

# Electric ENERGY T&D

M A G A Z I N E

Volume 7, No. 4 [www.electricenseonline.com](http://www.electricenseonline.com) July-August 2003 Issue

**In this Issue**

**Understanding Customers  
Through Opinion Research**

**Plus**

**2004 Suppliers & Buyers Guide Issue**

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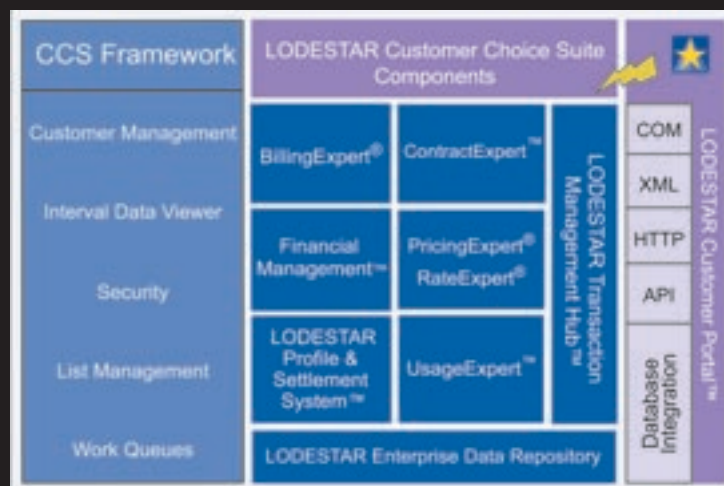
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Opinion polls, focus groups, executive interviews, mail panels, mall intercepts, customer contact evaluations, Internet surveys, and website feedback mechanisms: each of these methods will yield information about what your customers may be thinking, but they are far from equal. All have their uses, but they differ widely in both accuracy and applicability. This article will review some of the more common applications of opinion research, how companies can make use of the results, some of the pitfalls to avoid, and review some of the recent work by the Canadian Electricity Association (CEA) indicating the principal concerns of today's electricity customers.

# Understanding Customers Through Opinion Research

## Value of Research

Not everyone is convinced as to the value of opinion research, so let me state my bias up front. For the past two decades, in the electricity sector and in other fields I have been both a user and designer of opinion research. Having been involved in all aspects of research, from concept, design, fielding, data compilation, analysis and reporting of opinion polls, focus groups, executive interviews, media studies and readership survey, I am among those who believe in the value of research. At the same time, I have also seen poor research, and recognize that without integrity with respect to the objectives, design, implementation, analysis and reporting, misleading or inaccurate conclusions can result in potentially negative consequences if business decisions are made based on flawed research.

So how do you avoid the garbage-in/garbage-out trap? The answer is simply through credible and actionable research as detailed below.

## Methodology

It starts with the definition of the problem. While all steps are important, this one is absolutely critical. The first principle is defining what information you need, what is the critical issue upon which you need further input in order to make a decision. Once the problem has been clearly articulated, and you are able to determine that information on the customers' view of the issue would aid in decision-making, you can formulate the goals and objectives of your research. In some cases, opinion research projects should in fact come to halt at this stage, because some issues simply do not lend themselves to research, either because the customer has no knowledge of the issue, or the customers' view is irrelevant in the decision-making process. In these instances, knowing the customers' opinion would be of little value.

Once the goals and objectives are clearly understood and articulated, and you have determined that some form of opinion research would assist in decision-making, the next step is to match goals and objectives to the specific method of seeking the customers' view.

At the outset, a number of methods that companies use to gauge customer opinion have been identified. Each has different characteristics, and it is at this stage that matching goals and objectives to methods should take place. Among the characteristics you need to take into consideration are accuracy, level of detail, cost, and timing.

## Types of Research

Generally, opinion research methods can be quantitative or qualitative, and a simple way of understanding the difference is to think of quantitative research as being able to tell what customers think, and qualitative research as giving you an understanding of why customers hold the opinion they do. While each can be used for the other purpose as well, this short-hand is an indication as to what method of research is best suited to certain types of goals and objectives.

The most frequently used methods of quantitative research include opinion polls, mail panels and Internet polls. The opinion poll often is the most accurate, and depending upon the sample, can yield results with a very high degree of confidence. It is most helpful in determining customers' views, from general to very specific, and can be employed to identify changes over time.

CEA uses polling as the anchor for its annual Public Attitudes Research study. As part of that study, we measure customer views on a broad range of issues, from service satisfaction to perceptions of environmental performance. Because we are seeking maximum accuracy, we opt for an opinion poll of a random sample of Canadians, which delivers a high degree of confidence that results are representative of the population as a whole.

The need for accuracy is the reason we do not use other quantitative methods of inquiry. For example, while an Internet-based poll may provide results that suggest how customers feel, it is only accurate in so far as it is representative of Internet users, and specifically those Internet users who respond to the survey. Internet usage is higher in certain demographic groups, and can depend upon age, income and level of education. As a result, an Internet poll may be a simple and cost effective way to get a general indication of how people view a certain issue, but the results can not be extrapolated to the population as a whole.



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## Combining Methods and Thorough Analysis

Quantitative and qualitative research is often used together as part of an opinion research project. For example, a survey may indicate a reduction in the level of confidence in the industry, and while an analyst may speculate as to the cause, qualitative research can be used to better understand the reason for the views the customer holds. The most frequently used method of qualitative research is the focus group. In focus groups, 8-12 participants are gathered together, and with the guidance of a moderator, have an in-depth discussion on a predetermined issue.

Many companies use focus groups as part of their marketing efforts in order to understand customer motivations, and test both product offerings and marketing campaigns. CEA has also used focus groups to gain a better understanding of customer views on public policy issues, to test receptivity to various policy options, and to test communications materials. I highly recommend attending focus groups to company decision-makers. Often, focus groups facilities are equipped with one-way mirrors so clients can observe the proceedings. You certainly get a great deal more out of focus groups if you are able to hear what customers have to say, in their own words, than simply reading the results in a report. As well, a report cannot capture tone, attitude and body language.

One pitfall to be mindful of is drawing the wrong conclusions due to either inaccurate or a lack of depth in data analysis. An example of this can be found in work CEA undertook at the request of one of its members a number of years ago. We were asked to provide an assessment of the effectiveness of their bill stuffers. The first pass at the poll data suggested less than a third of customers were aware of a significant campaign being promoted in their bill stuffers. The initial conclusion drawn by the researcher was that bill stuffers were not an effective way of communicating with customers. However, a more detailed analysis of the data showed that a large majority of one segment of customers was aware of the campaign, and that segment was customers who were most supportive of and favorably disposed towards the company. Thus the correct conclusion was not that bill stuffers were a poor communications vehicle, but that they were in fact a very effective communications vehicle for communicating information to one of the most important customer segments. This conclusion also provided guidance as to what type of information should be provided in bill stuffers.

## Current Customer Concerns

In late April and early May of this year, CEA surveyed the Canadian public as part of its annual Public Attitudes Research project, aimed at providing an indication of customer views on a broad range of issues, and to pinpoint how those views have changed over time. While the detailed report is available only to CEA Corporate Utility members, the following summary of those results provides insight into current customer concerns.

The first and perhaps most important conclusion drawn from the research, and this has been the case for the past few years, is the price, while very important, is not the most important issue for customers. We track more than a dozen service attributes each year, both in terms of importance and satisfaction, and more than half of those are viewed as more important than price to customers. The most important service attributes are those which relate to the accuracy of billing and reliability, and include ensuring a sufficient supply for the foreseeable future, and speed in restoration when an outage occurs.

In a direct trade-off between reliability, environment and price, when customer must choose between them as to which is more important, reliability is the most important. Price in fact comes in third in this equation, less important than both reliability and ensuring environmental protection.

Environmental considerations are once again a growing concern for electricity customers, and the interest of customers in electricity from "green" sources continues to be significant. When asked what they would value most from an electricity supplier, electricity from alternative sources such as wind and solar was seen as more valuable than rates that were 10 percent lower.

In terms of overall measures of satisfaction, satisfaction is highest with respect to service-related issues, less so with respect to the perception of the environmental performance of the industry, and lowest overall when rating the communication efforts of companies. Clearly, more effort needs to be placed on effectively communicating with customers.

In conclusion, while many companies use opinion research in the development and delivery of their marketing efforts, there is a role for research in many areas of industries operations. This could include assisting communications, corporate planning, public policy, rate cases and facility site selection and approval. The key is ensuring the goal and objectives are conducive to opinion research, the methodology is appropriate for the issue being research, the process is conducted with integrity, and the analysis is thorough and without bias. ■





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The FC2100 allows to phase conductors at the end of a cut cable, when the other end is short and grounded. The "A" and "C" phase transmitter clamps are quick and easy to install and the handheld detector is able to phase up to 3km away from the transmitters. This makes the FC2100 a very simple and useful instrument.

The FC2100 is one of the many high-tech, user-oriented products NDB has developed for electricity workers during the past few years. These products are already sold in Europe and Ndb begins to commercialize them in North America. Ndb Technologie presented the FC2100 and FC2200 phasers at the last ESMO2003 Exhibition and received a very positive response from customers. For more information visit our web site: [www.ndb.qc.ca](http://www.ndb.qc.ca). ■

Circle 30 on Reader Service Card

## ALSTOM Announces Executive Promotions in North America

(Eddystone, PA / Bellevue, WA – May 28, 2003) ALSTOM has promoted two executives within its Bellevue, Washington-based energy management and market systems business to national and international positions within the company.

JD Hammerly is promoted to North America Vice President of ALSTOM's Energy and Automation Information Business within the company's Transmission and Distribution Sector, and Spero Mensah to Vice President of the Business' Worldwide Systems Marketing organization.

Mr. Hammerly joined the company in 1989 and has been Vice President of Sales at Bellevue since 1997, where he has been responsible for implementing strategy for primary power control systems and electrical deregulation. Prior to joining ALSTOM, Mr. Hammerly was Director of Western Operations for Harris Corporation. Mr. Hammerly will continue to be based in Bellevue, WA, and report directly to Laurent Demortier, Senior Vice President of ALSTOM's T&D EAI Business.

Dr. Mensah has been Director of the Bellevue site's Global Energy Market Group since 1996. He was responsible for developing and implementing strategy to position ALSTOM as the leading global solution provider for competitive energy markets worldwide. Prior to joining ALSTOM, Dr. Mensah held management positions in the Energy Control System Department at CAE Electronics. Dr. Mensah will be based at ALSTOM's T&D headquarters in Paris, France, and will also report directly to Laurent Demortier, Senior Vice President of ALSTOM's T&D EAI Business.

Mr. Hammerly and Dr. Mensah are assuming the roles which were formerly performed by Alain Steven, who served as President and CEO of the Bellevue site since 1991. Mr. Steven, who recently left ALSTOM to become Vice President and Chief Technology Officer of PJM LLC, based in Philadelphia, had managed the organization through a period of significant growth and has driven it to the leadership position it holds in the North American market today. ■

Circle 31 on Reader Service Card

## Green Power a 'dollar-and-sense' proposition for growing number of companies, organizations

By John Sawler

It has become a familiar refrain among environmentalists: Green Power – low-environmental-impact electricity that is generated using renewable energy resources, such as wind, solar, biomass, and low-impact hydroelectric – is good for the planet. But now, a steadily growing number of commercial, institutional and industrial companies are realizing that incorporating Green Power into their energy portfolios can be good for business, too.

Until recently, corporate energy buyers have been reluctant to include Green Power options in purchasing strategies. Many have viewed it as expensive – especially companies that operate in highly competitive market segments, and for

which cost control is critical. But the approaches now being used to measure return on investment are changing. A number of organizations are beginning to take a more qualitative approach to measure ROI.

At one time, a company's commitment to environmental issues was often made and driven by a high-ranking senior executive. But now, stakeholders from myriad departments – facilities management, finance, environmental health and safety, human resources, community and government relations, sales, marketing and public-relations professionals – are getting involved with the delivery of programs and results that respond to a company's environmental commitment. And environmental performance is receiving increased recognition as a key parameter for measuring ROI.

Nowadays, the choice to go Green makes a strong statement about an organization's corporate culture. Marrying a Green Power program to the company's marketing plan not only enables you to reach many audiences, but it will enable you to turn that investment into competitive advantage. More consumers now use a company's environmental performance as a criterion for purchase and investment decisions. Witness the rapid growth of socially responsible mutual funds within the investment community.

For all intents and purposes, the value proposition to be realized by companies that buy Green Power is two-fold:

- Green Power is good for business. More companies now realize that to be perceived as a good corporate citizen, they must develop policies to minimize the environmental footprint associated with the products and services they provide. Buying Green Power reinforces a company's image as a socially conscious, environmentally responsible citizen among all its stakeholders: customers, suppliers, distributors, investors, government, employees, local communities and environmental lobby groups. And that can help increase revenue, help manage relationships, and keep staff engaged.

- Green Power is good for the environment. Green Power is a sustainable source of power that can help to reduce society's dependency on carbon-based and non-renewable sources of power generation. Green Power does not produce the emissions that contribute to acid rain, smog and global warming. Each megawatt hour of Evergreen® Green Power, when compared to the equivalent amount of electricity generated by a new coal-fired power plant, avoids emissions of



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# Industry News

nitric oxide (NO), sulphur dioxide (SO<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) by as much as 0.45 kilograms, 0.53 kilograms and 900 kilograms, respectively. It is expected that the need for commercial and industrial entities to meet environmental compliance standards will help to quantify the need to go Green. Canada's ratification of the Kyoto Protocol means that all Canadians face a carbon-constrained future. The purchase of Green Power can be an important element in every company's strategy to manage greenhouse gas emissions. In the near term, purchasing Green Power helps to promote the development of clean energy technologies that will help Canada meet its Kyoto targets. Those who buy Green Power usually purchase Green as a small percentage of their overall electricity needs; this commitment typically increases their bill only a few percentage points.

One important attribute organizations look for when choosing a supplier is whether the Green Power that supplier generates has been certified by a third-party program. This is why OPG specifically chose to have its Green Power facilities certified by Environment Canada's Environmental Choice' program. OPG customers can be sure that the Green Power they've purchased actually comes from facilities that have a low impact on the environment.

As the leading generator of electric power in the province, Ontario Power Generation (OPG) produces Green Power because it's an important part of its vision of becoming a sustainable energy company and because many of its customers are asking for it. OPG Evergreen' Energy, which manages the operation of the company's Green Power portfolio, currently produces enough Green Power to meet the electricity needs of about 60,000 Ontario households. OPG expects that additional capacity will come online as customer demand increases.

Make no mistake, the choice to use Green Power has never been simple. But nowadays, with a growing number of environmental and regulatory pressures, and with so many good planning strategies and creative approaches to communicate the value proposition throughout the organization, the choice is becoming progressively easier. ■

John Sawler is Marketing Manager, Green Power, at Ontario Power Generation in Toronto. Circle 32 on Reader Service Card

## Putting the GO in Pay-As-You-Go

How many times have you heard that Pay-As-You-Go metering solutions are not viable in North America? Some say it's because the American culture isn't ready; others that there isn't enough competition; while still others blame the public utility commissions. All real issues for a utility program.

