expand their services and satisfy growing community needs. ■

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By:

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Applying Voltage Dip Proofing to Provide Ride-Through

For Facilities During Momentary Power Interruptions & Voltage Sags

ABSTRACT

Although the reliability of power to Industry is high, momentary power interruptions and voltage sags still occur. These may be caused naturally, by lightning strikes , snow storms and over grown vegetation or artificially, by heavy load switching, short circuits and automatic reclosing.

As these interruptions are generally less than one second in duration, most industrial installations and plants are able to ride through such power dips by virtue of their electrical and mechanical inertia. This is not the case with electrically held-in contactors and relays which control the machinery. These usually drop out after a few milliseconds, and as a result, the plant or process has to be restarted.

This paper presents the use of voltage dip-proofing to provide ride-through for facilities using a specific technique and specially developed equipment. The effectiveness of this technique on associated equipment is discussed.

I. INTRODUCTION

An interconnected power system, by its very nature , will under normal conditions experience short duration voltage sags and momentary interruptions.

A voltage sag is a partial reduction in RMS Voltage that usually lasts from 0.5 to 30 cycles. A momentary interruption is a complete loss of AC power which can be 0.5 cycles to minutes in duration.

They may occur naturally as a result of lightning strikes on high tension lines, flash-overs caused by fires under the line, dirty insulators or salt build up on insulators, snow storms, overgrown vegetation or animals. Automatic reclosures clear such faults but have to interrupt the line for some hundreds of milliseconds. Heavy load switching, large load starting and automatic re-closures are the most common artificial causes.

With the advent of the digital economy equipment and process sensitivity to short duration voltage sags has increased significantly. The microprocessors and industrial control equipment that drive this economy are subjected to 20-30 of these sags per year. These Power Quality (PQ) events lead to costly process and economic disruptions which are costing the US economy over $150 Billion per year in lost productivity.

The extent of the problem needs to be determined, the sensitivity of the equipment that requires support will be evaluated, a solution will be proposed and a few applications selected.

II. EXTENT OF THE PROBLEM

Extensive power quality studies have been conducted on the distribution systems in the United States. ***Figure 1*** is a typical plot of this recorded data. A number of points can be highlighted from this data. It can be seen that a distribution customer is subjected to over 50 events per year where the voltage drops below 90% of nominal and that great majority of voltage sags last 10 cycles or less and were 20-30% in magnitude. This statistical data can be used as a guide

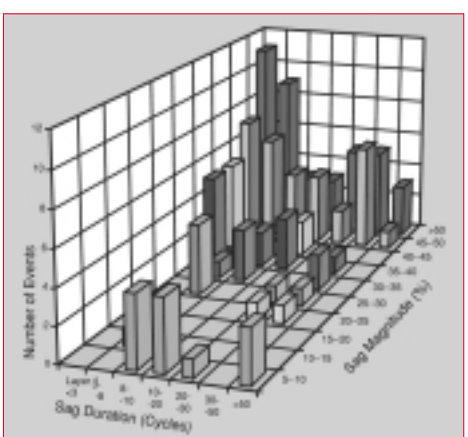

Figure 1 : Power Quality Monitored Data

by the distribution customer but it must be noted that the system performance can vary significantly from one part of the country to another as well as from one system to another. It must also be noted that distribution customers experience significantly more voltage sags and interruptions than customers fed directly from the transmission grid. However, faults almost anywhere in the power system can cause a momentary voltage sag that will last until the fault is cleared by the protection devices. In a transmission system it can take up to 6 cycles for the circuit breaker to open and clear the fault. In a distribution system it can take significantly longer to clear the fault depending on the settings of the over-current relays at the substation or fuse ratings on branch circuits.

However each case must be handled on a case by case basis and working with the local utility will prove invaluable in achieving the required solution performance.

III. IDENTIFYING EQUIPMENT SENSITIVITY

The sensitivity of equipment is the key component in evaluating the effect of voltage sags and interruptions at a facility. More and more data is becoming available but it is still not common practice to be able to easily obtain this sensitivity data for components used in the control systems at the facility. It can normally only be obtained by expensive testing or by trial and error.

A curve was developed by CBEMA (Computer And Business Equipment Manufacturers Association) as a reference for the ride through capability of data processing equipment. ITIC (The Information Technology Industry Council) have updated this curve. ***Figure 2.*** It shows that voltage sags below 70% of nominal will very likely affect the performance of the data processing equipment.

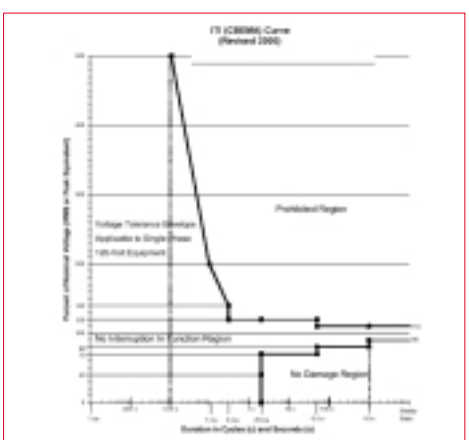

Figure 2 : ITIC Curve

The semiconductor industry identified the importance of voltage sags on their industry and have recently introduced the Semi F47 standard that specifies the voltage sag immunity for semiconductor processing equipment. To date there is no such standard in industrial facilities and many actual facilities fall well short of the published ITIC curve. There are cases where existing equipment cannot handle voltage sags where the voltage drops below 80% and the o Measurlogic Inc. 2001 adjustable speed drives can trip when the voltage drops slightly to below 90% of nominal.

IV. CATEGORIZATION OF LOADS

In order to run a facility through power interruptions and sags, either the stored kinetic energy of the plant is utilized or standby power is supplied. Four levels of protection in order of increasing cost can be identified.

1. The installation of equipment with ride-through facility already incorporated.
2. Identifying the sensitive equipment and controls of the plant and upgrading their ride-through capabilities.
3. The provision of stand-by power for the entire plant.
4. The use of a utility solution such a new nearby substation or a new feeder system.

Feasibility and cost of implementing each solution depends on practicality, economics and the losses incurred due to downtime. The less expensive solutions are considered first.

Using the stored kinetic energy of the plant, only short interruptions, of one second or less, can be catered for. Considering that most voltage dips (approx. 90%) are of short duration, using the inertia of the plant is a distinct possibility. With the aid of individual monitoring studies and some 'in-plant micro-surgery', the sensitive equipment and controls can be identified and only these items protected, thereby reducing equipment and retrofit costs as well as enhancing reliability.

Next, the dynamic response of the electrical equipment in a plant is analyzed and divided into three distinct groups;

1. ***Very low inertia;*** the controls.
   Typically contactors, relays, PLC's, electronic relays and similar sensitive auxiliary equipment. In general all controls either drop out or switch off within a 5 to 30 millisecond (0.5 to 2 cycles) period.
2. ***Low inertia;*** motors and drives.
   Compressors or positive displacement pumps may drop in speed to a level where they have to be switched off within approximately 350 milliseconds. Small motors driving spinning or CNC machines could also come to a standstill within this period.
3. ***High inertia;*** motors and drives.
   Conveyers and fans can run for seconds after the power is removed.

The desirability of maintaining motor connection as well as when to disconnect, needs to be evaluated and justified. Keeping the controls energized only solves part of the problem and the actual motors and drives must also be analyzed.

Rotating loads can be grouped into three categories:

1. Induction Motors
2. Synchronous Motors
3. Adjustable Speed Drives

Induction Motors

If the inertia of induction motors is used for dip-proofing, the motor can either be disconnected during a voltage dip or it can remain connected. If it is disconnected, no currents can flow in the stator and the existing magnetic field is maintained only by the rotor current.

Figure 3 shows a 75HP motor under load during a 280 millisecond open circuit. As the resistance of the rotor is very low, the flux will decay slowly and with it the residual voltage on the terminals. If the supply voltage is now reconnected and out of phase by more than 180 degrees, the rotor of the machine will first be decelerated to bring it into phase and then accelerated. Besides high voltages on the o Measurlogic Inc. 2001 windings and high inrush currents a very high torque of up to 15 times nominal can occur on the shaft which can damage it mechanically. Proposed standards recommend that the total residual voltage combined with the oncoming supply voltage should not exceed the rated voltage by more than 35%.