And yet the Pay-As-You-Go payment option consistently receives high consumer satisfaction ratings. For example, in Canada the Woodstock Hydro Services has had a Pay-As-You-Go metering system in place since 1989. Their initial intent was to address high maintenance customers, but the offering attracted a much wider base of customers. Approximately 26% of the consumers in the City of Woodstock now utilize the Pay-As-You-Go service. The prepaid customers like the convenience of being able to purchase energy on their terms. Pay-As-You-Go innovators SRP, FP&L and LG&E report similar programs and results.

North America is taking note. According to a recent Chartwell report, 38% of IOU's are considering prepay programs. Some obstacles must still be overcome including the high cost of meters and complicated systems with overlapping CIS and vending software programs. It may take an English Meter Company to put the go in the North American Pay-As-You-Go market.

The leading meter company in England has recently chosen to enter the North America prepayment market. AMPY Automation Digilog Limited will announce two North American partners this month. The US based company, Widefield, will handle the Western and Southern states; and, the Canadian based Info Energy Inc. will address Canada and the North Eastern USA.

AMPY's entry into the North American market is significant because they are a successful meter manufacturer with 40 years of expertise in the design of measurement control devices and 20 years of experience in the prepay metering solution market. They have designed a system that does not duplicate the complex CIS programs or vending programs but merely works to interface these systems together for maximum efficiency. And their experience as a low cost manufacturer will result in a cost effective solution. AMPY is located in Peterborough, England and employs approximately 350 people. ■

Circle 33 on Reader Service Card

## AB Nynas Petroleum and Valero Energy begin Cooperation in USA

Nynas USA, Inc., a wholly owned subsidiary of AB Nynas Petroleum, and Valero Marketing and Supply Company, a subsidiary of Valero Energy Corporation, are entering into a long-term co-operation agreement in the USA. The deal contains two major parts. Firstly, Valero will purchase technology from AB Nynas Petroleum to improve the naphthenic base oil production at Valero's Three Rivers refinery in Texas, USA. It is estimated that the production capacity will increase by 50%, and in addition product quality will be substantially improved. It is planned to bring the new capacity on-stream during the third quarter of 2004. Secondly, Nynas will enter into a long-term supply agreement with Valero to purchase the total naphthenic base oil capacity from the Three Rivers refinery as of June 1, 2003.

"The co-operation with Valero will enable Nynas to better serve our present customers in the US as well as being a good base for export to Nynas international sales and marketing system" says Mans Collin CEO of AB Nynas Petroleum.

"This is a great partnership because we're combining Nynas' expertise in producing and marketing naphthenic base oils with our technical and operational expertise in refining," said Bill Greehey, Valero's chairman and chief executive officer. "Nynas is recognized as the world's premier producer and marketer of these products so we couldn't have picked a better partner."

"As a result of this agreement, we will be able to upgrade our facility to produce the highest-quality naphthenic base oil products and we'll have a guaranteed market for them," he said. ■ Circle 34 on Reader Service Card

## The New Lean Delta Star

Companies of all sizes are in a desperate race to remain competitive and profitable. The steps outlined below will help organizations shorten delivery times, improve quality and reduce costs. Lean techniques are commonly broken down into five introduction steps commonly known as 5 S.

- 1) Organization - clearly distinguish between needed and unneeded items and disposing of the latter. It's more than just reorganizing existing items neatly;
- 2) Orderliness - arranging needed items for easy use and labeling everything that is needed. Have a dedicated area for each item;
- 3) Cleanliness - keeping everything swept and clean;



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- 4) Standardization - maintaining the three conditions above;
- 5) Discipline - making a habit of maintaining current procedures. It's the foundation for any organization to maintain 5 S conditions.

When entering a new organization the first place to look is the scrap hopper. This step will tell you a lot about your operation. Next educate your employees and staff on what Lean means. If you don't have commitment from your team, there is no way to make Lean successful. The easiest way to demonstrate the Lean concept to your employees is to develop a mini workshop or plan using their existing techniques, and try to meet goals and objectives by using batch and queue. Once they feel the pain of trying to control inventories, quality and on time performance using their old systems, take the 5 S techniques and introduce it to your mini factory. If this is done correctly you will show inventory drop, quality improvements, and an increase in on time performance.

The next step is implementing a pull system to the manufacturing floor. In most cases the plant problems hidden by inventory. If you walk up to a supervisor on the shop floor and ask why they have so much finished component inventory, you typically will hear "I don't want to be the reason the plant is not functioning". As the inspection continues, I find that the inventory covers up a poor maintenance program, supplier delivery, employee absenteeism, lack of planning and lack of communication within the organization. I believe lowering inventories will expose the real issues, and this is the first step to starting a Lean program. It is often said you must lower the water in the creek to expose the rocks. Once the rocks are exposed you must put a plan in place to eliminate each one. Don't just put a band-aid on a problem; set up task teams to identify the root cause and eliminate the problem.

If you will pay attention to the 5 S program, receive participation from each employee, and implement a pull system in your organization you will obtain the benefits of Lean and improve your business. ■

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## MasTec Energy Services Contracts

MasTec Energy Services has recently been awarded two distribution construction contracts. The first contract is to provide underground distribution construction for Gulf Power, headquartered in Pensacola, FL. MasTec crews will install new underground residential services,

backbone construction for new developments, and related services. The second contract is with Tampa Electric Company. MasTec crews will be providing overhead distribution construction and maintenance services. MasTec Energy provides distribution, transmission, substation and wind-farm construction and maintenance, as well as emergency restoration. ■

Circle 36 on Reader Service Card

## SIEMENS Completes Expanded Oasis Operations

**Service conducted for PJM Interconnection**

RALEIGH, N.C., - Siemens Power Transmission and Distribution, Inc. has completed its second month of expanded OASIS operations under an innovative and collaborative ASP (application service provider) delivery model. In operation since April 16, this new service provides OASIS services to PJM Interconnection's members and customers, as well as hosted third-party Available Flowgate Calculations (AFC) for the entire PJM region including future market members Commonwealth Edison (Exelon) and Dayton Power & Light (DP&L).

PJM operates the world's largest competitive wholesale electricity market and North America's largest centrally dispatched control area and serves all or parts of Delaware, Maryland, New Jersey, Ohio, Pennsylvania, Virginia, West Virginia and the District of Columbia. The company currently coordinates a pooled generating capacity of more than 74,000 megawatts and operates a wholesale electricity market with more than 200 market buyers, sellers and traders of electricity.

Hosted in Minneapolis, Minn., the OASIS node serving PJM represents the latest in technology, constructed on an Oracle® database platform that will provide for flexibility and adaptability as the energy industry and PJM continue to transition. In addition, an integration bus, built on IBM® MQSeries™ technology, securely transfers data between PJM, their members, and the Siemens Data Center. This integration bus enables members to easily integrate their new applications with existing legacy systems.

"Advanced technologies are critical to maintaining our responsibility of delivering both reliable electricity and premier customer service," said Mike Bryson, manager of transmission services, PJM. "The Siemens Data Center is contributing to the progress that we are making, especially as we work to continue to enhance transmission services."



# Industry News

On May 21, 2003, the Siemens Data Center also began hosting, the OASIS node for DP&L, which was previously part of the ECAR OASIS node. This step facilitated easy integration with the new AFC engine operated by PJM, and moved Dayton forward on the path toward full integration into the PJM market. ■

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## GE Power Systems' Affiliate Viceroy Selects CIC's Electronic Signature Technology

REDWOOD SHORES, Calif., - Communication Intelligence Corporation ("CIC") (BULLETIN BOARD: CICI), the leader in electronic signature, biometric verification and natural input solutions announced today that GE Power Systems' (NYSE:GE) affiliate Viceroy has selected Sign-it(R), CIC's biometric electronic signature software on all timesheets country-wide. This will enable field Superintendents to process these documents electronically resulting in the elimination of current shipping costs, data entry errors and a reduction in document processing time.

"CIC's electronic signature technology has been a great addition to our electronic workflow process. As a company going paperless, this application addresses one of the most common but critical forms of documentation required by businesses today," said Ned Sheppard, Manager of Information Technologies, Viceroy. "Through the use of the CIC software we are managing these documents more effectively, at a lower cost, and the response from our field Superintendents has been great. They are able to spend less time dealing with this repeating process and more time supervising their crews."

GE was featured in E-Week Magazine (November 12, 2001 issue) for topping the list of 500 fast track innovative companies committed to digitization. CIC has worked closely with various organizations within GE to gain acceptance for its technology. This order places CIC on GE's approved Vendor List facilitating future purchases from other GE business operations.

"We are extremely pleased that GE's affiliate Viceroy has selected our technology to simplify its processes and maximize its competitive advantage," said Collin Bruce, Director of Strategic Accounts for CIC. "This deployment demonstrates the flexibility of our technology which can be easily used for everything from the common timecard to closing an electronic mortgage."

Based on underlying biometric information that is unique to each signature, Sign-it ensures that a signature cannot be forged or reproduced. Once signed, industry standard cryptography techniques are used to bind the signature and document content together so that any change to a previously signed document can be instantly detected, insuring the highest level of document integrity available today. ■

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## Hoku Scientific and SANYO to Develop Fuel Cell Technology

HONOLULU, - Hoku Scientific, Inc., announced that it has formed a joint development relationship with SANYO Electric Co., Ltd. The focus of the development effort is a new membrane electrode assembly technology for use in SANYO's Proton Exchange Membrane (PEM) fuel cell. The membrane electrode assembly will incorporate SANYO electrode technology and the Hoku Membrane, a Hoku Scientific product.

The joint development relationship includes the financial, service and technical contributions of both companies, totaling more than \$6 million. Joint development work is planned for the next 18 months. A successful outcome would likely serve as the basis for a long-term customer-supplier relationship between the two companies.

This agreement reinforces the opportunity for PEM fuel cells in the stationary power markets. Residential and light commercial consumers stand to benefit substantially from the reliability and eventual cost advantages of PEM fuel cells over conventional power solutions. Stationary PEM fuel cells are attractive in part because they use the heat from the fuel cell to produce hot water for the home, allowing for very high system efficiencies.

PEM fuel cells offer particular appeal to residential users in countries such as Japan where energy costs are high. In these and other markets, PEM fuel cells could begin supplementing or replacing conventional power production as early as 2005. SANYO and Hoku Scientific anticipate playing a central role in this emerging marketplace. ■

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# Don't Trust Equivalency Presumptions When Choosing Distribution Poles

By: Martin Rollins

There are now more choices than ever in distribution poles, but purchasers must be wary: simply substituting one type of pole for another based on presumed equivalency could result in a selection unfit for the load condition and out of compliance with NESC requirements. Specifiers should look at relevant strength factors rather than “wood equivalency.”

Steel and prestressed concrete poles have been used for decades for transmission applications, and are now being introduced on a broader basis for distribution, an application long dominated by wood poles. Traditional differences in the design of distribution lines, however, have lead to potential problems in specification.

## The root of the problem

It is common practice to design transmission structures individually, but distribution line designs have typically been based on a range of standard pole sizes. This allows for poles to be inventoried, and allows repair and new construction to proceed without the delays inherent in a custom design and fabrication scenario.

Historically, virtually all distribution poles were wood, and wood poles have been manufactured to distinct class sizes established by the American National Standards Institute (ANSI) specification for wood poles, presently known as ANSI O5.1. In order to improve marketplace acceptance, non-wood distribution poles have been marketed as “wood equivalent” pole classes.


Because the National Electrical Safety Code (NESC) applies different strength and overload factors to poles of different materials under different controlling design conditions, there can be no true “wood equivalent” pole. A non-wood distribution pole designed for equivalence, for instance, to meet the requirements of NESC Grade B under a transverse wind load condition, will not be equivalent under the requirements of NESC Grade C, which controls the safety of most distribution pole designs.

Since most non-wood distribution poles are manufactured for “equivalence” based on NESC Rule 250B Grade B Transverse Wind Load design situations, yet most distribution lines are subject to the provisions of NESC Grade C, there has been confusion in the field concerning how to utilize

**Transverse Load Conditions (NESC 2002)**

<b>Table 1</b>	Extreme Wind Rule 250C	Grade B Combined Ice & Wind Rule 250B	Grade C Combined Ice & Wind At Crossings Rule 250B	Grade C Combined Ice & Wind Not At Crossings Rule 250B	Wire Tension Grade B	Wire Tension Grade C
Wood Overload Factor (Table 253-1)	1.0	2.5	2.2	1.75	1.65	1.3
Wood Strength Factor (Table 261-1A)	0.75	0.65	0.85	0.85	0.65	0.85
Steel & Prestressed Concrete Overload Factor (Table 253-1)	1.0	2.5	2.2	1.75	1.65	1.1
Steel & Prestressed Concrete Strength Factor (Table 261-1A)	1.0	1.0	1.0	1.0	1.0	1.0
Ratio of Required Steel or Prestressed Concrete Strength to ANSI Wood Pole Strength	0.75	0.65	0.85	0.85	0.65	0.72





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## NESC changes

Changes made in the 2002 edition of the National Electrical Safety Code, C2-2002, altered the strength relationship between wood and metal or prestressed concrete poles under one of the NESC load conditions. This load condition is Grade C, Transverse Wind Load, Not at Crossings, for which the overload factor for metal and prestressed concrete structures was reduced to 1.75, the same as for wood poles. This means that metal and prestressed concrete poles now have overload factors equal to wood in all transverse wind load conditions. However, the strength factors for wood change with the grade of construction, so a "wood equivalent" pole under Grade B Rule 250B is not a "wood equivalent" pole under Grade C Rule 250B, or under Rule 250C Extreme Wind, load conditions.

There are 14 different load conditions for which the NESC provides overload factors and strength factors. In many cases the overload and strength factors vary between wood and non-wood materials, and the ratio of the combination of the two values represents the "wood equivalent" design condition for non-wood materials.

Table 1 presents the overload factors and strength factors for the Transverse Load Condition and Table 2 presents the overload and strength factors for the Other Load Conditions. An examination of these tables reveals that there are five different ratios of required non-wood design strength relative to the wood design strength.

It must be remembered that in some cases the controlling design is transverse load, and in others, it may be another load condition such as vertical loading. A non-wood pole designed to be a "wood equivalent" pole under a transverse load would not be a "wood equivalent" pole if vertical loading were the controlling criteria.

For example, even though the relative strength ratio in Table 1 is 0.65 for the transverse load condition of Grade B Rule 250B, Combined Ice and Wind Load, and it is also 0.65 in Table 2 for Grade B, Vertical Load, the "wood equivalent" pole would not be the same in each case. In the first case, the non-wood pole would have to be designed to 65% of the ANSI wood pole transverse strength, and in the second case, the non-wood design would have to be to 65% of the column loading strength of the ANSI wood pole.

These are not the same design point, and the effect would be different depending upon the non-wood material used for the pole. In other words, the relative transverse load strength versus column loading strength of poles varies by material and method of construction. A thin-walled steel pole, a prestressed concrete pole, and a wood pole all designed to have the same transverse load capacity would normally each have a different column loading capacity.