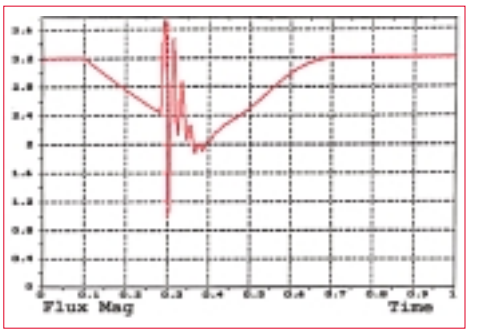

Figure 3 : Flux decay of a 75HP motor under a 280msec open circuit

However, if a motor is kept connected during a voltage dip, current can still flow in the stator, either through other loads parallel to the motor or the secondary of the supply transformer. As current is flowing in the stator and the rotor

torque develops that uses up the energy of the magnetic field and with it the voltage on the motor terminals will decrease much faster than in a disconnected motor.

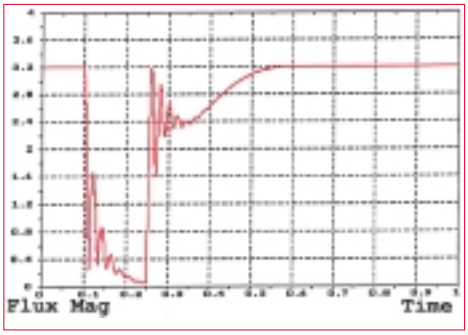

Figure 4 : Flux decay of a 75HP during a 150msec short circuit

Voltage dips of 100msec and less are considered safe as the load and supply would not be significantly out of sync. Dips longer than 100msec have the effect of quickly reducing the induced voltage to acceptable levels, typically, the flux will decay rapidly to less than 30% of rated within 5 - 6 cycles thereby reducing the stress to the system. ***Figure 4.***

Keeping the load connected is in most cases preferable to reconnecting it. In certain cases where the above methods are still deemed unsafe, more sophisticated methods, like synchronized re-switching, can be employed where the supply remains connected for a period of time, disconnected and then reconnected within a safe 'window'.

Although low inertia drives can only be dip-proofed for relatively short periods of time using their inherent inertia, a fairly large percentage of problems will still be overcome. For longer periods, external energy would have to be supplied in order to keep the drive running.

This is less of a concern when the voltage has only sagged and not been totally interrupted as the supply and load would still be synchronized.

Synchronous Motors

The second group is synchronous motor drives. They can also be dip-proofed by either removing the DC rotor field as fast as possible with the stator still connected, or disconnecting the stator and applying synchronized re-switching.

Adjustable Speed Drives

Adjustable speed drives can be divided into AC drives and DC drives. AC drives can be further divided into voltage driven and current driven types. Some, but not all, can tolerate voltage dips and various methods of providing ride-through can be considered.

The feasibility of each option will depend on practicality, economics and the type of drive installed. Briefly, they are as follows:

1. *The use of a "Phase Loss Detector" to automatically restart drives which have instantaneous trip circuitry:*

These drives include a very sensitive phase loss detection circuit which shuts the drive off in less than 10 milliseconds. The detector with a response time of approx. 10 milliseconds or better would, upon phase loss detection, send a signal to the drive logic or controlling PLC. This would in turn reissue a command to the drive to automatically restart and as a result, would not slow down significantly or trip off line.

2. *The support of the control circuitry andpower supplies within the drive, (assuming the lack, or modification of, the 3-phase loss detection and trip circuit):*

These drives can be "Dip-Proofed".

3. *The bypass of the power loss detection and trip circuitry:*

This requires careful investigation and should only be considered if damage is unlikely and/or warranties will not be voided. This will apply to older drives and has been implemented on plastic extrusion line drives.

4. *The addition of increased energy storage capacity on the DC bus to provide ride-through:*

This can be achieved by adding extra capacitors on the DC side of the rectifier in the drive. The auxiliary or regulator supplies will probably also need support.

5. *The exchange of older drives for newer ones with limited ride-through:*

Instead of tripping and switching off, some newer drives are able to re-synchronize their output with the spinning load. This option is only feasible if the duration of the voltage dips is around 500 milliseconds as most manufacturers only offer an average published ride-through of around o second

6. *The addition of a ride-through device specifically designed for drive applications:*

Such devices may only be cost effective when used to protect larger drives and depending on their design, are not suitable for total interruptions, only sags.

V. A SOLUTION

From the above, it becomes clear that the first thing to do to **DIP-PROOF** a plant is to supply the very low inertia equipment, i.e. controls, with standby power. The following specification applies.

- The ability to handle highly inductive loads as they are made up mainly of electromagnetic devices.
- The ability to withstand the inrush or energizing current of contactors, starters and relays which can be up to 10 times the holding current.
- Inherent reliability is of utmost importance as failure of the device would mean involuntarily shutting down the plant. For this reason an "Off Line" system was chosen.
- The device is only required to run for short periods of time.
- The device should be maintenance free. If adjustment or routine testing is required, it must be possible to by-pass it without dropping the switch-board and load.
- The device should be small, light weight and easy to install in new or existing switchboards.
- The incorporation of an adjustable timer to provide 'pre-set' ride through to loads deemed unsafe to keep connected beyond a certain point.

The **DPI - VOLTAGE DIP-PROOFING INVERTER™** is a capacitor based power conditioning device that can provide ride through capability for voltage sags and momentary power outages :

1. ***Reliability:*** The MTBF (mean-time-between-failures) is two to three times better than with similar devices. This is the result of using an off-line method, where the inverter is on stand-by until a voltage-dip occurs. Losses develop only over the static switch making the unit 98% efficient. A fail-to-safety design approach enhances the reliability.
2. ***Maintenance:*** By using capacitors as energy storage devices, battery maintenance and hazardous waste disposal is eliminated. Typical voltage sag characteristics also tend to reduce battery life dramatically. This method is ideal for ultra clean environments where gaseous emissions can not be tolerated.
3. ***Support of multiple sags or outages:*** The capacitor energy storage is able to be recharged within 1 second which allows support for multiple sags or outages which occur in quick succession.
4. ***Inrush currents:*** The unit can tolerate between 10 and 20 times the nominal current. When choosing the correct size inverter, only the holding VA or continuous current needs to be considered.
5. ***Speed:*** An ultra-fast transfer time of approx. 700 microseconds prevents extremely sensitive relays, starters, contactors and PLC's from dropping out.
6. ***Low power factor tolerance:*** In contrast to normal UPS's which specify power factors of 0.7 or higher, the DPI is well suited to drive switchboards which generally have a power factor of 0.15 to 0.4.

7. ***Size:*** A 3kVA 120V unit measures only 21.84in x 12.25in x 6.4in. Using capacitors for energy storage, batteries are eliminated and the DC voltage can be kept high which eliminates the need for transformers.
8. ***Easy installation:*** only three terminals have to be connected. Status monitors in the form of LED indicators.
9. ***Accurate application control:*** All units incorporate a timer adjustable from 0.1 seconds to 3.1 seconds and offer a transfer level variable from 55% to 90% of nominal supply voltage.
10. ***Industrial Robustness:*** Unit has been designed specifically for operation in harsh environments and therefore has a robust enclosure and does not require ventilation

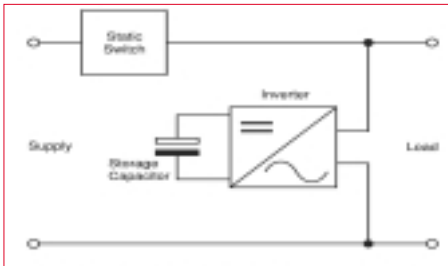

Figure 5 : Basic configuration of a capacitor based voltage sag support device

VI. THEORY OF OPERATION

The basic configuration is shown in ***Figure 5*** and the use of an off-line system dictated the design of ultra-fast circuitry to avoid sensitive control devices from dropping out or faltering during switch over.