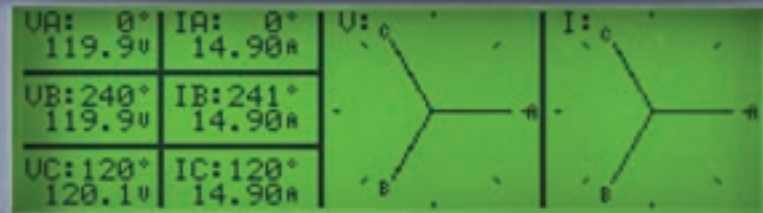
these poles in Grade C designs based on wood. Contrary to some statements, the changes made in the 2002 version of the NESC did not make it acceptable to use a Grade B "wood equivalent" pole in Grade C lines designed on wood pole classes, or in any other wood pole designs not controlled by NESC Rule 250B Grade B Transverse Wind Loading criteria.

**Other Load Conditions (NESC 2002)**

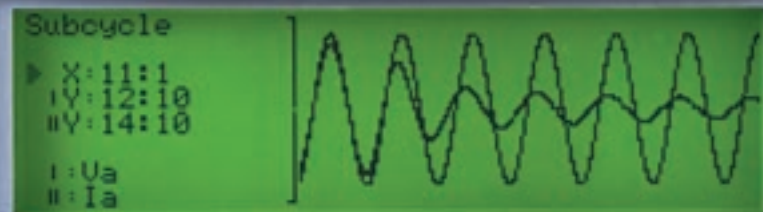
<b>Table 2</b>	Vertical Load Grade B	Vertical Load Grade C	Longitudinal Load At Crossings Grade B In General	Longitudinal Load At Crossings Grade B At Dead Ends	Longitudinal Load At Crossings Grade C At Dead Ends	Longitudinal Load Elsewhere Grade B In General	Longitudinal Load Elsewhere Grade B At Dead Ends	Longitudinal Load Elsewhere Grade C At Dead Ends
Wood Overload Factor (Table 253-1)	1.5	1.9	1.1	1.65	1.3	1.0	1.65	1.3
Wood Strength Factor (Table 261-1A)	0.65	0.85	0.65	0.65	0.85	0.65	0.65	0.85
Steel & Prestressed Concrete Overload Factor (Table 253-1)	1.5	1.5	1.1	1.65	1.1	1.0	1.65	1.1
Steel & Prestressed Concrete Strength Factor (Table 261-1A)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Ratio of Required Steel or Prestressed Concrete Strength to ANSI Wood Pole Strength	0.65	0.67	0.65	0.65	0.72	0.65	0.65	0.72



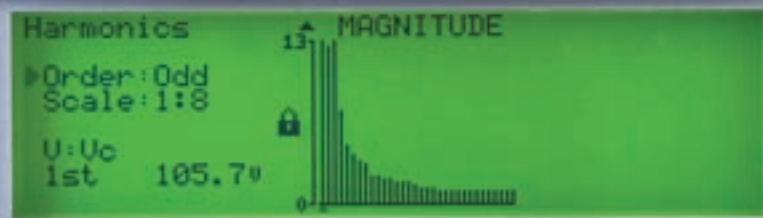
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## How could this be?

Some pole designers and users feel that it is counterintuitive that a “wood equivalent” steel or prestressed concrete pole designed for equivalence in Grade B, which is the more conservative design condition, cannot be used as a substitute for wood in a Grade C design based on wood. The reason is that wood is penalized in Grade B designs because of its perceived higher variability of strength. That is why the wood strength factor is only 0.65 in Grade B designs. However, in Grade C, the wood strength factor is 0.85 and under Rule 250C Extreme Wind the strength factor is 0.75.

Therefore, a “wood equivalent” pole of steel or prestressed concrete would have to be designed to 85% of the ANSI O5.1 wood pole transverse strength to be suitable for substitution for wood in a transverse load Grade C design and 75% of the ANSI strength in a situation controlled by Rule 250C Extreme Wind. Most thin-walled steel poles are designed to 65% of the ANSI transverse strength, and therefore, it should be clear that those poles could not be substituted for wood poles in NESC Grade C or Rule 250C transverse load situations.

Under each of the potentially controlling design conditions shown in Tables 1 and 2, a different “wood equivalent” pole may be required. For these reasons, the concept of a “wood equivalent” pole is fundamentally flawed. It is imperative that users of non-wood poles employ them in accordance with the requirements of the NESC. Failure to meet the requirements of the NESC could have serious consequences.

However, many non-wood distribution pole manufacturers only produce “wood equivalent” poles that are manufactured to be equivalent in an NESC Grade B Rule 250B Transverse Wind Load design. This creates potential problems in misapplication of the product, because NESC Grade C Rule 250B, or Rule 250C Extreme Wind, are the criteria applicable to most utility structures. A non-wood distribution pole manufactured to be a “wood equivalent” pole under an NESC Grade B Transverse Wind Load cannot be used as a direct substitute for wood in a Grade C Transverse Wind Load situation, which governs most distribution pole installations.

Use of the Grade B “wood equivalent” pole in anything other than an installation governed by transverse wind loads under Grade B Rule 250B of the NESC may result in conditions not in compliance with the NESC.

## Summary & conclusions

The differences in relative strengths inherent in poles manufactured of different materials by different methods, the many different permutations of possible controlling load configurations in the NESC, and the different load and strength factors assigned to different materials under different load conditions in the NESC make it clear that there can be no universally applicable “wood equivalent” pole made from steel, prestressed concrete, or other non-wood material. The corollary to this statement is equally true: a wood pole cannot be used as a replacement for a steel or prestressed concrete pole without a thorough evaluation of all of the design loads and the proper application of the appropriate overload and strength factors for wood.

The line design engineer or utility company must have a complete understanding of the basis for the “wood equivalent” pole design in order to avoid misapplication of the product in situations for which it was not designed. A misapplication could result in construction not meeting the minimum requirements of the NESC. Since there may be statutory or regulatory provisions requiring utility construction to meet the minimum standards of the NESC, there could be substantial risk associated with any failure to fully comply with the code requirements.

The line designer does not need to use the “wood equivalent” pole concept in order to effectively utilize non-wood poles. Use of the actual design strength and the appropriate overload and strength factors for the material of construction under the controlling load condition and grade of construction specified in the NESC will ensure that the design meets the NESC code requirements.

The 2002 edition of the NESC includes one minor change to the overload factor for steel and prestressed concrete in Table 253-1, for the Grade C Transverse Wind Load, Not at Crossings, design condition. This change did not make it acceptable to employ “wood equivalent” poles designed for equivalence under NESC Grade B Transverse Wind Load as replacements for wood in NESC Grade C Transverse Wind Load, NESC Rule 250C Extreme Wind, or any other controlling design conditions. ■

## About the Author

Martin Rollins is a registered professional engineer and president and principal engineer of H. M. Rollins Company, Inc., a consulting engineering firm in Gulfport, Miss., serving clients in the wood utility pole and other wood products industries.





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# Utility Automation Projects Surge

By: Chris Harlow

It's the economy Stupid! Or is it? Everywhere you turn, some talking head tells you just how bad the economy is. But the smart business person knows that if you target your opportunities, you can always find the bright side of the economy. For example, snow in the city usually keeps shoppers away from the stores. Snow in the mountains brings out the ski bunnies.

Yes, the IT industry is flat — survey after survey points that out. But in niche markets, things can look pretty bright. As you may know, I am associated with InfoNetrix. ([www.InfoNetrix.com](http://www.InfoNetrix.com)), a leading technical market research firm focused on utility and energy automation markets. In 2002 I conducted the GIS and Mobile Computing Solutions Market Study on their behalf and will conduct the 2003 study as well. While I naturally tend to focus on the strategic view (I guess I'm just a big picture guy), other InfoNetrix research analysts toil at producing the firm's quarterly tactical project activity reports. That is to say they identify the projects that utilities are planning by conducting interviews with 200–300 utilities each calendar quarter.

This effort has identified a record level of project activity — almost 300 projects valued at nearly \$150 million. The important details are in InfoNetrix' just published Q1-2003 Business Horizons™ Reports. These reports, published each calendar quarter by InfoNetrix, identify project activity in two principal automation sectors within the North American electric utility marketplace, as summarized below.

- \* **TDMS (Transmission & Distribution Management Solutions) includes projects for...**
  - \* SCADA (supervisory control and data acquisition)
  - \* EMS (energy management systems)
  - \* DMS (distribution management systems)
  - \* DA (distribution automation)
  - \* SSA (T&D substation automation)
  - \* RTUs (remote terminal units) and RTU-like field devices
  - \* Communications Systems
  - \* Professional Consulting Services
- \* **GMCS (GIS & Mobile Computing Solutions) includes projects for...**
  - \* GIS (geographic information systems)
  - \* AM/FM (automated mapping/facilities management) systems
  - \* Mobile Computing Systems
  - \* Critical Applications, including OMS and WMS
  - \* Professional Engineering & System Integration Services
  - \* Conversion Services

**Yup, it is the economy, Stupid!**

According to InfoNetrix Principal and co-founder Mike Marullo “GMCS showed the largest number of projects (183) and the most significant spending outlook (over \$76 million), but TDMS also exhibited robust project plans with 106 projects valued at just under \$70 million.”

For you transmission techies, get this: the TDMS report identifies utility plans to procure more than 3,700 RTUs for new systems and additions to existing installations — also a record number. Yeah, nothing like a slow economy to make your quota.

“These first two reports of 2003 identify the most opportunities and highest project spending outlook ever documented in our quarterly Business Horizons™ Reports series and represents significant growth potential in the major market sectors (i.e., TDMS and GMCS) they address,” said Ed Finamore, who leads the InfoNetrix Electric Utility practice area.

## But what kind of projects are out there?

I thought you might ask. As it turns out, those InfoNetrix researchers called and interviewed managers at over 230 electric utilities during the January through March survey period. The table below summarizes the projects and project values depicted in the resulting reports.

TDMS & GMCS PROJECT ACTIVITY		
TDMS PROJECT TYPE	TOTAL PROJECTS	VALUE (\$000s)
T&D Automation Systems	72	\$51,030
RTU Add-on/Expansion Units	38	\$12,935
Communications Projects	54	\$4,567
Consulting Services	14	\$1,440
TDMS Sub-total	106	\$69,972
GMCS PROJECT TYPE	TOTAL PROJECTS	VALUE (\$000s)
AM/FM/GIS Systems	85	\$29,905
Mobile Computing	48	\$19,480
Professional Services	15	\$1,040
Conversion Services	35	\$25,785
GMCS Sub-total	183	\$76,210
<b>TDMS + GMCS TOTALS</b>	<b>289</b>	<b>\$146,182</b>

## Why the rebound?

To get that answer, we checked with another InfoNetrix principal, Mike Smith, director of tactical market research and development. He was kind enough to share his thoughts with us. “Frankly, we’re somewhat surprised at the strength of the recovery this early in the new year so it will be interesting to see if it is sustainable for the balance. However, we’re seeing many utilities come full circle, having transitioned from tightly regulated monopolies to an almost unbridled period of diversification, followed by a recent return to a more traditional utility focus “all within a few years.”



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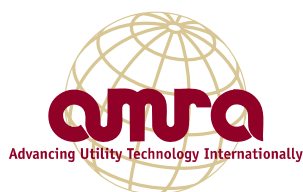
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"Bear in mind that these quarterly Business Horizons™ Reports address a 3-to 30-month planning horizon for each utility we survey," Smith continued. "This means that the projects we identified in this first quarter will be initiated between now and fall 2005. Each quarter we survey 200-300 new utilities and are able to project out a little further as the year progresses. By the end of 2003 we should have a pretty clear picture of planned TDMS and GMCS projects through mid-2006," Smith explained.

## Conclusion

Although I have known Mike Marullo and Mike Smith for a decade or so, my participation in last year's GMCS study was my first opportunity to get an insider's look at how they conduct their research. Believe me when I tell you that they are first rate. Marullo is a stickler for detail and accuracy — great for you; a pain for me. Smith understands this market, knows what to ask, and how to go about getting it. Unlike the "other Mike", Smith is not constantly "adjusting" my writings. (All "sticklering" is left to Marullo!)

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# Defibrillation Program Implementation Checklist:

- Obtain management commitment to and approval of the early defibrillation program, as well as commitment and support for those individuals/departments that will support the program
- Conduct a site survey to identify barriers to response and high-risk areas
- Identify the medical director, program coordinator and defibrillator response team members
- Develop your emergency response plan
- Identify a training program and provider and training plan
- Identify the minimum equipment needed for each location and any maintenance needs.

## Utility Early Defibrillation Programs Save Lives

By: Kathy Hjelmeland, Philips Medical Systems

An end-of-day soda run turned three members of a Wisconsin electric utility line crew into heroes last December. The Richland Center Electric Utility crew had pulled into a local Mobil-Mart, where Line Foreman Dale Bender was waiting in line when he witnessed a man a couple of places in front of him slump to the floor, grabbing his chest. As bystanders rushed to aid the man, Bender ran to the bucket truck and grabbed the defibrillator it carried. He alerted his fellow crewmembers, Journeyman Chris Chitwood and third-year Apprentice Rod Klossowski, who responded with him.

Upon reaching the victim, Chitwood began CPR as Klossowski applied the defibrillator pads. Following patient analysis and Bender's "All Clear!," the device immediately advised a shock. After receiving a single shock, the victim began breathing and exhibited signs of a pulse. EMTs arrived almost simultaneously, and according to Bender, "They simply unplugged the leads from our machine and hooked it to theirs, which was the same model."

The close proximity of an automated external defibrillator, available within moments following the sudden cardiac arrest (SCA) and followed by a rapid EMS response, helped save the victim's life, proving once again that early defibrillation programs pay off for both utilities and communities.

Following the rescue, Dick Dosch, electric superintendent for Richland Center Electric Utility, released a statement saying, "Words are hard to find to describe how proud I am of these electric utility employees for their actions. I am also proud of the Richland Center Utility Commission for having the foresight to see that this equipment is needed not only by employees, but also in the community."

Dosch credits Municipal Electric Utilities of Wisconsin (MEUW) President Richard Kirchoff, of Hutisford Utilities, for bringing attention to the need for defibrillators on utility trucks several years earlier.

### Defibrillation programs protect both employees and community

For utility industry employees, quick access to defibrillation following SCA is a good idea already proving its worth with real-life results. In the two years since the inception of early defibrillation programs at both Cobb Energy and XCEL Energy, two lives have been saved, thanks to the availability of automated external defibrillators put in place by company teams who designed programs specifically tailored for their workforce and communities.

At Cobb Energy, one of the company's 75 defibrillators was used to treat a member of the public who collapsed in March 2002. A Cobb Energy service crew driving by a local restaurant noticed police cars, and became concerned. Crew members Ken Bryant, Brian Mathison and Adam Moody turned into the parking lot and discovered a 70-year old man being given CPR. The crew offered their assistance and use of the defibrillator in the truck until an ambulance arrived. Cobb Energy, which has made a commitment to serve the communities in which employees live and work, recognized the three for their bravery in offering their assistance to a private citizen. The Cobb Energy line crew that stopped to see if they could assist embodied the commitment to community for which the industry is known.

At Xcel Energy's Black Dog Plant in Minnesota, a 47-year old contractor is alive today because of the close proximity of a defibrillator and the quick response of co-workers. In April 2002, coworkers discovered Mike Rogers of Duluth, MN, collapsed on a second floor stairway landing. He wasn't breathing. The plant's control room immediately called 9-1-1 while three operator repairmen rushed to his aid with one of the plant's defibrillators. After one shock, the victim regained a stable heart rhythm. The Burnsville Fire Department then arrived and transported the victim to a local hospital.

The three responders—Greg Fischer and Scott Helgeson, operator repairmen, and Gary Strom, lead operator repairman—each received Life Sustaining Awards from the company. Carl



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Sannes, plant director at Xcel's Black Dog facility, underscored the importance of having a defibrillator readily accessible by trained employees, saying, "We are very proud of how our entire operating shift responded to this emergency, and are all grateful that we had a defibrillator and trained plant personnel available."

### Utility industry starts on and stays on the leading edge

Today, safe, easy-to-use and technologically advanced defibrillators are increasingly being deployed throughout the industry, where it is well-known that accidental contact with high voltages can result in sudden cardiac arrest. SCA is most often caused by ventricular fibrillation (VF), a condition in which the heart's electrical impulses suddenly become chaotic. The only effective treatment for SCA is rapid defibrillation. While CPR can buy a victim time by delivering oxygen to the brain, it cannot restore a normal heart rhythm. Automated defibrillators rapidly and automatically assess a victim's heart rhythm and safely make the appropriate therapy decisions, using an electrocardiogram (ECG) analysis system. As a result, equipping and training employees such as linemen to use automated external defibrillators immediately following a cardiac event can measurably improve SCA survival rates.

### Industry committed early to fighting SCA

The utility industry has demonstrated a longstanding commitment to protecting the lives of employees and community members from SCA. It has long been recognized that a shock of 50-100mA can result in VF, severe burns and muscular contractions<sup>1</sup>. As a result, utilities, along with airlines and casinos, were among the first industries to implement wide-scale early defibrillation programs to protect employees and the public. Long before that, utilities were among the first to invest in research and technology to treat for this deadly condition. Notably, the utility industry was a catalyst in the development of the first bulky, "portable" defibrillator, more than half a century ago.

In 1925, Consolidated Edison of New York consulted the Rockefeller Institute on how to improve survival from electrical accidents resulting in SCA. The Institute funded research at several universities including Johns Hopkins to study the effects of electric shock, in hopes of protecting

employees. At that time, there was no remedy for VF. Investigator William Kouwenhoven, a professor of electric engineering at Johns Hopkins, noted that low-voltage shocks caused VF. In 1933, by administering a countershock of electricity, he and fellow researcher neurologist Orthello Langworth, MD, discovered they were able to restore a normal heart rhythm. Several years later, their discovery would result in the development of the first defibrillator--280-pound contraption mounted on a wheeled cart.<sup>2</sup> In 1957, the device saved its first life--a 42-year old Hopkins patient who suffered VF in the operating room. Luckily for the patient, the admitting resident was familiar with the defibrillator locked in the 11<sup>th</sup> floor laboratory. He was able to persuade a security guard to give him access to the device in time to wheel the huge defibrillator down to the patient. According to Johns Hopkins, the patient lived another 18 years. Kouwenhoven's research was later used to develop a smaller 45-pound model that could operate on either small battery or AC current. The work was funded by Edison Electric specifically for use by utility line crews. Consolidated Edison's early investment had paid off.<sup>2,3</sup>

The manufacturer of the devices selected by Cobb Energy, Xcel, and Richland Center has also been on the leading edge in the fight against SCA as it further developed defibrillation technology. The company has the distinction of introducing the first low-energy biphasic defibrillator in 1996. The defibrillation technology selected was designed to be virtually maintenance free and easy to use for all trained responders, with voice and text prompts to guide the user. The company's next generation model was the first defibrillator designed to effectively and safely treat pediatric patients. The most recent addition to a growing collection of "firsts" for the manufacturer is a groundbreaking new defibrillator, the first in a new generation designed for the home.

### Program design creates effective response

Both Xcel Energy and Cobb Energy utilized implementation assistance from Amy Dixon, a clinical implementation specialist and EMT. Using recognized guidelines, research and industry practice, Dixon provided site assessment and program consultation to determine the most effective way to deploy defibrillators to protect employees.

"The department of Labor's Occupational Safety and Health Administration (OSHA) recommends treatment within 3-4 minutes for life-threatening events, such as severe bleeding, respiratory arrest, or cardiac arrest. Additionally, the American Heart Association recommends defibrillation response times from 3-5 minutes, depending on the environment," explained Dixon.

She also emphasized that an emergency response plan that identifies how and when lay rescuers will respond to emergencies is essential to a successful early defibrillation plan.

"The plan should be defined in formal policies and procedures that include how defibrillator responders as well as local Emergency Medical Systems are to be notified in the event of an emergency," she said. Dixon added that it should also include how the defibrillator response protocol is to be used by the response team members and the procedures to be followed after response to an emergency incident. In addition to covering normal business hours, the plan should include special procedures for alternate shifts, and times of reduced or increased occupancy.

### Where should defibrillators be placed?

Manufacturers and experts such as the National Center for Early Defibrillation, a nonprofit advocacy organization, recommend that utilities perform a site survey to gather information to help identify where the defibrillators should be located in order to meet the response time goal. Placement should be based on one of two response models: localized or centralized.



In a localized response, such as that used by the Richland Center Electric Utility line trucks, defibrillator placement is made with time factored in for someone to witness to the victim's collapse, retrieve the defibrillator, return, and apply it to the victim within the response time. Companies using this model have often deployed defibrillators on line trucks to provide the close proximity of the defibrillator which is critical in the event that a pole-top rescue may need to be performed. Many companies also express a commitment to their communities, and desire to be able to respond to SCA in the general population as needed.

In a centralized response model, the defibrillator is placed in a central location staffed by full-time responders. In this approach, the witness to the victim's collapse notifies the central location and proceeds to provide basic care until the device is brought to the victim's side.

In either case, defibrillators should be located so that the walk to retrieve the nearest one is no greater than 90 seconds. Any barriers, such as stairs or elevators, will increase the time needed. The need to climb stairs or use elevators to access multi-story buildings can significantly slow EMS response time.<sup>4</sup>

### Walk it Out

To determine the best location for a defibrillator, conduct an "SCA response test" for each planned defibrillator location. Whenever possible, your test should mirror real response situations throughout representative locations in your facility or work area. Place a "victim" (either a mannequin or volunteer) at a selected location. Then place a witness to the SCA event at the victim's side. Using your response model, have the witness initiate the response. Use a stopwatch to measure all of the relevant time intervals. Start with recognition of sudden cardiac arrest by a witness as "time zero" and factor in time for:

1. Calling 9-1-1 or an in-house emergency response number
2. Beginning CPR
3. Arrival of the defibrillator
4. Application of the defibrillator pads
5. Delivery of the first shock

### Response team training boosts confidence

A quality training program is important to the ultimate success of an early defibrillation program. Advances in defibrillator technology have made the devices much easier to use and maintain, with reduced training requirements. To be confident in using a defibrillator in an emergency situation, rescuers should be trained in the proper skills and understand the basics of responding to sudden cardiac arrest. Since most trained personnel will go for long periods of time without being called on to use an AED, a re-training program will keep responders sharp and their confidence high.

### Rugged, lightweight equipment a must for line truck deployment

The defibrillator model chosen by Cobb Energy, Richland Center and Xcel Energy has become the utility industry standard—rugged, effective and reliable, virtually maintenance free, as well as compact and lightweight. The devices are designed to withstand harsh weather conditions and rough treatment, and to perform daily, weekly and monthly self-tests to help ensure that they are always ready to use.

The risk of sudden cardiac arrest—and the need for early defibrillation—will continue to be one that the utility industry must prepare for, given the potential for accidental contact with high voltages. Having a well-planned program, the right equipment and a quality training plan helps these utilities prepare for the unexpected.

### For more information

Information on implementing an early defibrillation program specifically tailored to the utility industry is available from Philips by calling 1-800-263-3342, or by visiting the web site at [www.medical.philips.com/goto/heartstart](http://www.medical.philips.com/goto/heartstart). If you have questions regarding training requirements, Good Samaritan laws, or state laws regarding use of defibrillators by trained first responders, contact the American Heart Association at 1-800-242-8721 or your local Red Cross chapter. Or visit the National Center for Early Defibrillation website, at [www.early-defib.org](http://www.early-defib.org). ■

### About the Author

*Kathy Hjelmeland is a freelance writer based in Seattle, Washington. Her articles on early defibrillation programs have appeared in CorrectCare, Electric Energy, Occupational Health & Safety, Ski Patrol Magazine, US Cycling, and Utility Safety. Philips Medical Systems offers a complete solution in resuscitation products, helping rescuers treat SCA quickly and effectively whenever it occurs.*

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# Utility Mobile Data Computer - Wireless Internet Access

In the 1960's, when the U.S Department of Defense set a requirement for a packet-switched network nobody anticipated that it would grow into what we know today as the Internet. The Internet and Internet Protocol (IP) have changed the way we communicate and conduct business. Having a common communications protocol such as IP has opened the door for many application programmers to develop unique applications for businesses. Today, our networking tools have reached incredible speeds of 1 Gigabit/sec or faster allowing them to support a variety of media including text, audio and video.

In today's fast-paced, customer focused, business environment mobile workers need and want to have the same information at their fingertips whether they are in the office or on the road. Though wireless data communication has been around for over 20 years, the limitations of radio still don't allow the same data rates to be obtained in the wireless world as in the wireline world. Today, most over-the-air data rates in the private data industry are between 4,800 bps and 19,200 bps. Compared to their 10 Megabit and 1 Gigabit wireline cousins, wireless data systems are considerably slower. Therefore, when you marry applications that were developed to be used on a high speed, IP-based network with a wireless network, the results can be (and usually are) very disappointing.

## To Connect Or Not to Connect – TCP vs. UDP

IP based applications are either "connection-oriented" or "connectionless". A "connection-oriented" application uses TCP (Transmission Control Protocol) and IP while "connectionless" applications use UDP (User Datagram Protocol) and IP when communicating over a network.

Though you may not have realized it, some common connection-oriented applications are web surfing, email, file transfer TN 3270 green screen and remote terminal login. When one of these applications initiates a remote connection, it is the responsibility of TCP to establish the connection. A TCP connection consists of a three-step process:

### The Hello Handshake -

Establishes a connection between the sending application and the receiving application

### The Acknowledgement -

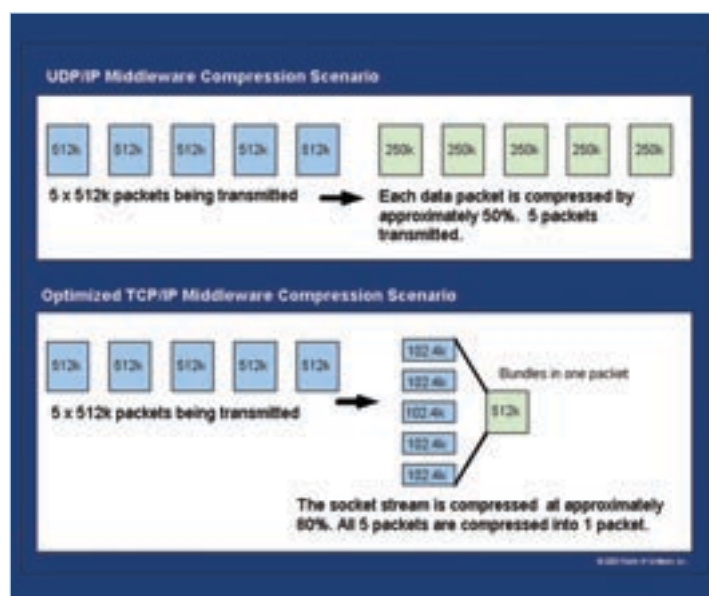
Transfers the information and acknowledges that it was received properly. (i.e. the receiving application must acknowledge that the data was received.)

### The Goodbye Handshake -

Tears down the connection that was established in step 1.

A connection-oriented process (TCP/IP) is similar to the process of having a conversation with a friend on the telephone. First, you must call your friend to see if he is home. If someone answers then you would ask to speak to your friend. Assuming your friend is there and picks up the phone, you have now established a connection with your friend. Once the connection is established you can begin a conversation. This exchange of conversation usually consists of something being said and a response from the

receiving party to indicate that they heard what was said. If their attention was diverted while you were speaking and they didn't hear everything you said you might have to repeat what you had just said. In a TCP/IP based application, TCP works the same way. If it doesn't receive an acknowledgment within a certain amount of time it will retransmit the message.



The "speak and acknowledgement received" aspect is an important part of the process. It tells you if the other person received the information that you just told him. Once the conversation has ended you would start the process of saying goodbye and then terminate the call by hanging up the phone.

As you can see, a connection-oriented process provides some form of reliability. The reliability doesn't mean that each time you attempt to make a connection that your friend will be there or that you'll have a good phone line. What the reliability does provide is a series of acknowledgments to let you know that 1) a connection could be established and 2) the information was transferred successfully. Though they provide a certain level of reliability, connection-oriented processes have a lot of overhead or "chattiness" associated with them. Here lies one area that can be optimized.

In contrast to the connection-oriented process, the application in a connectionless process (UDP/IP) does not establish a connection with the receiving application. A connectionless process makes the assumption that either the medium being used (wireline or wireless) will get the message there or the application will determine that the message was received. UDP has been nicknamed the "Unreliable Data Protocol" since there aren't any acknowledgments given by the system to inform the sending application that the message was received.



Who determines if an application will use a TCP/IP or UDP/IP protocol? The application developer does, and their decision is typically based on the type of network that the application will be used on. Up until now, networks as we know them have predominately been wireline-based, operating at 10Mbps or faster. Since capacity on most wireline networks isn't an issue, application developers haven't worried about the additional overhead or "chattiness" required for TCP/IP services. Most of the major, and most popular, business applications in use today have been developed for wired networks and so use TCP/IP.

Understanding the difference between TCP and UDP applications is essential when considering the deployment of a wireless data network. The wired and wireless computing worlds operate under completely different paradigms. The wired world assumes a constant connection with high bandwidth and increasingly faster speeds. A wireless environment functions via intermittent connections over a narrow bandwidth, operating at much slower speeds. These fundamental differences introduce a number of difficulties when organizations attempt to extend traditional "wired" applications over wireless networks.

## Packet Payloads

As described earlier, to establish a connection or "socket" TCP requires a three-packet-overhead "handshake." It also requires another three packets to disconnect. When you are talking about a browser-based application where every HTTP request (which is required for each graphic or file included in a page) opens and closes a socket, the overhead is excessive. This is particularly true in a wireless environment where in some cases you are paying according to the amount of data sent.

TCP also uses a "windowing" protocol that regularly sends acknowledgement packets to let the sender know the progress of the communication. With a wide pipe, numerous acknowledgements are not a problem. However, in a wireless environment, the difficulty comes in the number of acknowledgements that TCP sends. Typically, TCP sends one acknowledgement packet for every one to two packets of data that are sent. Once again, this is extremely high overhead for a wireless network.