The system consists of a static switch in series with the load, and an inverter parallel to it. For energy storage, capacitors are used.

Capacitors are available with high voltage ratings so that no transformers are necessary.

They need no maintenance and are, in general, much more reliable than batteries. The capacitors are only loaded during dips, they work under ideal conditions by being always charged and carrying no ripple current. Subsequently no heat is generated and they are hardly stressed. Predicted life-time is approximately 12 years at 25°C/ 77°F

The incoming sine wave is continuously monitored and should it deviate from the nominal value by a pre-determined percentage, the static switch is switched off and the inverter is switched on.

The voltage supplied by the inverter is synchronous with the supply voltage and is a *stepped* square wave. This wave shape has various advantages, firstly the RMS and the peak value is the same as that of a sine wave, it can therefore be used with transformers and coils where RMS is important and with electronic relays using capacitor input filters where peak voltage is required. It can supply any inductive load without being distorted and the RMS voltage is regulated.

The only power device that is constantly loaded is the static switch. This consists of a diode bridge and an IGBT transistor. Should they malfunction it is probable that they fail to short circuit and would therefore not 'drop' the load. The systems fails to safe in the event of a component failure to ensure that the load is never disconnected from the supply.

VII. APPLICATION EXAMPLES

The following section considers suitable applications and installations for this capacitor energy storage power condition solution.

a) Semiconductor wafer manufacturing:

In order to address the impact of voltage sags on semiconductor manufacturing, The semiconductor industry formulated the SEMI F47 standard for Voltage ride through of semiconductor tools. This standard requires semiconductor tools to operate within a specified input AC line voltage vs. time profile. This SEMI F47 curve closel represents the power quality experienced at

a typical semiconductor fabrication facility. Capacitor based ride through devices are very suitable for the voltage support of individual components eg. Vacuum pump controls, or processes within the tool ensuring a cost effect and reliable solution for existing or new installations. The DPI exceeds the requirements of SEMI F47 as it can withstand a complete outage for up to 3.1 seconds.

b) Plastic pipe extrusion plant:

Plastic extruders have a wide range of controls associated with them including AC or DC drives, PLC's as well as numerous control relays, solenoid valves etc. The associated cost when a line trips because of an outage can run from $10-60k per outage caused by down time, scrap product and cleaning of the system before being able to restart. If the plant experiences numerous dips within a short period, conventional battery life was diminished drastically. Maintenance and replacement can also become a nuisance.

The DPI can be used as a single solution or multiple units can be used depending on the number of controls that need to be supported during a voltage sag or momentary interruption.

c) Large Pump or Compressor applications:

Large pumps and compressors offer a challenge when it comes to maximizing voltage ride through capabilities for both Voltage Sags and momentary outages.

If the pump or compressor is subjected to an outage of greater than 350msecs it is prudent that the supply is disconnected and remains so even if the supply returns. This will ensure that the compressor is not subjected to possible excessive mechanical stresses. However a voltage sag of up to 70% can be ridden through for a longer period with safety.

The DPI, with its two level option can achieve this. The DPI has two level sensing and ride through times.

Level 1 - The standard users adjustable settings.

Level 2 - A fixed timer set to 200msecs triggered when the supply drops to 30% of nominal.

This allows the DPI to function on the Level 1 settings for sags down to 30% of nominal but for sags below 30% or for an outage the DPI will drop the load after 200msecs or rest to normal operation if the supply recovers before the time out.

Any process that is affected by a momentary sag or outage is a possible candidate for this capacitor based power conditioning solution.

These would include but not limited to :

- Chemical processing plants
- Lubrication pump controls
- Submersible pumps
- Crushers Blowers Foundries
- Adhesive manufacture
- Printing
- Paperboard and box manufacture

VIII. CONCLUSION

Providing ride-through for facilities is obviously not a simple task. Using the methods described in this paper involve more than just the installation of a 'black box' to support the system. The interaction between the controlling equipment and sensors, motors and drives along with power quality monitoring reports and studies needs to be evaluated before implementation can begin. Although this requires a combined effort from involved parties, investment return should be realized in a relatively short period of time and the costs involved are usually considerably lower than implementing huge and expensive solutions to protect an entire facility. ■

IX. REFERENCES

[1] "Applied Electronics In The Field Of Voltage Dip-Proofing" by F.V. Fischer, 1992

[2] "The Effects Of Voltage Dips On Induction Motors" by M.D. McCulloch, 1992

[3] "Distribution Power Quality Monitoring Data" - EPRI, 1994

TECHADVANTAGE® 2003 EXPO

Wednesday, February 26 – Saturday, March 2
Loews Vanderbilt Hotel, Nashville, Tennessee

NRECA's TechAdvantage® Conference attracts more than 500 cooperative engineering and operations; information services and technology; and purchasing staff. **The Engineering and Operations Track** includes sessions on computers in the field and office, fuel cells, system planning, distribution construction updates, distributed generation interconnection issues, AMR technologies, downline monitoring and automation, substation issues, and right-of-way maintenance strategies. **The Information Services and Technology Track** includes sessions on computer hardware and software, business decisions and technical solutions, customer relationship management, data and site security, disaster recovery management, and a variety of Internet topics. **The Supply Management Track** includes sessions on e-commerce, warehouse options and management, fleet purchasing and leasing, shared inventory, and group purchasing. Joint Sessions include industry updates, new uses for the Internet, environmental and regulatory updates, uniform business practices, and current hot topics.

For additional information on the TechAdvantage® Conference, visit www.techadvantage.org or contact Valerie Parks at (703) 907-5578 or by e-mail at valerie.parks@nreca.org.

NRECA's TechAdvantage® Expo gives TechAdvantage® Conference attendees and Annual Meeting attendees the opportunity to view exhibits presenting state-of-the-art products and services that they can utilize in the daily operation of their cooperative. The show attracts more than 225 exhibiting companies who occupy approximately 55,000 net square feet.

NRECA's Annual Meeting, the association's yearly business meeting, attracts more than 6,000 cooperative general managers/chief executive officers, employees, and directors from cooperatives throughout the United States. More than 200 delegates come from rural electric programs in other countries. Sessions update attendees on the state of the electric utility business and new initiatives that cooperatives are undertaking. For additional information on NRECA's Annual Meeting, call the Meetings Information Line at (800) 931-9607.

TechAdvantage 2003 Conference Schedule-at-a-Glance

Wednesday, February 26

Pre-Conference Workshops

8:00 a.m. – 5:00 p.m. –

A. Certified Purchasing Manager Review, Modules 1 & 2

B. Materials Management Certificate Program, Unit II

C. Spill Prevention, Control and Countermeasures Plan Overview

1:00 – 5:00 p.m. –

D. Saturn Plant Tour (limit 60 people)

Thursday, February 27

Opening Joint General Session

7:00 – 8:30 a.m. –
Registration and Continental Breakfast

8:30 – 8:50 a.m. –
Conference Welcome

8:50 – 9:30 a.m. –
Opening Remarks/Industry Discussion

9:30 – 10:00 a.m. –
Fulfilling the Cooperative Promise

10:00 – 10:15 a.m. –
Networking Refreshment Break

10:15 – 10:20 –
Solon Bennett Award Presentation

10:20 – 11:45 a.m. –
"Gaining the Edge! – Inspiring People to Take Action and Make a Difference"

11:45 a.m. – 1:15 p.m. –
Lunch On Your Own

1:15 – 5:00 p.m. –
Engineering & Operations, Information Technology, Supply Management Concurrent Workshop Sessions

Engineering & Operations

1:15 – 3:00 p.m. –
EO-1G – E&O Cooperative.com Community and T&D Committee Report
Restructuring Update with a T&D Focus

3:00 – 3:15 p.m. –
Networking Refreshment Break

TECHADVANTAGE® 2003 EXPO

Thursday, February 27

3:15 – 5:00 p.m. –
E&O Peer-to-Peer Forums
EO-2A – CIAC/Line Extension
EO-2B – Work Crews/Work Management
EO-2C – AMR Experiences
EO-2D – Power Quality
EO-2E – SCADA/DA
EO-2F – E&O Organizational Structure

Information Technology

1:15 – 2:30 p.m. –
IT-1A – Utilities Critical Infrastructure – Issues, Responsibilities & Action

2:45 – 3:15 p.m. –
IT-2A – Cooperative.com/ IT Community Update

3:15 – 4:30 p.m. –
IT-3A – IT Peer Exchange "Security and Disaster Recovery from a Cooperative Perspective"

Supply Management

1:15 – 3:00 p.m. –
SM-1A – The Value of Education in Supply Chain Management
SM-2A – Institute of Supply Management-Cooperative Utilities Update

3:00 – 3:15 p.m. –
Networking Refreshment Break

3:15 – 5:00 p.m. –
Interactive Supply Chain Management Forums (by co-op size)
SM-3A – Less than 20,000 Consumers
SM-3B – 20,000 – 40,000 Consumers
SM-3C – 40,000 + Consumers
SM-3D – G&Ts

5:00 – 7:00 p.m. –
"Country Roads" reception sponsored by the Cooperative Research Network®

Friday, February 28

8:00 a.m. – 4:30 p.m. –
Engineering & Operations, Information Technology and Supply Management Concurrent Workshop Sessions

Engineering & Operations

8:00 – 9:30 a.m. –
EO-3A – Power Quality I: How and Where to Measure
EO-3B – Transformer Connections Delta and Y
EO-3C – Distribution Automation (This session is comprised of three different presentations)
- How Cooperatives are Benefiting from Wireless Remote Monitoring and Control Technologies
- Keeping Your GIS Updated Through Wireless Communications
- Modern Distribution Automation by Integrated Wireless Communications and Networks

EO-3D – Outage Management Systems (This session is comprised of three different presentations)
- Outage Management System Components
- Improving Outage Management Through Automation
- Integrating AMR Data with Outage Management Software to Meet a Utility's Future Business Needs

9:30 – 9:45 a.m. –
Networking Refreshment Break

9:45 – 11:15 a.m. –
EO-4A – Power Quality II: Doing a Power Quality Survey
EO-4B – New Overhead Conductors for Improved Reliability and Higher Ratings
EO-4C – Using PDAs in the Field: How Good are They?
EO-4D – Interconnection Metering and Power Supply Interface

11:45 a.m. – 1:15 p.m. –
Lunch on your own

TechAdvantage 2003 Conference Schedule-at-a-Glance

Friday, February 28

1:15 – 2:45 p.m. –
EO-5A – Stretching Your Maintenance Dollar
EO-5B – Distribution Automation
(repeat of session EO-3C)
EO-5C – Outage Management Systems
(repeat of session EO-3D)
EO-5D – Sectionalizing and Fault Currents

2:45 – 3:00 p.m. –
Networking Refreshment Break

3:00 – 4:30 p.m. –
EO-6A – Power Quality III: Benchmarking
EO-6B – Living Through the BIG One – Disaster Management
EO-6C – NESC Update and Questions
EO-6D – New Rules for Wood Preservatives, What's Next?

Information Technology
8:00 – 9:15 a.m. –
IT-4A – When Disaster Strikes: A Primer on Business Continuity

9:15 – 9:30 a.m. –
Networking Refreshment Break

9:30 – 11:30 a.m. –
IT-5A – Security Workshop

Supply Management
8:00 – 9:30 a.m. –
SM-4A – Scheduling 101: Lead Time Essentials
SM-4B – Storage 102: Proven and Effective Intermediate Warehousing Strategies
SM-4C – Storage 103: Advanced Stores Capacity Planning, Control and Automation

9:30 – 9:45 a.m. –
Networking Refreshment Break

9:45 – 11:00 a.m. –
SM-5A – Storage 101: Warehousing FUNdamentals
SM-5B – Value 102: Intermediate Supply Chain Value Analysis
SM-5C – Scheduling 103: Enhancement Through Advanced Scheduling Applications

Friday, February 28

11:10 a.m. – Noon –
Institute of Supply Management-CU
10th Annual Meeting

Noon – 1:15 p.m. –
Lunch on your own

1:15 – 2:45 p.m. –
SM-7A – Value 101: Value Added Elements of the Professional Supply Chain Process
SM-7B – Scheduling 102: Intermediate Lead Time Planning – Outsmarting the Calendar
SM-7C – e-Procurement 101: Initial Assessment, Risks and Rewards of Common e-Commerce Practices

2:45 – 3:00 p.m. –
Networking Refreshment Break

3:00 – 4:30 p.m. –
SM-8A – New Rules for Wood Preservatives, What's Next?
SM-8B – e-Procurement 102: Legal Issues Associated with e-Commerce
SM-8C – Value 103: Benchmarking and Advance Quantitative Value Determinations

4:30 – 7:30 p.m. –
(5:30 p.m. Grand Opening Reception sponsored by TWACS by DCSI)
TechAdvantage 2003 Expo Open
Nashville Convention Center

Saturday, March 1

8:00 a.m. – 10:00 a.m. –
Engineering & Operations, Information Technology and Supply Management Concurrent Workshop Sessions

Engineering & Operations/ Information Technology
8:30 – 10:00 a.m. –
EO-7A – Securing Your Cooperative Infrastructure

TECHADVANTAGE® 2003 EXPO

Saturday, March 1

Supply Management
8:00 – 8:40 a.m. –
SM-9A – ISM Certification
SM-9B – Driving Supplier Performance

8:50 – 10:00 a.m. –
SM-10A – E-Procurement 103: E-Commerce Practices, Putting Bricks on the Foundation, P-Cards, Use and Considerations

10:00 – 10:30 a.m. –
Networking Refreshment Break

Closing Joint General Session
10:30 a.m. – Noon –

10:30 – 11:45 a.m. –
"Dare to be Different"

11:45 a.m. – Noon –
Bringing it Home

Noon – 5:00 p.m. –
TechAdvantage 2003 Expo Open
Complimentary Lunch
Nashville Convention Center

Sunday, March 2

8:30 – 11:30 a.m. –
Tech Day
Hilton Suites Nashville Hotel

11:30 a.m. – 3:00 p.m. –
TechAdvantage 2003 Expo Open
Afternoon refreshment break sponsored by Hunt Technologies
Nashville Convention Center

Monday, March 3

11:30 a.m. – 2:30 p.m. –
TechAdvantage 2003 Expo Open
Lunch available for purchase in the Expo hall
Nashville Convention Center