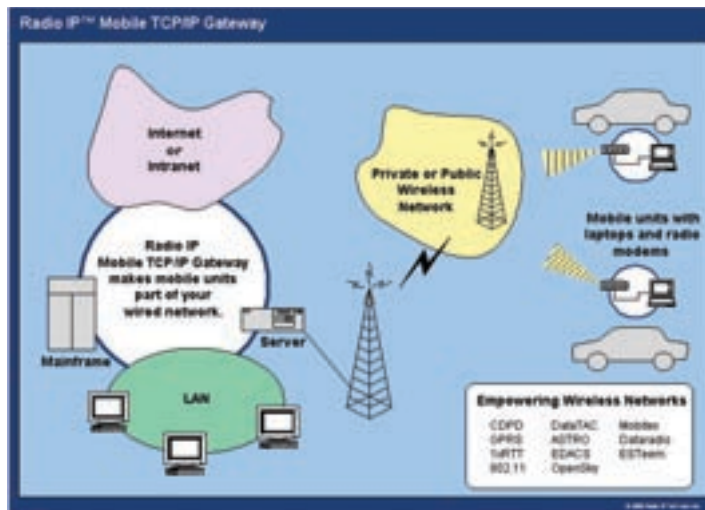
Also, because TCP/IP assumes it is communicating between two devices over a wired network the TCP protocol expects to receive these acknowledgements very rapidly. There are timers within the TCP protocol that cause additional retransmissions or a connection to have to be reestablished if these acknowledgement packets aren't received in a set time because it is assumed that the connection has been disrupted. In a wireless environment, where throughput speeds are much lower and users frequently move in and out of coverage or operate in "fringe" coverage conditions, the timers "expire," causing connections to drop and restart. To make matters worse, reestablishing that connection yields yet another three-packet handshake.

When operating under fringe wireless conditions, it is not uncommon for some packets of data not to make it through. With TCP, when this occurs it automatically resends all packets since the missing one taking up more bandwidth.

To top it off, TCP applications themselves can often be very "chatty," generating many communication transactions between devices. For example, these applications may require excessive handshakes (similar to the TCP protocol handshakes) to establish the communication. Also, many terminal emulation-based applications have a number of different screens and since it assumes a "dumb" terminal is being used it sends the data for the entire screen with each field. Finally, TCP applications frequently use "fat" data formats that could be too large to send over-the-air cost-effectively.

## TCP/IP Gateway Solutions

So you would think with all this "overhead" and "chattiness", why even bother using TCP applications? Some organizations have chosen to overcome these TCP overhead issues by substituting the TCP protocol with UDP (User Datagram Protocol). This choice would appear even more obvious when you consider that while UDP/IP's header payload is only 28 bytes (8 for UDP and 20 for IP) the TCP/IP handshake or header has a payload of 40 bytes (20 for TCP and 20 for IP). However, while UDP/IP's header size is smaller and does not require handshakes or an always-on connection, it also does not provide acknowledgements, making it truly a "send and pray" protocol. This simply isn't acceptable in most wireless applications because mobile users need to be sure their message got through and don't need the hassle of manually resending messages.





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While the TCP/IP protocol clearly isn't designed for wireless communications, at the same time, it has become a "de facto" industry networking and communication standard with the advent of Internet and intranet computing. So the question becomes, if you want to leverage your TCP/IP applications for use in the field, how do you make it work reliably and efficiently?

Over the past couple of years, several vendors have realized that there are a lot of customers that have existing TCP/IP based applications, but would like to use them in a wireless environment. With this in mind, Radio IP Software Inc. has developed TCP/IP gateway software that improves the performance of TCP/IP-based applications in a wireless environment. Using TCP/IP gateway software is a very viable and cost efficient way to extend existing Windows and browser based HQ applications to field personnel. However, before investing in a TCP/IP wireless solution, make sure you're getting the best possible solution for your particular situation. Here are a few key questions you should ask your supplier or systems integrator when considering a TCP/IP gateway deployment.

### Will the software allow me to use my existing Windows based applications?

Rather than offering a truly optimized TCP/IP gateway solution some vendors offer what is called UDP/IP middleware. Be careful. It is just not viable to run today's web-enabled, off-the-shelf software like MS Explorer and Outlook in the field using a UDP/IP transport protocol. When UDP/IP middleware is implemented, applications must be modified to do their own error checking and data recovery. Often, a costly Application

Program Interface (API) is required for each off-the-shelf software product. With a TCP/IP gateway solution, users have the flexibility to run many TCP/IP applications straight out-of-the box.

### Is the wireless IP solution truly optimized to maximize the application performance?

While UDP middleware does offer data compression, the data is compressed on a packet-by-packet basis but the total number of packets transmitted is not reduced. Packet-by-packet based compression typically compresses data at about 50%, while TCP/IP gateway software compresses data on a socket basis. Data is compressed going into the socket, sending fewer packets and using each more efficiently. Compression rates may vary from vendor to vendor so make sure you check the specs. Some TCP/IP gateway software solutions are able to reduce packet header size to as small as 7 bytes, so it's worth checking into to make sure you're getting the best bang for your compression buck.

### Can the wireless IP solution roam to dissimilar networks using TCP/IP?

It is rare for one radio network to provide complete coverage of your service area. What you are looking for is a vendor who can offer a TCP/IP gateway solution that automatically and transparently switches to the best network available, based on availability, priority, time of day and cost, to deliver TCP/IP data seamlessly across a number of discrete wireless systems.

### Does the wireless IP solution offer data/network security?

The Data Encryption Standard (DES) was developed by an IBM team in the mid seventies and adopted as a national standard a few years later. At the time DES was a major breakthrough in data network security, however, it proved not to be foolproof. The answer was triple DES. Early DES was based on a key length of 56 bits, triple DES simply extends the key length to 128 or 168 to achieve a much higher degree of reliability. The extended key length proved to be very secure and today triple DES has become the de facto standard for data encryption. You should check to see if the TCP/IP gateway solution uses an encryption standard which meets or exceeds federal and state requirements.

### Mobile Data Computing – Today and Tomorrow

Mobile Data is here to stay and there is no question that its potential is great. But without the proper implementation plan or reasonable expectations the results can be disappointing at best and disastrous at worst.

In one form or another the enabling technologies to deliver real-time data to field personnel are available today, but these technologies are still evolving as are the mobile networks themselves. The best approach is to ask questions. Your wireless provider can be very helpful when it comes to suggesting a development plan. But don't rely on their advice alone. Look at what other utilities are doing, talk to your peers; conferences and trade magazines like this one can also be a good source of information.

Building a profitable and efficient mobile data network will require careful planning, coordination, and the integration of business processes and technologies. The key is to get educated, work within your resources and start small to meet short-term objectives, while ensuring that you've planned a longer-term migration path. ■

### About the Author

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Recent announcements concerning the transition away from CCA-treated wood in *residential* applications do not affect the status of CCA *poles*.

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Arch Wood Protection, the leading producer of CCA for poles, promises to continue serving the utility market.

\*See Technical Bulletins from the  
North American Wood Pole Coalition  
at [www.preservedwood.com/pole.html](http://www.preservedwood.com/pole.html).



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\*Associate membership in NRECA does not signify an endorsement of products or services.

Wolmanized® ET® pole

Circle 58 on Reader Service Card

By:  
Kevin Hutchison  
Account Director  
Bozell & Jacobs

# "Stay Clear" – Save a Life

Ladders are some of the most often-borrowed equipment in the garage. Given this reality, how could an energy company effectively transform an innocuous ladder into a message to benefit the consumer while tying a safety message to this vital piece of equipment?

Ladder tags. Think for a moment — how many times has that one annoying neighbor come over and asked to borrow a ladder? Everyone has one, the one that does not shovel his driveway or sidewalk — waits to clean the gutters until spring? The one who mows his lawn when normal people are still drinking that first cup of coffee, and constantly borrows the ladder because it is so multipurpose? It is used to hang clothes at a garage sale. When he trims trees on a ladder, there is a birds-eye-view of our windows. Is he playing *I Spy*?

If he were in MidAmerican Energy Company's region, the next time he asks to borrow the ladder (or helps himself) he will also get a safety message. Attached to the ladder will be ten simple words that can save a life — "STAY CLEAR of overhead power lines when using a ladder". This safety message is prominently printed on one side of the ladder tag. On the flip side the weatherproof tag, similar to a luggage tag, are spaces for the owner's name, address and phone number (a nice reminder to neighbor Jim to get the ladder out of his garage and back to its rightful owner).

The key message and true benefit hit the mark. That the neighbor will read the tag is a positive thing considering how many injuries occur every year from ladders contacting electrical lines. While not traditional safety messaging, the tag is effective.

After waiting months to buy that new power tool, it is finally in hand. Once home, the box is opened, the tool is unveiled and the paperwork is tossed aside. The power tool is plugged in and the work begins immediately. Wait, what about that paperwork with the electrical safety information? That little folded piece of paper should be read first, right?

## Of course it should. But it usually is not.

Why would we, people involved in the energy industry, choose to ignore reading the information in those warnings when we inherently know the potential hazards? We do it for the same reasons that many consumers choose to ignore the warnings. They are just black words on white paper that have been seen a hundred times before. That would be acceptable if safety messages actually were all the same. They are not. Whether on a tool or a hair dryer, electrical warnings can look similar and send the signal of "blah, blah, blah".

As marketers, how do we ensure consumers read and understand the proper message? The tough test is to also meet regulatory requirements by delivering safety messages by effective and measurable means. MidAmerican Energy's ladder tag safety initiative holds the key. The ladder tag program built upon a solid foundation of traditional broad-based media such as TV and radio, and expanded upon it with a unique grassroots approach to safety.

In the TV spot developed for MidAmerican, family members stage an "intervention" for a man who continually endangered himself by accidental contact with electrical safety hazards such as sticking a fork into a toaster and using power tools with frayed cords. This informative and entertaining spot fit the brand's personality. By exposing a large audience to the safety message, it also fulfilled regulatory requirements.

The grassroots approach was designed strategically to take safety messages to the consumer at the point of interaction with a potential safety issue, in this case, ladders and power lines.

MidAmerican partnered with Lowe's, a key home improvement center in the utility's prime market to distribute the tags. Ladders in the store carried the eye-catching tags. Point-of-sale signage drove home the message. Tags were also distributed at a local safety fair and were backed by public relations efforts.

## The successful campaign had the following characteristics:

- **Simple Message.** "STAY CLEAR." was placed on large, colorful tags and signs in the participating store. The tags were unlike bedding safety tags laden with the plethora of information commonplace in product literature.
- **Beneficial and Informational.** Buyers of new ladders received a free tag to keep their name prominently displayed wherever their ladder landed. At the safety fair, tags were made available for any ladder owner who desired one. The ladder tags included a Web address and a phone tip line for additional self-help information.
- **Continual Message.** Ladders, like many products, have peak purchase seasons — late fall and early spring — but are purchased all year long. The message became a year-round platform for in-store effectiveness.
- **P.R. Friendly.** Public relations and media teams are always interested in communicating public safety. Creative safety information projects make good soft news for media teams to promote public safety. The company







provided media information that served a dual purpose. Should safety violations become a news story the media will already have on their desk information on prevention and safety standards. The Des Moines, Iowa press covered a local safety message and credited MidAmerican as a company dedicated to its customers. MidAmerican simultaneously delivered its key message and received a wealth of goodwill.

- **Cost-Effective.** "STAY CLEAR" was cost-effective, quantifiable, and led to new partnerships. The materials were simple, durable, and inexpensive. MidAmerican recorded the number of tags distributed through each channel, so the number of consumers exposed to the message through stores and event traffic could be counted.

- **Relationship Building.** The relationship built with the home improvement center has become a meaningful partnership for future safety communication efforts.

Safety messaging has expanded into several other stores throughout MidAmerican Energy's territory.

The MidAmerican Energy ladder safety campaign worked. It worked at the corporate level because it backed their brand message of being "Obsessively, Relentlessly at Your Service®." It worked at a local level because consumers saw a proactive, caring message. Most of all, it worked because consumers saw it. It was hard to ignore. The message was in their face both at the point-of-sale and every time the ladder was used. That is definitely more than can be said for safety messages printed in black and white, and either tucked away in the depths of a new power tool box or deposited in the circular file.

Next time Jim wants to borrow a ladder, tell him to get his own. Give him a ladder tag with your company's safety message printed on it for his new ladder — in case another neighbor wants to borrow it. ■

## About the Author

*Kevin Hutchison is an Account Director at Bozell & Jacobs, an Omaha-based marketing communications firm. Kevin may be reached at (402) 965-4318 or khutchison@bozelljacobs.com.*

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Circle 80 on Reader Service Card

# It's not just getting older

*— it's getting better!*



It is said that with age comes wisdom. Such is the case with Doble Engineering Company's annual Client Conference, which celebrated its 70th consecutive year in April. The Doble Client Conference has developed over the years, from a small gathering of twenty engineers discussing power factor testing, to what it is today – hundreds of electric industry professionals from utilities, testing companies, manufacturing plants and related businesses worldwide, reviewing recent practice for the much broader aspects of maintenance engineering activities.

350 companies from 25 countries sent representatives to Doble's 2003 event. They came to take advantage of the unique aspect of the Doble Conference – the fact that it continues to be designed by and for the needs of those that purchase, test, and maintain electric apparatus and protection. The agenda included over 80 technical presentations, 11 tutorials, 12 committee meetings, 2 user group meetings, and a trade show, not to mention a few social events! Attendees came for the opportunity to exchange information and knowledge, to share their experi-

ences with others and learn from their colleagues the latest maintenance findings and practices. Together, these delegates are charting the course for continued research and development in the electric power industry. As talented engineers change positions or retire, new individuals take their place, and the collective knowledge needs to be passed on. The attendees at Doble's Client Conference place a very high value on the experience, and put their new information to practical use when they return to their jobs.

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Circle 125 on Reader Service Card



A person wearing a black cap is shown in profile, looking out of an airplane window. The view outside the window is a city at night, with numerous lights from buildings and streets. The interior of the airplane is dimly lit, with a warm glow from the window. The overall mood is one of looking forward to the future.

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The 2003 Doble Client Conference was kicked off with a keynote address by Bruce Blakeman, U.S. Department of Commerce, on the state of the current electrical power industry. Major themes at this year's Conference included Asset and Maintenance Management, Substation Engineering, Power Plant Design and Distribution Engineering.

The Asset and Maintenance Management session was introduced to the Doble Conference in 2002. This addition was prompted by Doble's recommendation that this new trend would be of benefit to the client group and needed to be addressed. The practice of asset management is advancing quickly in some countries and is beginning to develop in the U.S. As proof of this, some Doble Conference attendees who were formally Transformer Maintenance Engineers are now attending the Conference in the role of Asset Managers.

A special session covering the management of asset performance in the current utility business was given by industry leaders on the first day of the 2003 Doble Conference. Presenters included Barry Worthington, U.S. Energy Association, Stephen Lewis, National Grid USA, David Mohre, National Rural Electric Cooperative Association, and James Connelly of the Massachusetts Dept. of Telecommunications and Energy. The session focused on whether a clear vision could be found that would ensure an effective open market - one that would lower costs to the nations' industries, creating an effective level of system integrity and maintaining investors in the utility sector. The implications for those responsible for managing and maintaining the asset base of all utilities was also covered. The discussion continued with a variety of presentations on asset management experiences from around the world.

The Conference program continued throughout the week with the main sessions, consisting of technical presentations organized by the different Doble Client Committees.