TechAdvantage 2003 Conference Exhibitors

Company	Booth #
3M	1532
4DataLink	443
ABB Power T&D Company	317
ACES Power Marketing	1001
ACS Government Services, Inc.	1520
Advanced Control Systems	200
Aerotec, LLC	1042
AES-Intellinet	637
Altec Industries, Inc.	1401
American Iron and Steel Institute	1028
Amistad Fiberglass Co., Inc.	540
Applied Technology Solutions (ATS)	343
Arch Wood Protection	734
Arkansas Electric Cooperatives, Inc.	809
ARNCO Corporation	1516
Art Advertising Inc.	1531
Asplundh Tree Expert Company	738
Atmos Power Systems	1322
Beckwith Electric Co.	434
Bermex, Inc.	216
Beta Engineering	1319
Bombardier Utility Vehicles	1418
Bridges Electric, Inc.	621
C.H. Guernsey & Company	501
Cable Constructors, Inc.	722
Calpine Corp.	119
Cannon Technologies Inc.	115
Caremark Inc.	923
Carlton Industries LP	1522
Cass County Electric Cooperative	909
Caterpillar Inc.	1019
Central Service Association	1235
Centurion, Inc.	644
CEVA Energy	1015
Chapel Mapping	226
Chapman Metering, LLC	649
CIS Conference, Inc.	1244
ClearNova	235
Clough Harbour & Assoc. LLP	219
Cognicase-CYME	543
Cogsdale Corporation	1537
Coleman Powermate	100
Comsquared Systems	110
Cooperative Response Center	701
Crosslink Technology Inc.	545
Cummins Onan Power Generation	739
Currin Energy Page	1328
Daffron & Associates, Inc.	533
Data Comm for Business, Inc.	107
Datamatic	108
dataVoice International, Inc.	1333
Davey Resource Group	1114
DeAngelo Brothers Inc.	332
DIS-TRAN	218
Doble Engineering Co.	1408
Document Imaging Solutions, Inc.	500
Dominion	217
Double-LL Distributing LLC	1529
DTE Energy Technologies	409
DuPont Vegetation Management	503
ECO--Energy Co-opportunity	1200
ei Bottled Water	1148
ELCO Industries Ltd.	127
Electric Energy Publications	1521
Electric Power Engineers	1221
Energy Alternatives	1523
EnerVision, Inc.	1211
Environmental Protection Services	1243
Envision Utility Software Corporation	901
ERMCO	908
ESRI	325
EUDA/GRESCO	215
ExpressBill	237
Eye Lighting International of North America	542
G&W Electric Company	937
Gator Rock Bit, Inc.	1514
GE Industrial Systems	1121
Genics, Inc.	335
GeoForce	344
Geotek, Inc.	438
Gillette Generators	403
Granger Telecom	1513
Hall's Safety Equipment Corporation	124
Hastings Hot Line Tools	1343
HDW Electronics	1315
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HealthSmart Preferred Care, Inc.	921
Hi-Line Engineering	1416
Homac Companies, The	1327
Howard Industries, Inc.	433
Hubbell Power Systems	622
Hughes Brothers, Inc.	1225
Hughes Group, The	811
Hunt Technologies, Inc.	801
iBank, LLC	1423
ICM Corporation	641
IEEE/PES T&D Expo	1022
Immediate Response Spill Technologies, LLC	445
Innovative Utility Products	838
International Utility Structures, Inc.	427
Itron	831
J&B Software	338
JCMB Technology Inc.	423
Joslyn Hi-Voltage/Fisher Pierce	1108
Kaddas Enterprises, Inc.	436
Katolight Corporation	1517
Kershaw Manufacturing	1145
Laminated Wood Systems, Inc.	1535
Landis+Gyr	133
Landis+Gyr (Pty) Ltd, South Africa	133
Lawson Software	301
Lewis Manufacturing Company	125
LiveData, Inc.	839
Logical Business Solutions, Inc.	1440
LTA Software Solutions, Inc.	640
Manheim Auctions Government Services, Inc.	1245
MAP Communications, Inc.	1329
Marathon Water Heaters	1034
MarKi Industries	1339
Mastec Energy Services	407

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Mauell Corp.	206
McFarland Cascade	224
Meteorlogix	1249
Midland Radio	233
Milsoft Integrated Solutions	415
MiniMax Software Corp.	527
MultiPlan, Inc.	927
Multispeak Initiative c/o Booth Associates	731
NASCO Industries, Inc.	935
National Renewable Energy Laboratory	1323
National Rural Electric Cooperative Association - NRECA	715
Nationwide Utility Pole & Supply, Inc.	1417
NERTEC Design Inc.	627
NISC	1035
North American Wood Pole Coalition c/o WWPI	337
Northrop Grumman Information Technology	401
NRTC	723
Okonite Company, The	1217
Omega Systems	939
On Site Ram Environmental	544
Optical Systems Industries	1444
Osmose Inc.	709
Ozark Electric Cooperative	509
PACCAP	639
Pantellos	1144
Pattco Printer Systems	1435
Patterson & Dewar Engineers	1538
Philips Medical Systems	1045
Pike Electric, Inc.	1414
Pole + Management	720
PORCHE Systems, Inc.	415
Power Delivery Associates, Inc.	449
Power Delivery Associates (PDA)	415
Power Quality Systems	1038
Powertel Systems Inc.	1341
Preformed Line Products	1342
Professional Computer Systems	617
PSG Enterprises, Inc.	623
QEI, Inc.	1426
Radius Radio Network Technology	522
Rainbow Treecare Scientific Advancements	642
Red Simpson, Inc.	1439
Renfroe Collection of Fine Art, The	103
Ripley Company	1317
Roanoke Energy Resources, Inc.	400
RPCI, Inc.	1024
Rural Electric Utilities Underwriting Managers	1109
S.D. Myers Inc.	106
Salisbury	606
Schlumberger Electricity, Inc.	1115
Schweitzer Engineering Laboratories, Inc.	511
SeaWest WindPower, Inc.	645
SecureWorks	1415
SensorLink Corporation	1250
Service Concepts	716
Shell Trading/Coral Energy	1409
Sherman & Reilly Inc.	1316
Siemens PT&D	1427
Solar Turbines Incorporated (A Caterpillar Company)	1309
Solomon Corporation	938
Southeastern Data Cooperative	609
Southeastern Reprographics, Inc. (SRI)	329
Southwire Company	539
Spatialinfo	1525
Spirit Business Solutions	1421
STARcorp	214
Statewide Editors Association	1219
Steffes Corporation	600
Stratos VSAT, Inc.	707
Stuart C. Irby Co.	1527
SunGard Mailing Services	441
Survalent Technology Corporation	1026
T&R Service Company	638
Tantalus Systems Corp.	507
Terex Telelect	1301
Thomas & Betts/Elastimold	130
Time Manufacturing Company	139
Timmons, Inc.	1442
Tobin International Ltd.	1006
Touchstone Energy	917
Townsend Tree Service Co., Inc.	1518
Trachte, Inc.	340
Transworld Network Corporation	1127
Triple Crown Products Inc.	101
Tru-Check, Inc.	336
TSE International	241
TVD Inc.	1009
TWACS by DCSI	307
Twenty First Century Communications	907
United Utility Supply	806
USAT	1320
Uticom Systems, Inc.	1438
UTILCO	1419
UtiliTec Communications, an Anchor Company	541
Utility Automation Integrators	601
Utility Equipment Leasing Corp.	841
VA Tech Ferranti-Packard Transformers	635
Vaisala-GAI (formerly Global Atmospherics)	610
Vaughn Manufacturing Corporation	941
VON Corporation, The	104
W.I.R.E. Services/Manitoba Hydro	1050
W.J. Whatley	840
Waukesha Electric Systems	201
WeatherTAP.com	1044
WESCO Distribution, Inc.	227
Wilson Bohannan Padlock Company	1326
Wire Dynamix	523
Wood Quality Control, Inc.	808
Worklife Company, The	1445
World Wireless Communications, Inc.	220
Zemar Inc.	334

TechAdvantage 2003 Conference Floor

Plan

161 -10X10 BOOTHS = 16100 SQ.FT.
4 -10X15 BOOTHS = 600 SQ.FT.
43 -10X20 BOOTHS = 8600 SQ.FT.
1 -10X30 BOOTHS = 300 SQ.FT.
1 -15X20 BOOTHS = 300 SQ.FT.
25 -20X20 BOOTHS = 10000 SQ.FT.
5 -20X30 BOOTHS = 3000 SQ.FT.
1 -20X70 BOOTHS = 1400 SQ.FT.
6 -30X30 BOOTHS = 5400 SQ.FT.
1 -30X40 BOOTHS = 1200 SQ.FT.
2 -30X50 BOOTHS = 3000 SQ.FT.
1 -40X40 BOOTHS = 1600 SQ.FT.
TOTAL SQUARE FOOTAGE: 51500 SQ.FT.

WASHINGTON NATIONAL SALES OFFICE
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THE TOTAL SHOW BY FREEMAN

By:

Marzio P. Pozzuoli
RuggedCom Inc.

"Zero-Packet-Loss" in the Substation

Introduction

The proliferation of Ethernet networking technology from the office environment to the substation environment for use in real-time mission critical control applications has resulted in both the IEC and IEEE developing new standards addressing networking equipment in substations. In both cases the standards define conditions that require the networking equipment to operate without any loss or interruption of communications during the application of a variety destructive EMI immunity type tests. These type tests are essentially the same type tests applied to protective relaying devices and utilize essentially the same test levels. Since the protective relaying devices are required to pass these type tests without 'misoperation' or damage, the equivalent is also required of the networking equipment to which these devices are being connected to. Zero-Packet-Loss under EMI stress is the networking equivalent of no 'misoperation' under EMI stress for protection relays.

This paper explores the emerging trends of using the network to perform mission critical real-time control applications, the new IEC and IEEE standards for communications systems and networking equipment in the substation, and the reasons/needs for Zero-Packet-Loss in the substation.

Ethernet in the Substation – Why?

Not so very long ago every major vendor of relays, remote terminal units (RTU), meters and programmable logic controllers (PLC), to name but a few intelligent electronic devices (IED) used in substations, had their own communications protocol. What this often meant was that most of the IED's were incompatible even at the physical layer interface as well as the communications protocol layer. Therefore, as was often the case, some sort of protocol converter device was required to bring all of the IED's onto a common physical network and perform the translation to allow everyone to speak a common application layer protocol. This resulted in expensive integration with often-poor performance because of the insertion of protocol converters. To remedy these woes utilities turned to the Electric Power Research Institute (EPRI), and along with IED manufacturers and leading utilities such as American Electric Power, collaborated to develop the Utility Communications Architecture (UCA2.0) which is soon to be released as international standard IEC 61850. It provides a set of standards and specifications with a common application layer protocol, to ensure everyone speaks the same language, and several communications profiles, with Ethernet at the physical layer, to ensure everyone resides on the same physical network. This is because Ethernet brings with it a multitude of advantages:

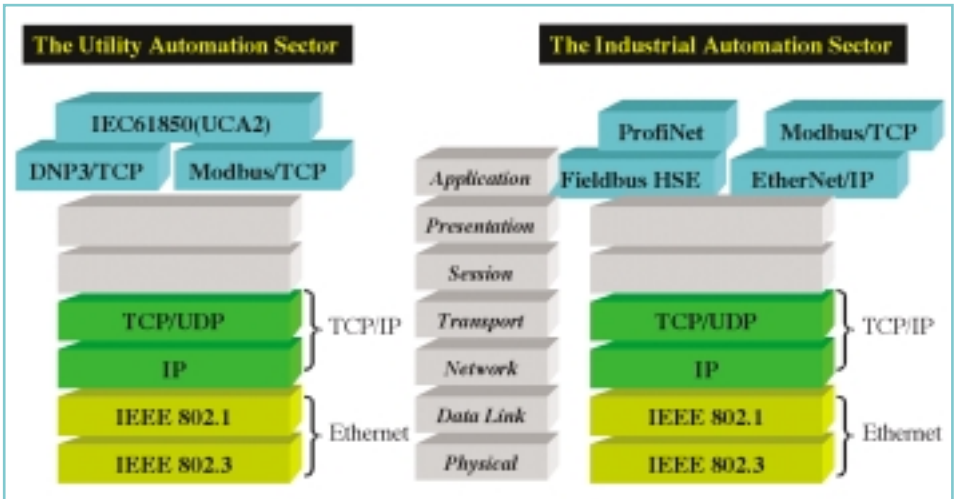


Figure 1: Ethernet based communications profiles in the Utility and Industrial Sectors

- 10Mbps, 100Mbps, 1Gbps, 10Gbps and growing speeds!
- Support for fiber, copper and wireless media!
- Network redundancy and fault tolerant ring architectures per IEEE 802.1w Rapid Spanning Tree protocol
- Message Prioritization and Class of Service for real-time control per IEEE 802.1p Priority Queuing
- Virtual LAN's which allows for traffic isolation and system security per IEEE 802.1Q VLAN
- Deterministic (yes that's right I said 'deterministic') full-duplex operation with no collisions per IEEE 802.3x Flow Control (Modern Ethernet Switches which support IEEE 802.3x do not allow, nor support, nor experience collisions! Collisions are a thing of the past associated with Ethernet networks implemented using shared media hubs/repeaters.)
- Ethernet is the world's most widely adopted local area network (LAN) technology and is now migrating into the wide area networking (WAN) space. In the future we could see a total Ethernet solution from the WAN to the MAN (Metropolitan Area Network) to the LAN.
- Every major manufacturer of IED's (e.g. Relays, RTU's, Meters, PLC's) now provides at least one (some provide dual) Ethernet port on their devices.

In the process control industry (i.e. industrial automation) a similar transformation has taken place with every major vendor of process control IED's now providing Ethernet connectivity to the degree that many have espoused the notion that "Ethernet is becoming the RS232 for process control…"

New Standards Covering Networks in Substations

IEC - First Off the Mark

In January 2002, the International Electrotechnical Commission (IEC) released a new standard entitled IEC 61850-3 "Communications networks and systems in substations" to specifically address the general environmental and electromagnetic interference (EMI) immunity requirements for network equipment used in substations. In particular, section 5.7 EMI Immunity states that "The general immunity requirements for the industrial environment are considered not sufficient for substations. Therefore, dedicated requirements are defined in IEC 61000-6-5…" [1]. **Table 1** below summarizes the possible worst case test levels defined by IEC 61000-6-5 depending on location of the equipment within the substation.

A key definition in the soon to be released standard is the definition of two classes of communications devices: Class 1 communications devices allow for communications errors and delays during the application of the required type tests while Class 2 devices allow for no communications errors or delays during the application of the required type tests [3].

The Essence of Zero-Packet-Loss Under EMI Stress

For an Ethernet LAN in the substation the performance requirements of IEC 61850-3 for critical functions and IEEE P1613 Class 2 devices translate to zero-packet-loss under EMI stress which in practical terms means that one must be able to apply all of the EMI type tests listed in **Tables 1 & 2** above while network traffic through the Ethernet LAN is at its maximum (i.e. 100% frame/packet rate) and experience no frame/packet errors, delays or losses. This in essence guarantees that the LAN equipment has the same level of EMI immunity as the protective relaying IED's connected to it. Bear in mind that protective relaying IED's must also pass these very same type tests under simulated operational conditions without any 'misoperation' or failures.

UTILITY (IEC 61850-3 (61000-6-5) Communications Networks and Systems in Substations (Jan 2002))				
TEST	Description		Test Levels	Severity Levels
IEC 61000-4-2	ESD	Enclosure Contact	+/- 6kV	3
		Enclosure Air	+/- 8kV	3
IEC 61000-4-3	Radiated RFI	Enclosure ports	10 V/m	3
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 4kV @ 2.5kHz	x
		D.C. Power ports	+/- 4kV	4
		A.C. Power ports	+/- 4kV	4
		Earth ground ports *	+/- 4kV	4
IEC 61000-4-5	Surge	Signal ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
		D.C. Power ports	+/- 2kV line-to-earth, +/- 1kV line-to-line	3
		A.C. Power ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
IEC 61000-4-6	Induced (Conducted) RFI	Signal ports	10V	3
		D.C. Power ports	10V	3
		A.C. Power ports	10V	3
		Earth ground ports *	10V	3
IEC 61000-4-8	Magnetic Field	Enclosure ports	30 A/m continuous, 1000 A/m for 1 s	N/A
IEC 61000-4-29	Voltage Dips & Interrupts	D.C. Power ports	30% for 0.1s, 60% for 0.1s, 100% for 0.05s	N/A
IEC 61000-4-11		A.C. Power ports	30% for 1 period, 60% for 50 periods	N/A
			100% for 5 periods, 100% for 50 periods *	N/A
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5kV common, 1kV differential mode @ 1MHz	3
		D.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
		A.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	30V Continous, 300V for 1s	4
		D.C. Power ports	30V Continous, 300V for 1s	4
IEC 61000-4-17	Ripple on D.C. Power Supply	D.C. Power ports	10%	3

Table 1: IEC 61850-3 (IEC 61000-6-5) EMI Immunity Type Test Requirements

Of critical importance in the IEC 61000-6-5 specification is the performance criteria defined for key functions within the substation. Essentially, it allows for no delays or data loss for critical functions such as Protection and Teleprotection functions, On-line Processing and Regulation, and Metering when exposed to various EMI phenomena [2].

IEEE – Following Suit

The Substations Committee of the IEEE Power Engineering Society via the C2TF1 Task Force was also busy in 2002 producing its own equivalent standard for communications networks in substations entitled IEEE P1613 -

"Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations" which as of December 2002 had gone through formal balloting and passed with 95% approval. Table 2 below summarizes the key EMI immunity requirements defined in the standard.