**In the Asset and Maintenance Management session, there were three major themes.**

In the first, presenters from New Zealand, UK and Canada described their experiences introduc-



ing an integrated approach to the management of electric apparatus. They described the significant gains and the accompanying pain from the associated cultural changes within their companies. The second theme covered the techniques used to cost justify either asset replacement/ investment, with a particularly useful presentation from the Czech Republic. The third theme looked at methods to assess the effectiveness of maintenance strategies, and included discussion of key performance indicators, benchmarking and using operational performance statistics to focus operating expenditure. The Asset and Maintenance Management Committee sponsored two different tutorials at the Conference. In the first, Carl Manger and Joseph Reynolds of FTI presented "The Engineer in Court", which provided advice for engineers involved in giving expert witness testimony. In the second of the committee's tutorials "Managing Safety in the USA", Jim White of Shermco gave a very comprehensive description of the requirements for complying with OSHA safety legislation.

**The Transformer session** continued to hold its position of popularity, and included presentations on condition assessment of transformers, general maintenance activities and advanced testing methods. The maintenance engineers and test technicians attending this session gained information concerning on-line conditioning, preservation systems, phase shifter testing and welding of oil filled tanks. The advanced transformer testing included discussions about sweep frequency analysis and leakage reactance.

**The Bushings, Insulators and Instrument Transformers session** was also very well attended. It included presentations on oil leak problems, bushing failures that occurred in the field, and investigations of bushing failures. A report was provided on the development of methods for predicting current transformer failures. In addition, revisions of the IEEE Standard C57.19.01 (Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings) were discussed in detail, and the effects it would have on the power industry. There was a lengthy discussion of C2 power factor and capacitance measurements on low



voltage bushings. The latest advancements in bushing technology were shared, such as the development of polymer sight bowls for bushings and the use of polymer for condenser bushings in lieu of porcelain weathersheds.

**The Doble Insulating Materials session** included an eclectic but extremely interesting range of topics. The first paper focused on an alternative method for accelerated oxidation of synthetic and vegetable-based insulating oils. Presentations on diagnostics for load tap changers and oil circuit breakers using laboratory analysis provided information on some of the most current and provocative research being conducted in these areas. Since the Insulating Materials committee has expanded to include solid dielectrics as well as liquid dielectrics, there was a timely presentation on the factors that affect the dielectric strength of solid insulation such as Kraft paper, providing an in-depth look at aging, water and contamination as factors. A new concept in SF6 contamination detection by the use of ion mobility spectrometry was provided. A presentation on a new acetylene sensor for transformer oil that is presently being field tested not only provided relevant information on the sensor itself, but the formation of gases from an incipient-fault condition. With Shell Global Solutions, Inc. U.S. refineries leaving the marketplace as a supplier of transformer oil, a representative for Shell products presented information on the situation as part of the Insulating Materials session. Following the session, a tutorial was given by Doble on "Insulating Mineral Oils." It covered many aspects of oil manufacture, specifications for electrical insulating mineral oils, typical properties of oils, transportation, testing of new oils and oils received in new equipment, in-service criteria for oil quality and case studies about in-service transformers.

For those Doble clients with an even greater interest in Oils, Doble also has a private **Oil Committee** that they can join. At this year's Conference, the Oil Committee met and continued the Insulating Material session's discussion on the topic of Shell Global Solutions, Inc. U.S. leaving the marketplace. Transformer oil purchasers are looking for alternative sources for





good quality product for the last quarter of this year when supply may be short of demand. The Oil Committee sponsors the annual Doble Oil Survey, which provides the results of specification tests for many electrical insulating oils produced and sold worldwide. The tests included in this report include all those outlined in the Doble Transformer Oil Purchase Specification and the ASTM D 3487 specification for new transformer oil. In light of the challenge facing transformer oil purchasers this year, the Doble Oil Survey findings should be a very valuable tool. The Oil Committee has also just developed a research report on the gassing characteristics on new oils under moderate thermal and oxidation conditions that revealed significant differences in the behavior of commercial products.

**In the Circuit Breaker session**, utility representatives exchanged valuable information on several subjects. In the area of safety, fall protection for employees working on high voltage large oil circuit breakers was discussed, with several important solutions presented. From an environmental point of view, the handling of SF<sub>6</sub> gas cylinders, and of SF<sub>6</sub> gas in general was debated. One client explained a serious safety problem developing after the repair/refurbishment of some older circuit breakers and how it was resolved. There were six presentations relating to problems with several types of new circuit breakers, along with manufacturer's service advisories and proposed solutions. Eleven other situations were presented regarding older breakers, breaker bushings, reclosers, and general switchgear. Training is an important aspect of this committee's work – they sponsored two highly successful tutorials on Circuit Breakers, presented by an expert in the field, David Peelo. These tutorials explained the arc extinction processes in circuit breakers and gave the attendees a greater appreciation of the maintenance requirements for circuit breakers.

**In the Rotating Machinery session**, a great deal of interest and discussion was generated around the topic of Life Cycle Management. Two presentations were offered in this area. The first discussed the upgrade of four hydroelectric motor-generators where the greatest change

occurred in the cooling system. The stator cores are cooled by raw water heat exchanging stainless steel tubes recessed into the back of the stator core. The second discussed how an in-service failure resulted in not only a repair, but also an upgrade in capacity by 2 to 4 MVA (depending on cooling water conditions). The upgrade permitted a 25 degrees C increase in safe operating temperature and the use of Roebel bars helped reduce winding losses by 5 kW.

Discussion of problems with distribution class equipment was sponsored by **the Arresters, Capacitors, Cables and Accessories Committee**. Two papers reviewed the performance of transformers at 69kV and below with transmission class units. Failure, electrical and oil test data are surprisingly similar. The Doble Knowledgebase was used to examine failure modes and test data, and illustrated with a detailed study of National Grid USA transformer performance. Failure performance was also covered in a paper from Salt River Project as the topic moved to cables. Detection of defects in cable systems using on and off line partial discharge methods was presented in papers from IMCORP and Pirelli.

One of the most highly valued activities at the Doble Conference continues to be the private **Client Committee meetings**. Unlike the Conference sessions, which also run throughout the week and are open to manufacturers and insurers, the Client Committee Meetings are for utilities and testing companies only, which allows to discuss their needs and issues openly. At the April Committee meetings, a number of new projects were discussed. The Transformers Committee reported on the progress of a Large Transformer Specification Guide they are developing. They are also planning a tutorial on transformer cooling, pumps and piping. This year's Doble technical questionnaires will include the topics of transformer overloading and testing requirements after a through fault. In the Bushings Committee Meeting, the need was expressed for the development of a Bushing Field Troubleshooting Guide. The guide would include all common testing issues, and would provide testers and end users with a reference guide to determine the condition of their bushings. It will provide guidelines for actions to be taken based on test results, and include proper test procedures and connections and explain what to do if data is suspect.

Once developed, these new guides will become part of Doble's Knowledgebase, and be accessible by the client community.

The 2003 Doble Conference also included an **Industry Expo** with exhibits from over 60 companies. With so many utility representatives



attending the Doble Conference, the event is an excellent opportunity for manufacturers and other companies who wish to show their most recent products. Doble's utility client attendees find the tradeshow is of great benefit to them as well, as it enables them to meet with vendors throughout the week at their convenience. This was the third year that Doble has offered the Industry Expo, and it continues to be a positive addition, and does not diminish the Conference's technical nature.

Planning for the 2004 International Conference of Doble Clients has already begun. Next year's Conference will be taking place March 21-26 at the Westin Copley Place hotel in Boston, MA USA. Doble has already sent out the first Call for Papers announcement for the 2004 Conference, and will be considering submissions from presenters outside of the Doble client group. For more information on submitting an abstract for consideration, go to [www.doble.com](http://www.doble.com).

The annual "Fall Meetings" of the Doble Client Committees will be taking place at the Westin Resort in Hilton Head Island, SC, on September 21-26, 2003. This event is open to all Doble clients involved in the electric industry except manufacturers and insurers, and is a more informal networking experience than the April Conference. At the Fall Meetings, there is more time and space for the attendees to share experiences in a way that would not be possible in an open meeting where OEMs, insurers and the like are present. This gathering has been and continues to be one of the key value-added factors for Doble's client group.

Doble's ProTest User Group will also hold its annual meeting during the same week in Hilton Head; this co-location was tested in 2002 and was well received by all parties. In addition, Doble will be offering a Laboratory Diagnostics Seminar at the same site on September 26th. For more information about Doble's events, visit the company web site at [www.doble.com](http://www.doble.com). ■

## Note:

The September issue of *Electric Energy* will include an editorial based on one of the 2003 Doble Conference presentations.

## By:

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

# Proud to be the voice of metering & revenue-protection managers

*Our Utility News has spotlighted 200 metering-point managers over the years*



1



2



3

At E.J. Brooks Company, our customer-focused philosophy is at the very core of our company's mission. It manifests in product design, manufacturing practices, communications, support, and in every other facet of our business.

*Utility News* exemplifies Brooks' dedication to meeting customers' needs. Along with sister companies Meter Devices Company and Ekstrom Industries, Brooks has for 17 years supported customers with this trade paper. A significant voice for metering and revenue protection managers, *Utility News* is a forum for scores of metering and RP issues. As deregulation swept the industry, the biannual publication kept readers updated with metering-related information.

*Utility News* promotes trade shows, meter schools and IURPA, EUSERC, and EEI Distribution Conferences. UN spotlights special features and in-depth interviews with principals at leading IOUs, RECs and Muni's.

You need not work for an industry giant to merit a feature in *Utility News*, e.g., a full-page feature of RP efforts at Horry Electric Co-op painted a picture of theft-deterrence efforts in rural South Carolina.

## Listening to customers



4

*Utility News* reports on new products and services to allay metering and RP concerns. We listen to those needs. "We make it our business to pay special attention to utility managers' needs," says Brooks President John K. Roessner III. "By listening to our customers, we have created scores of products worthy of patent protection—products that evolve as our customers' needs do."

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

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

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

## Industry forecasts

Year after year, *Utility News* has been there, as metering pros face and forecast sweeping industry changes. In 1992, six metering executives shared ideas at an Ekstrom forum. Revisiting their wish list of products and services they hoped to see in the decade, now-familiar items appeared:

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

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

## Keeping pace online

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

## Photo Captions:

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

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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.



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



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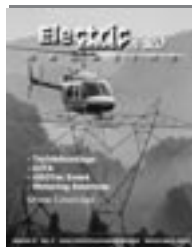
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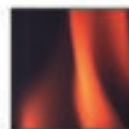
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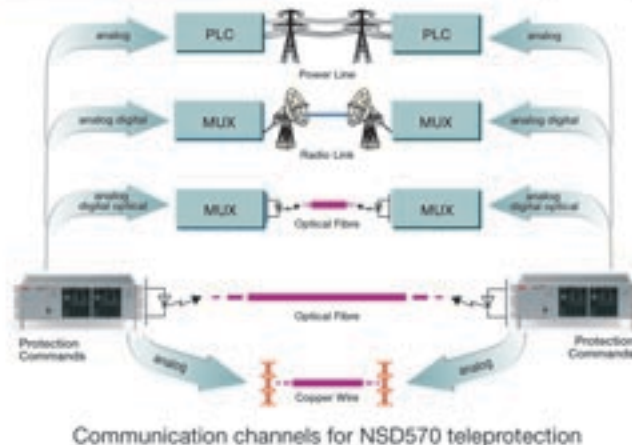


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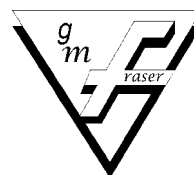
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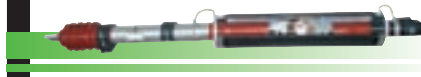
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**DTE ENERGY TECHNOLOGIES**

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**1952 Consultants - Power Quality**

**INVENSYS POWERWARE**

Tel.: (919) 872-3020 / Web: www.powerware.com

**1967 Consultants - Substation Design & Engineering**

**DIS-TRAN PACKAGED SUBSTATIONS, LLC**

Tel.: (318) 448-0274 / Web: www.distran.com

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**1972 Consultants - T&D Engineering**

**\* KEMA INC.**

Tel.: (781) 273-5700 / Web: www.kemainc.com

Kristen Kruger

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**1977 Consultants - Underground and Underwater Cable**

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**\* DAVEY TREE EXPERT COMPANY (THE)**

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**\* KEMA INC.**

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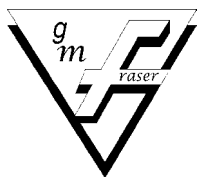
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**2302 Cranes - Manufacturers/Distributors**

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Tim Hughes / See ad on page: 33

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**HUGHES BROTHERS INC.**

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**2339 Crossarms, Wood - Solid**

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SUBSTATIONS, LLC**

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**DATAMATIC**

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See ad on page: 9

**DATTEL INC.**

Tel.: (508) 339-3000 / Web: www.datel.com

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**ITRON**

Tel.: 1-800-635-5461 / Web: www.itron.com

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**Landis+Gyr Inc.**

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Hassan Ali, Gen. Mgr. Digital Business

**SCHLUMBERGER ELECTRICITY INC.**

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**2474 Data Conversion****DATTEL INC.**

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**2477 Data Set - Fiber Optics****TC COMMUNICATIONS**

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**2537 Detectors - Cable Fault Locating****MEGGER**

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See ad on page: 17

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See ad on pages: 6 - 12

**2542 Detectors - Fault****IFD CORPORATION**

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www.radiodetection.com

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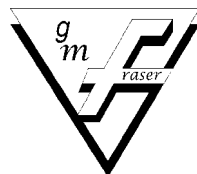
Tel.: 1-800-613-0507 / Web: www.flir.com

See ad on page: 125

**2557 Detectors - Leak****CCI CONTROLS**

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Mark Filing, Sales Manager

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**WH SALISBURY**

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**2587 Diagnostic Equipment****DTE ENERGY TECHNOLOGIES**

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**2602 Diggers - Derricks****TEREX TELELECT**

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Paul Tannenbaum

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See ad on page: 117

## 2817 Electrical Apparatus - Maintenance

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See ad on page: 117

## 2845 Electrical Services

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### K & H INDUSTRIES INC.

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## Thomas&Betts

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### HD ELECTRIC COMPANY

Tel.: (847) 473-4980 / Web: www.hdelectriccompany.com

Kimberly Huggins, Marketing Mgr.

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## 2952 Enclosures - Cabinets

### A G BODY INC.

Tel.: (801) 355-8053 / Web: www.agbody.com

See ad on page: 156

## 2957 Enclosures - Cabinets, EMI Shielded

### MuSHIELD CO. INC. (THE)

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David Grilli

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## 2972 Enclosures - Metering Equipment



## Meter Devices Company, Inc.

### METER DEVICES COMPANY INC.

Tel.: (330) 455-0301 / Web: www.meter-devices.com

### THOMAS & BETTS LIMITED

Tel.: (450) 347-5318 / Web: www.tnb-canada.com

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Bob Dasso, Sls. Mgr

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Tel.: (603) 666-4433 / Web: [www.mushield.com](http://www.mushield.com)

David Grilli

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## 3002 Energy Management Systems

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Rita Simonetta, Sr. Mgr., Communications

See ad on page: 35

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See ad on page: 113

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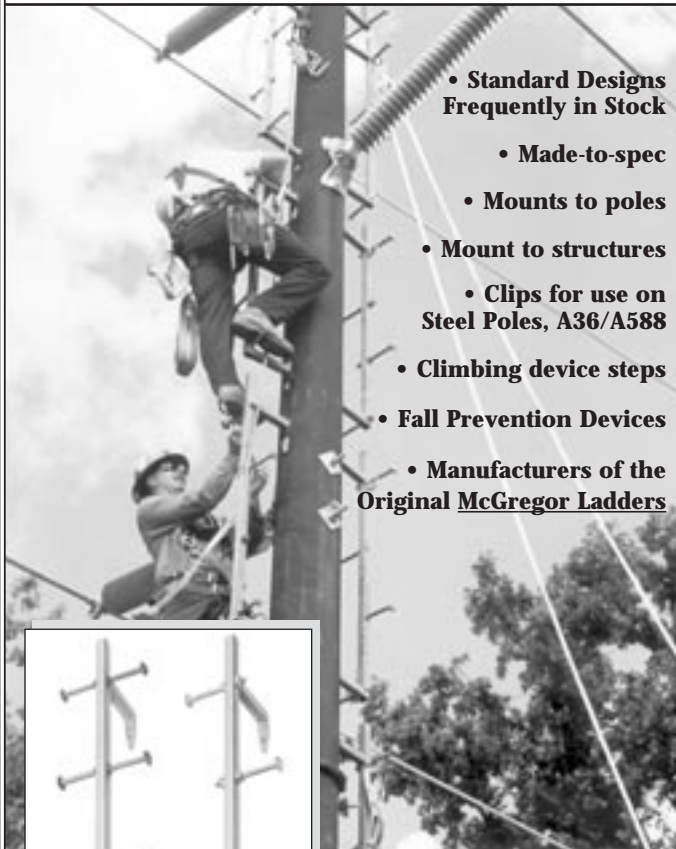
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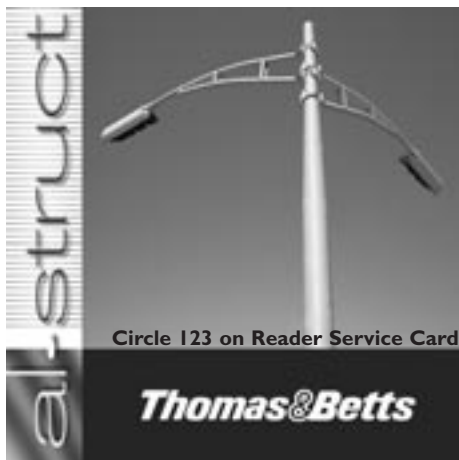
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**STORAGE BATTERY SYSTEMS INC.**

Tel.: (262) 703-5800 / Web: www.sbsbattery.com

**4871 Maintenance - Preventive  
Maintenance Equipment**
**FLIR SYSTEMS LTD.**

Tel.: 1-800-613-0507 / Web: www.flir.com  
See ad on page: 125


**INVENSYS POWERWARE**

Tel.: (919) 872-3020 / Web: www.powerware.com

**MEGGER**

Tel.: (214) 333-3201 / Web: www.megger.com  
See ad on page: 17

**TransiNor AS**

Tel.: +47-7382 53 50 / Web: www.transinor.no

**UNIQUE CONCEPT LTD**

Tel.: 1-800-455-9673 / Web: www.uclsafetysystems.com  
Colin Riley / See ad on page: 155

**4873 Maintenance -  
Services and Products**
**DTE ENERGY TECHNOLOGIES**

Tel.: (248) 427-2243 / Web: www.dtetech.com  
See ad on page: 133

**VISTA TRAINING INC.**

Tel.: (262) 767-2100 / Web: www.vista-start-smart.com

**4888 Maintenance - Systems**
**INVENSYS POWERWARE**

Tel.: (919) 872-3020 / Web: www.powerware.com

**4898 Manholes - Electric**
**HARTFORD CONCRETE  
PRODUCTS INC.**

Tel.: (765) 348-3506 / Web:  
www.hartfordconcrete.com  
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**UTILITY STRUCTURES INC. (USI)**

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**4910 Mapping Systems - Mobile**
**MAPFRAME CORPORATION**

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Melinda Brown

**4923 Markers - Fiber Optic**
**UTICOM SYSTEMS INC.**

Tel.: (610) 380-9430  
Melinda Brown

**4928 Markers - Poles**

**PREMAX, LP**

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**4938 Markers - Transmission Poles**

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**TEREX UTILITIES**

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See ad on page: 11

**4958 Measure Instruments**
**FLIR SYSTEMS LTD.**

Tel.: 1-800-613-0507 / Web: www.flir.com  
See ad on page: 125

**4963 Measurement Specialists -  
Electrical**
**DTE ENERGY TECHNOLOGIES**

Tel.: (248) 427-2243 / Web: www.dtetech.com  
See ad on page: 133

**4980 Media Converters**
**RUGGED COM INC.**

Tel.: (905) 760-7799 / Web: www.ruggedcom.com  
See ad on Divider #3 Recto

**4983 Metal - Copper, Brass**
**PECKOVER'S**
**A DIVISION OF VPK METAL INC.**

Tel.: (905) 669-9444 / Web: www.peckovers.com  
See ad on page: 126

**4988 Metal - Custom Fabrication**
**VIFAB A DIVISION OF VPK METAL INC.**

Tel.: (514) 338-1699

**WINOLA INDUSTRIAL INC.**

Tel.: (570) 378-3808 / Web: www.winolaindustrial.com  
Jim McGlynn / See ad on page: 127

**4993 Metal - Custom Made Parts**
**VIFAB A DIVISION OF VPK METAL INC.**

Tel.: (514) 338-1699

**WINOLA INDUSTRIAL INC.**

Tel.: (570) 378-3808 / Web: www.winolaindustrial.com  
Jim McGlynn / See ad on page: 127

**5003 Metal - Manufacturer**
**A G BODY INC.**

Tel.: (801) 355-8053 / Web: www.agbody.com  
See ad on page: 156

**5008 Metal - Products**
**A G BODY INC.**

Tel.: (801) 355-8053 / Web: www.agbody.com  
See ad on page: 156



**5008 Metal - Products (Continued)**

**NEHRWESS**

Tel.: (812) 358-4593 / Web: [www.nehrwess.com](http://www.nehrwess.com)

See ad on page: 110

**5030 Meter - Reading Services**

**HUNT TECHNOLOGIES INC.**

Tel.: (218) 562-4877 / Web: [www.turtletech.com](http://www.turtletech.com)

See ad on page: 1

**5036 Meter Reading Equipment - Automatic**

**DATAMATIC**

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See ad on page: 9

**ELSTER ELECTRICITY, LLC**

Tel.: (919) 212-4700 / Web: [www.elsterelectricity.com](http://www.elsterelectricity.com)



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Heather Cottrell, Mktg. Services Manager

**5041 Meter Socket - Accessories**

**THOMAS & BETTS LIMITED**

Tel.: (450) 347-5318 / Web: [www.tnb-canada.com](http://www.tnb-canada.com)

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**5042 Metering - Prepaid**

**AMPY**

Tel.: 44 1778 343 560 / Web: [www.ampy.co.uk](http://www.ampy.co.uk)

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**5043 Metering Accessories**

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Tel.: (218) 562-4877 / Web: [www.turtletech.com](http://www.turtletech.com)

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**INNER-TITE CORP.**

Tel.: (508) 829-6361 / Web: [www.inner-tite.com](http://www.inner-tite.com)

See ad on page: 142

**5045 Metering Data - Management**

**HUNT TECHNOLOGIES INC.**

Tel.: (218) 562-4877 / Web: [www.turtletech.com](http://www.turtletech.com)

**\* KEMA INC.**

Tel.: (781) 273-5700 / Web: [www.kemainc.com](http://www.kemainc.com)

Kristen Kruger

**5053 Metering Systems - Electronic**

**Landis+Gyr Inc.**

Tel.: (765) 742-1001 / Web: [www.landisgyr.us](http://www.landisgyr.us)

Hassan Ali, Gen. Mgr. Digital Business

**5058 Meters**

**DATTEL INC.**

Tel.: (508) 339-3000 / Web: [www.datel.com](http://www.datel.com)

See ad on page: 13

**Landis+Gyr Inc.**

Tel.: (765) 742-1001 / Web: [www.landisgyr.us](http://www.landisgyr.us)

Hassan Ali, Gen. Mgr. Digital Business



**MANTA TEST SYSTEMS INC.**

Tel.: (905) 828-6469 / Web: [www.mantatest.com](http://www.mantatest.com)

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Tel.: (905) 760-7799 / Web: [www.ruggedcom.com](http://www.ruggedcom.com)

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Web: [www.ekstrom-metering.com](http://www.ekstrom-metering.com)**SOUTHERN UTILITY SERVICES INC. (SUSI)**Tel.: (770) 448-6810 / Web: [www.SouthernUtility.com](http://www.SouthernUtility.com)

Chris Matthews

**5072 Meters - Amperes****SENSORLINK CORP.**Tel.: (360) 595-1000 / Web: [www.sensorlink.com](http://www.sensorlink.com)**5075 Meters - Amperes - Hour****DATEL INC.**Tel.: (508) 339-3000 / Web: [www.datel.com](http://www.datel.com)

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**5078 Meters - Batteries and Accessories****STORAGE BATTERY SYSTEMS INC.**Tel.: (262) 703-5800 / Web: [www.sbsbattery.com](http://www.sbsbattery.com)**5083 Meters - Cable Length****MEGGER**Tel.: (214) 333-3201 / Web: [www.megger.com](http://www.megger.com)

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**5103 Meters - Frequency, Digital****DATEL INC.**Tel.: (508) 339-3000 / Web: [www.datel.com](http://www.datel.com)

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**5108 Meters - Ground Resistance****MEGGER**Tel.: (214) 333-3201 / Web: [www.megger.com](http://www.megger.com)

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**5113 Meters - KilowattHour****METER SMART L.P.**Tel.: (215) 752-0745 / Web: [www.metersmart.com](http://www.metersmart.com)

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**5130 Meters - Micro-Ohmmeter****NDB TECHNOLOGIE INC.**Tel.: (418) 877-7701 / Web: [www.ndb.qc.ca](http://www.ndb.qc.ca)

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**5138 Meters - Phase****HASTINGS FIBERGLASS PRODUCTS INC.**Tel.: (269) 945-9541 / Web: [www.hfgp.com](http://www.hfgp.com)

David Baum / See ad on page: 140

**THE WHITE RUBBER CORPORATION - WHITE-SAFETY LINE**Tel.: (330) 296-6497 / Web: [www.whitesafetyline.com](http://www.whitesafetyline.com)

Mark Filing, Sales Manager

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**5143 Meters - Power Factor****MEGGER**Tel.: (214) 333-3201 / Web: [www.megger.com](http://www.megger.com)

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**SATEC**Tel.: (908) 608-0500 / Web: [www.oksatec.com](http://www.oksatec.com)

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**5148 Meters - Power Quality****MEGGER**Tel.: (214) 333-3201 / Web: [www.megger.com](http://www.megger.com)**SATEC**Tel.: (908) 608-0500 / Web: [www.oksatec.com](http://www.oksatec.com)

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**5158 Meters - Ratio****MEGGER**Tel.: (214) 333-3201 / Web: [www.megger.com](http://www.megger.com)**5173 Meters - Test Automation****DATEL INC.**Tel.: (508) 339-3000 / Web: [www.datel.com](http://www.datel.com)

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**TESTCOR INC.**Tel.: (905) 501-1888 / Web: [www.testcor.com](http://www.testcor.com)**5178 Meters - Test Sets - Test Equipment****HD ELECTRIC COMPANY**Tel.: (847) 473-4980 / Web: [www.hdelectriccompany.com](http://www.hdelectriccompany.com)

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**TESTCOR INC.**Tel.: (905) 501-1888 / Web: [www.testcor.com](http://www.testcor.com)**THE VON CORPORATION**Tel.: (205) 788-2437 / Web: [www.voncorp.com](http://www.voncorp.com)

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**5183 Meters - Time-of-Use****HUNT TECHNOLOGIES INC.**Tel.: (218) 562-4877 / Web: [www.turtletech.com](http://www.turtletech.com)

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**5193 Meters - VAR****SATEC**Tel.: (908) 608-0500 / Web: [www.oksatec.com](http://www.oksatec.com)

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**5203 Meters - Volt****DATEL INC.**Tel.: (508) 339-3000 / Web: [www.datel.com](http://www.datel.com)

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**HASTINGS FIBERGLASS PRODUCTS INC.**Tel.: (269) 945-9541 / Web: [www.hfgp.com](http://www.hfgp.com)

David Baum / See ad on page: 140

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**5233 Metrology****WYLE LABORATORIES INC.**Tel.: (310) 322-1763 / Web: [www.wylelabs.com](http://www.wylelabs.com)

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Tel.: (303) 728-1300 / Web: www.datria.com

### INFONETRIX

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### RADIO IP SOFTWARE INC.

Tel.: (514) 890-6070 / Web: www.radio-ip.com

Mike Bourre, V.P. Sales & Marketing

### \* TVD INC.

Tel.: +64 9 376-6016 / Web: www.tvd.co.nz

Andrew Thompson, CEO / See ad on page: 34

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### DATEL INC.

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### RUGGED COM INC.

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## 5268 Monitoring - Generators

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Tel.: (508) 339-3000 / Web: www.datel.com

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## 5315 Monitors - Temperature

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Tel.: (418) 688-8065 / Web: www.fiso.com

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## 5323 Motor Control Centers - Low and Medium Voltage

### SIEMENS POWER TRANSMISSION & DISTRIBUTION, INC.

Tel.: (919) 325-7044 / Web: www.ptd.siemens.com

Rita Simonetta, Sr. Mgr., Communications

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## 5353 Motors Generators Large - Repair, Refurbishing, Upgrading, Rewinding

### WYLE LABORATORIES INC.

Tel.: (310) 322-1763 / Web: www.wylelabs.com

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## 5364 Multiplexers - Data Communications

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Tel.: (617) 393-2908 / Web: www.doble.com

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See ad on page: 133

### FLIR SYSTEMS LTD.

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See ad on page: 125

## 5504 Operation and Maintenance Services

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### ABB INC. NETWORK MANAGEMENT

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John Wannamaker, Tech. Mgr.