When is Zero-Packet-Loss Under EMI Stress Needed?

Utilities and vendors alike are no longer simply talking about pilot projects and proof of concept scenarios. In ever-growing numbers utilities in North America and around the world are deploying substation Ethernet LAN's and leveraging them to perform a variety of tasks.

Those who tread cautiously are doing the following:

- IED data collection and monitoring over a high-speed (10/100Mbps) LAN.
- Leveraging the fact that Ethernet LANs allow IED's supporting different application layer protocols (e.g. Modbus/TCP, DNP3.0, UCA2.0) to co-exist harmoniously on a common physical network without protocol converters. This allows one to continue to leverage the investment made in existing protocols and incrementally migrate to a common protocol such as UCA/61850 when there is a sufficient comfort factor.

For this level of performance Zero-Packet-Loss is optional.

The more 'adventurous' are starting to do the following:

- Relay 'Trip' and 'Block' signaling via UCA/61850 GOOSE messaging over the LAN.
- Relay Voting Schemes (e.g. 2 out of 3 relays say 'TRIP') – where again GOOSE messaging is used over the LAN.
- Bus Blocking/Trip Co-ordination schemes via GOOSE message signaling over the LAN.
- Load shedding and restoration schemes via GOOSE messaging over the LAN.

The truly "visionary" are looking at:

- A complete LAN based solution where even the CT/VT wiring and breaker control wiring has been replaced by single IED's which interface to the CT's and VT's and provide all the current, voltage and other power system parameters over the LAN in a broadcast manner allowing any or all IED's connected to the LAN to have access to this information.

IEEE P1613 – Draft Standard Environmental Requirements for Communications Devices Installed in Electric Power Substations				
TEST	Description		Test Levels	Severity Levels
IEEE C37.90.3	ESD	Enclosure Contact	+/- 8kV	N/A
		Enclosure Air	+/- 15kV	N/A
IEEE C37.90.2	Radiated RFI	Enclosure ports	35 V/m	N/A
IEEE C37.90.1	Fast Transient	Signal ports	+/- 4kV @ 2.5kHz	N/A
		D.C. Power ports	+/- 4kV	N/A
		A.C. Power ports	+/- 4kV	N/A
		Earth ground ports *	+/- 4kV	N/A
IEEE C37.90.1	Oscillatory	Signal ports	2.5kV common mode @ 1MHz	N/A
		D.C. Power ports	2.5kV common & differential mode @ 1MHz	N/A
		A.C. Power ports	2.5kV common & differential mode @ 1MHz	N/A

Table 2: IEEE P1613 EMI Immunity Type Test Requirements

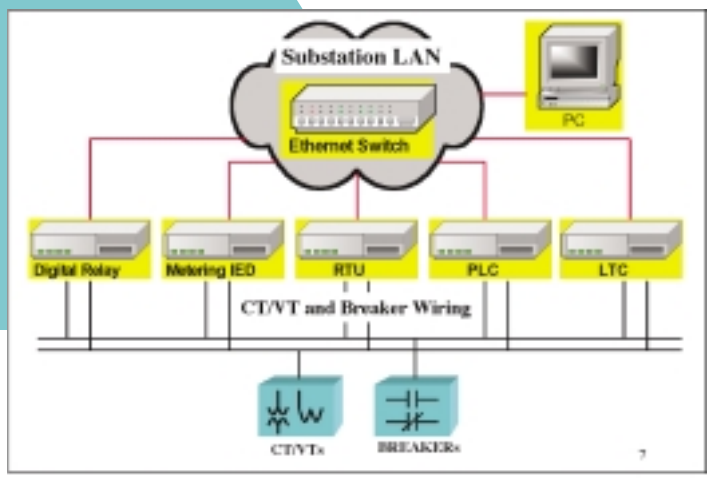


Figure 2: All IED's connected to a common physical Substation LAN.
For the more adventurous; all inter-IED control signaling is done over the Substation LAN.

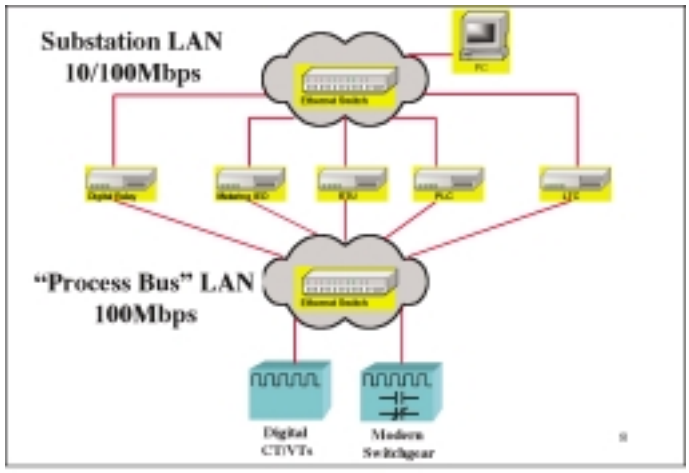


Figure 3: A complete LAN based solution with both IED's,
CT/VT's and Breaker's connected to Ethernet LANs.

For this level of performance and critical functionality of the LAN Zero-Packet-Loss under EMI is an essential requirement.

- At present companies such as ABB, Siemens and Alstom have been collaborating and have developed digital CT/VT sensors and breaker IED's which interface to a 100Mbps Ethernet LAN. This is often referred to in the industry as a "process bus" and is accommodated in sections of soon to be released IEC 61850 specification.

For this level of performance and critical functionality of the LAN Zero-Packet-Loss under EMI is a must!

Conclusions

Zero-Packet-Loss performance by networking equipment in the substation environment is essential for current trends to continue. The basic requirement of having all of the electronic equipment involved in the protection and control system (i.e. Relays, PLC's, and the LAN) capable of passing the same EMI immunity type tests without 'misoperation' will give protection and control engineers the confidence to take advantage of the many new possibilities afforded to them by a high-speed LAN based system.

About the Author:

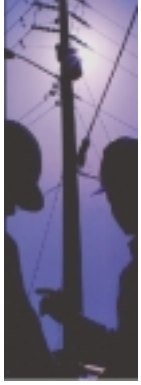
Marzio Pozzuoli is the founder and president of RuggedCom Inc., a company which designs and manufactures substation hardened networking and communications equipment. Prior to founding RuggedCom Mr. Pozzuoli was the Technology Manager for GE Power Management / Multilin where he developed advanced numerical 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] IEC 61850-3: *Communications networks and systems in substations – Part 3: General Requirements* (Section 5.7 - EMI Immunity)

[2] IEC 61000-6-5: *Electromagnetic Compatibility (EMC) – Part 6-5: Generic Standards – Immunity for Power Station and Substation Environments* (Section 8 - Performance Criteria)

[3] IEEE P1613: *Draft Standard Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations* (Sections 7.12, 8.9, 9.2 – Device Performance Classes)



Mergers in the Electric Industry

Lead to AM/FM/GIS Consolidation

By:

Doug Laslo
Autodesk

Background

Everywhere you look, electric utilities are reorganizing to streamline their businesses in an attempt to react more quickly, become more efficient, accomplish more with less – and generally operate more like competitive businesses and less like traditional, regulated utilities.

Mergers and acquisitions have been prevalent within the utility industry for many years. When utilities merge, many of the newly combined companies go through a process of reviewing all resources that were previously controlled by the individual companies. After thorough review, those resources best suited for the combined company are identified.

This review and selection process is used for nearly all types of resources within the utility environment, including automated tools and information systems.

Review and selection of the automated tools and information systems that are best suited to the combined company is, in nearly all cases, the best approach. The electric utility industry con tinues to undergo significant and rapid change in all corners of the world, and nearly all of these changes put pressures on companies to improve their business processes in order to remain competitive.

Goals of Consolidating Systems

Wise investments in information systems, if managed carefully, can provide significant relief from many of the pressures that electric utility companies are facing. The ongoing operating costs associated with maintenance and management of a single system will almost always be less than the costs for multiple systems.

One of the systems that has the highest potential for providing real performance gains for electric utilities during a merger is the Automated Mapping and Facilities Management or Geographic Information System (AM/FM/GIS).

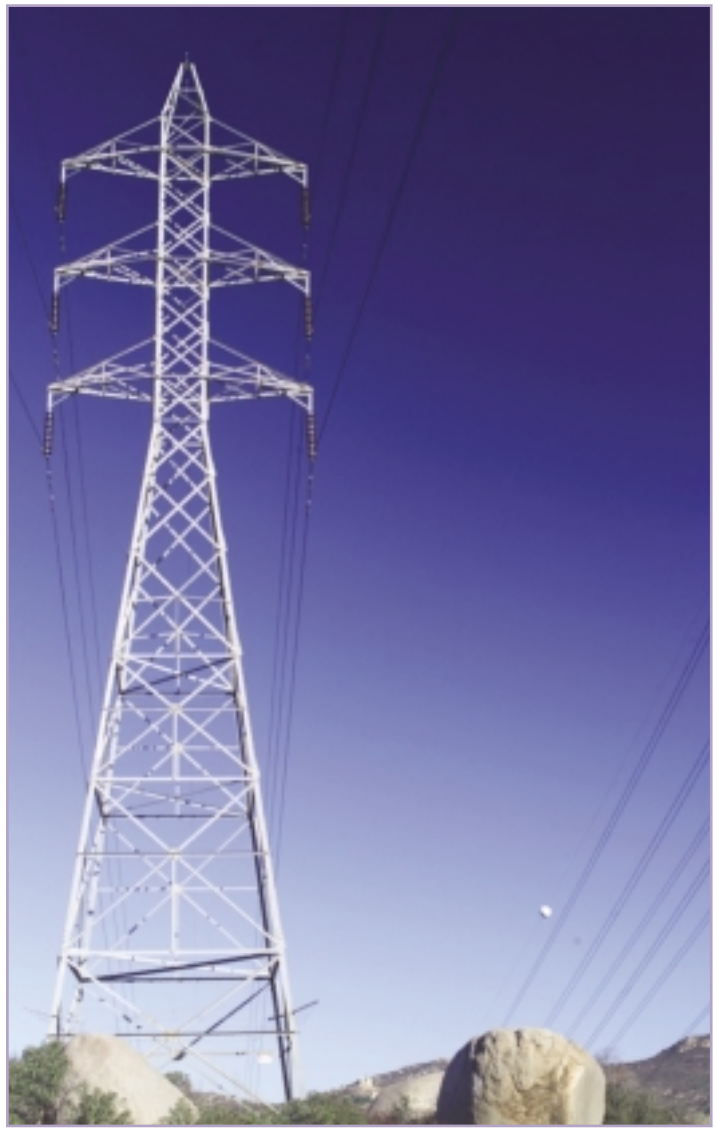
During the merger process, the AM/FM/GIS systems within each of the individual companies are reviewed from a number of perspectives, such as functional richness, user acceptance, associated initial cost, ongoing operating expenses, and ease of integration with other corporate information systems. Another important factor is the size of investment in the existing data that has been converted, and the portability of that data to another platform.

AM/FM/GIS systems have often come at a fairly high investment, especially relative to the data conversion costs of capturing paper maps and records and converting that information into digital data. Sorting out the differentiating factors and making the right choice between the competing systems can lead to significant cost savings, not only at the time of the merger, but also in the ongoing operating costs going forward into the future.

The Decision Process

Many factors can influence the selection of the AM/FM/GIS solution best suited for the merged company. One significant factor is how merger initiatives are being handled regarding the information systems.

Some utilities have the internal expertise and understanding, as well as the availability of internal resources, to work through the comparisons and selection processes from within. Alternately, many utilities contract the services of outside consultants to manage the process of system review and selection. Both methods can result in positive outcomes, and both have their pitfalls.



The benefit of having internal experts from the two merged companies come together to select the system is that individuals with an up-close, in-depth understanding of the systems are involved in the decision process. Under these conditions, the true overall operating costs, as well as the difficulties associated with each system, can be best understood.

The pitfall is that individuals who are protecting turf may resort to politicking and lobbying. At times, the system that survives is the system whose owner or champion made the most noise in the selection meetings, or offered the best Champagne to senior management.

When external consultants are involved, they can provide good information on industry trends, as well as examples of system successes and failures from outside the walls of the merged companies. Unfortunately, those consulting groups can have presupposed opinions and/or allegiances relative to the systems they have been contracted to judge. And it's hard to know if the industry trends exist before they are reported, or if they are driven by the associated industry consultants and the organizations in which they participate.

Whether the decision process is being driven from within the organization, or by external consultants, it is paramount that the decision owners within the utilities are involved in the process. Those individuals must have a clear understanding of true benefits and costs of both systems, and a first-hand knowledge of the capabilities and corporate longevity of the selected system.

Sometimes there is no decision. This can be the case when the merger is really an acquisition, and the merger process internally is handled more like a hostile takeover than two friendly organizations determining the best outcome. In many of those cases, the controlling company simply imposes its existing systems upon the company being acquired.

Cases to Study

Recent examples can be found of mergers where the identical two opposing AM/FM/GIS solutions were under review, and the opposite solutions were selected in each case. Did something go wrong in one of the processes? Were internal lobbyists the issue? Was the non-bias consultant actually bias?

Perhaps there was a problem, but it's also possible that the relative maturity and level of integration with the other selected information system platforms was different for each case, and that the choices in each case were completely appropriate. Also, it's possible that the modes of operation were just different enough that the system requirements were better met by one system.

In the case of one North American utility, a GIS solution was selected for two reasons. First, the AM/FM/GIS solution was operating with extremely low ongoing operating costs, which was a significant determining factor.

Secondly, the AM/FM/GIS system was extremely well integrated with the Work Management System within one of the organizations. When this is the case, efficiencies are gained due to the tight integration, and the resulting improvements in business process procedures are significant. The cost to rebuild an integrated solution that is as effective is too costly or too risky.

For instance, in the United Kingdom, a water utility with a very mature and extensive AM/FM/GIS solution recently merged with an electric utility. After the merger, the decision was made to extend the AM/FM/GIS solution to the electric utility. The fact that a very mature and functional solution existed was a driving factor in the selection process.

An interesting influencing factor in this case was the interoperability of the legacy solution with the current version of the GIS Solution. This allowed for collaboration of data from the water utility system, which was developed nearly 10 years prior, with data from the newly implemented electric utility system. The opportunity for collaboration between the two utility solutions – without forcing immediate upgrades on the legacy water utility implementation – provided real benefits in a shorter time frame.

Future Trends

Regulatory and competitive pressures will continue to force utilities to push for cost reductions and, where possible, to perform review and selection processes when time permits. Occasionally, utilities will be forced to move forward with two or more AM/FM/GIS solutions, due to pressure to continue uninterrupted operations and avoid the development costs of combining multiple platforms.

In these cases, the option of functioning with multiple AM/FM/GIS server-based solutions - but adjusting the design interface so that it can operate from either platform - is becoming more of an option today. For instance, one vendor's mapping interface can be coupled with a design solution in such a way that it can utilize data from a variety of AM/FM/GIS solutions, and also populate the completed design updates back to those solutions.

Additionally, web and field solutions are available today for publishing of data from various multi-vendor AM/FM/GIS solutions. This means that the users who are view-only in the office or field operations environment can utilize data from a variety of sources when utilities are forced to continue operating with multiple AM/FM/GIS Solutions.

This interoperability of tools with various back-end data sources will be a welcome trend as we move ahead into the future. Interoperability of user tools will provide more alternatives for merged companies to lessen the impact of homogenizing the post merger environment. ■

About the Author

Mr. Laslo worked in the Electric Utility Industry for 12 years and has spent the last 3 years at Autodesk developing the company's electric utility sales and market focus as well as development and communication of its products and solutions capabilities for the Electric Utility Industry.

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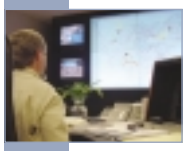

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