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## 5579 PCB Disposal

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See ad on pages: 27 - 29

**5689 Plastic**

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A DIVISION OF VPK METAL INC.**  
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See ad on page: 126

**5694 Plastic - Custom Built Parts**

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A DIVISION OF VPK METAL INC.**  
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PRODUCTS INC.**  
Tel.: (269) 945-9541 / Web: www.hfgp.com  
David Baum / See ad on page: 140

**5719 Platforms - Transformers**

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Tel.: (402) 643-2991 / Web: www.hughesbros.com  
Tim Hughes / See ad on page: 33

**5723 Pole - Wood/Perservatives**

**ARCH WOOD PROTECTION, INC.**  
Tel.: (770) 801-6600 / Web: www.wolmanizedwood.co  
See ad on page: 31

**5729 Pole Line Hardware**

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Tel.: (403) 253-1952 / Web: www.eecol.com  
See ad on page: 117

**HUGHES BROTHERS INC.**  
Tel.: (402) 643-2991 / Web: www.hughesbros.com  
Tim Hughes / See ad on page: 33

**NEHRWESS**  
Tel.: (812) 358-4593 / Web: www.nehrwess.com  
See ad on page: 110

**WINOLA INDUSTRIAL INC.**  
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Jim McGlynn  
See ad on page: 127

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COMPANY (THE)**  
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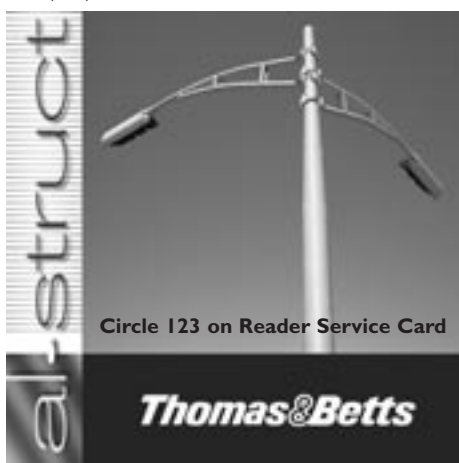
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**5774 Poles - Lighting - Aluminum**

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**5794 Poles - Lighting - Steel**

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**5904 Power Plant Equipment - Used****INDECK POWER EQUIPMENT COMPANY**

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Web: [www.wagnersmithequipment.com](http://www.wagnersmithequipment.com)

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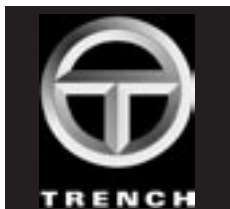
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**6274 Reactors - Shunt****TRENCH LIMITED**

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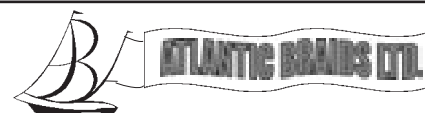
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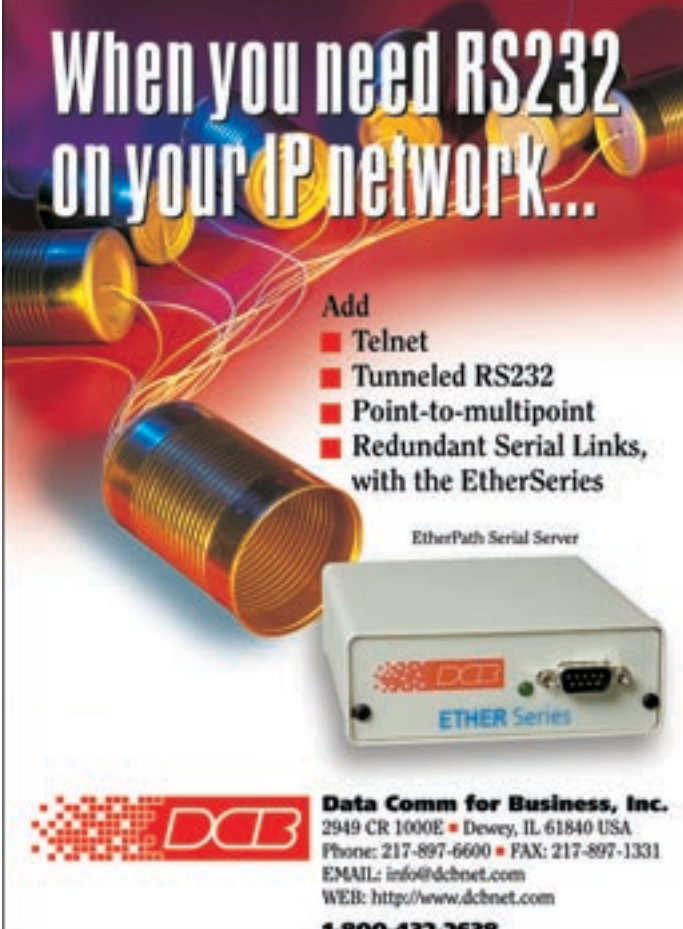
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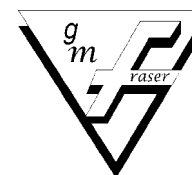
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#### 7579 Switches - Submersible

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**7649 Switchgears - Vacuum (Continued)****SIEMENS POWER TRANSMISSION & DISTRIBUTION, INC.**

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 See ad on page: 104

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 See ad on page: 17

**7674 Tag Outs****UTICOM SYSTEMS INC.**

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 Steve McNeil, VP Mktg. / See ad on page: 99

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 See ad on page: 104

**7719 Tap Changers - Transformers - Load, No-Load****BECKWITH ELECTRIC COMPANY**

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 See ad on page: 104

**7744 Telecommunications****DATA COMM FOR BUSINESS INC.**

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**7754 Telecommunications - DC Power****DATel INC.**

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 See ad on page: 108

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**7774 Terminal Blocks****MEGGER**

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**7794 Terminators - Cable****JOSLYN MANUFACTURING CO.**

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**7799 Test - Measuring Equipment****DATel INC.**

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**HD ELECTRIC COMPANY**

Tel.: (847) 473-4980 / Web: [www.hdelectriccompany.com](http://www.hdelectriccompany.com)  
 Kimberly Huggins, Marketing Mgr.

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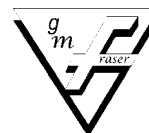
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#### RTDS TECHNOLOGIES, INC.

Tel.: (204) 989-9700 / Web: www.rtds.com

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#### TransiNor AS

Tel.: +47-7382 53 50 / Web: www.transinor.no

### 7806 Test Equipment - Aerial Lift

#### PHENIX TECHNOLOGIES INC.

Tel.: (301) 746-8118 / Web: www.phenixtech.com

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### 7809 Test Equipment - Batteries

#### MEGGER

Tel.: (214) 333-3201 / Web: www.megger.com

#### MIDTRONICS INC.

Tel.: (630) 323-2800 / Web: www.midtronics.com

#### STORAGE BATTERY SYSTEMS INC.

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### 7814 Test Equipment - Blanket

#### THE VON CORPORATION

Tel.: (205) 788-2437 / Web: www.voncorp.com

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### 7819 Test Equipment - Capacitance

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### 7854 Test Equipment - High Voltage

#### HASTINGS FIBERGLASS PRODUCTS INC.

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### 7864 Test Equipment - HV Test Sets, Portable

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#### MEGGER

Tel.: (214) 333-3201 / Web: www.megger.com

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#### RTDS TECHNOLOGIES, INC.

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**7949 Test Equipment - Sleeve, Rubber****PHENIX TECHNOLOGIES INC.**

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**8010 Testing Services - Corona Locating****DTE ENERGY TECHNOLOGIES**

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**8014 Testing Services - Electrical****DTE ENERGY TECHNOLOGIES**

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Tim Hughes / See ad on page: 33

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See ad on page: 11

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### 8374 Transformers - Field Repairs

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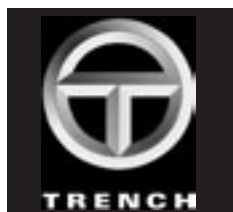
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#### TRENCH LIMITED

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Linda Meek

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Tony Jefferson

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Tel.: (204) 452-7446 / Web: www.pauwels.com

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John Bunkers, Sls Mgr / See ad on page: 153



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### 8459 Transformers - Network

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Curt Hickcox

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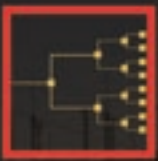
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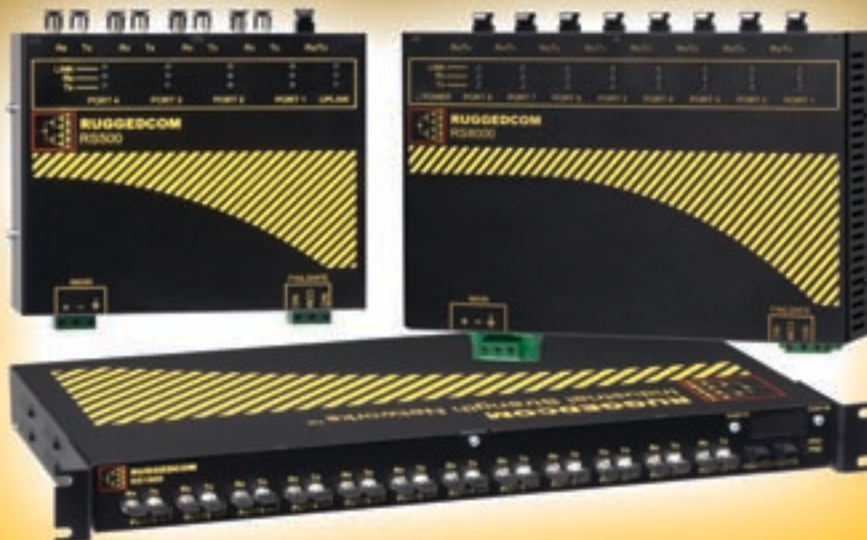


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- 962 .....Cable Pulling Accessories
- 972 .....Cable Testers - Communications
- 982 .....Cable Tray
- 1005 .....Cables
- 1023 .....Cables - High Temperature  
Superconducting
- 1024 .....Cables - High Voltage
- 1026 .....Cables - Medium Voltage
- 1027 .....Cables - Specialty
- 1032 .....Cables - Transformer Lead
- 1037 .....Calibration
- 1042 .....Calibration  
- Test and Measure Instrument
- 1047 .....Calibration and Test Equipment
- 1052 .....Calibration Services
- 1094 .....Capacitors - Controls
- 1100 .....Capacitors - Switches
- 1107 .....Capacitors Series - Transmission
- 1127 .....Caps - Conduits Ends
- 1132 .....Caps - Pole-Top
- 1176 .....Cathodic Protection - Communications
- 1207 .....Chemical Products
- 1234 .....Circuit Breakers
- 1245 .....Circuit Breakers - Fall Protection
- 1247 .....Circuit Breakers  
- Medium and High Voltage
- 1252 .....Circuit Breakers  
- Modification and Repairs
- 1259 .....Circuit Breakers - Outdoor
- 1267 .....Circuit Breakers - SF6
- 1277 .....Circuit Breakers - Vacuum
- 1302 .....Circuit Switchers
- 1311 .....CIS Solutions
- 1327 .....Clamps - Ground
- 1332 .....Clamps - Hot Line
- 1352 .....Clamps - Parallel Groove
- 1387 .....Clamps - Temporary Ground
- 1422 .....Climbers - Linemen's
- 1437 .....Clothing
- 1442 .....Clothing - Flame Resistant
- 1443 .....Clothing - Outerwear
- 1452 .....Co-Generation Insulation
- 1462 .....Coatings
- 1477 .....Coatings - Fire Resistant
- 1490 .....Coatings - Heat Resistant
- 1512 .....Coatings - Protective
- 1517 .....Coatings - Semiconducting
- 1522 .....Coatings - Silicone
- 1532 .....Coils - High and Low Voltage  
Manufacturing and Installation
- 1547 .....Communication Systems
- 1549 .....Communication Systems  
- Protective Relays
- 1552 .....Components - Electrical and Electronic
- 1557 .....Components - Electrical  
Fittings/Connections
- 1627 .....Compression/Crimp Terminals
- 1632 .....Compression Dies
- 1657 .....Computer Controls and Automation
- 1662 .....Computer Telephony Systems
- 1665 .....Computers - Accessories
- 1667 .....Computers - Equipment
- 1669 .....Computers - Mounts
- 1672 .....Computers - Notebooks
- 1675 .....Computers - Rugged Mobile
- 1677 .....Computers - Software
- 1683 .....Computers-Wireless
- 1702 .....Concrete - Poles
- 1707 .....Concrete - Products
- 1722 .....Condition Assessment Systems
- 1727 .....Condition Monitoring Equipment
- 1742 .....Conductor - Aluminum - ACSR
- 1757 .....Conductor, Steel - Aluminum - Clad
- 1762 .....Conductor - Stringing Equipment
- 1765 .....Conduit - Accessories
- 1772 .....Conduit - Electrical and Liquid Tight
- 1792 .....Conduit - Plastic
- 1797 .....Conduit - Polyethylene, Continuous
- 1814 .....Confined Space Equipment
- 1817 .....Connectors - Bolted - Distribution
- 1822 .....Connectors -  
Compression, Distribution
- 1827 .....Connectors -  
Compression, Transmission
- 1842 .....Connectors - Electrical
- 1845 .....Connectors - Fiber Optic
- 1847 .....Connectors - Flexible
- 1857 .....Connectors - Grounding
- 1867 .....Connectors - Manufacturing
- 1877 .....Connectors - Plug-in
- 1882 .....Connectors - Service
- 1893 .....Connectors - Substation
- 1894 .....Connectors - Teck Cable
- 1897 .....Connectors - Welded
- 1902 .....Connectors, Underground - Terminating
- 1922 .....Construction - Power Line and  
Substation - 25 to 735kV
- 1927 .....Construction and Project Engineering
- 1932 .....Construction Services
- 1937 .....Construction Specialized
- 1942 .....Consultants  
- Cable Testing and Fault Locating
- 1952 .....Consultants - Power Quality
- 1967 .....Consultants  
- Substation Design & Engineering
- 1972 .....Consultants - T&D Engineering
- 1977 .....Consultants  
- Underground and Underwater Cable
- 1982 .....Consulting
- 1992 .....Contactors
- 1994 .....Contactors - DC/AC
- 2015 .....Contractors
- 2017 .....Contractors - Construction
- 2019 .....Contractors - Electrical
- 2022 .....Contractors - Mechanical
- 2032 .....Control Panels
- 2037 .....Control System
- 2072 .....Controls - Capacitors
- 2095 .....Controls - Gas
- 2102 .....Controls - LTC Transformer
- 2122 .....Controls -  
Radio Alarm-Reporting and Control
- 2127 .....Controls - Regulator Tap Changer
- 2147 .....Controls - Tap Changer
- 2157 .....Controls - Temperature
- 2182 .....Converters - DC/DC
- 2197 .....Converters - Low Power
- 2207 .....Coolant
- 2217 .....Copper - Bus Bars
- 2225 .....Crimping Tools - Electrical
- 2277 .....Cranes
- 2302 .....Cranes - Manufacturers/Distributors
- 2322 .....Crimpers & Cutters -  
Battery Operated
- 2327 .....Crossarms
- 2332 .....Crossarms - Fiberglass - Reinforced
- 2337 .....Crossarms, Wood - Laminated
- 2339 .....Crossarms, Wood - Solid
- 2352 .....Cubicles - Switchgear
- 2377 .....Cutouts, Fused - Open, Non Loadbreak
- 2382 .....Cutouts, Loadbreak
- 2462 .....Dampers - Vibration
- 2467 .....Data Acquisition Systems
- 2474 .....Data Conversion
- 2477 .....Data Set - Fiber Optics
- 2497 .....Deadends Wood, Laminated
- 2537 .....Detectors - Cable Fault Locating
- 2542 .....Detectors - Fault
- 2552 .....Detectors - Infrared
- 2557 .....Detectors - Leak
- 2562 .....Detectors - Partial Discharge
- 2577 .....Detectors - Voltage
- 2587 .....Diagnostic Equipment
- 2602 .....Diggers - Derricks
- 2609 .....Direct Load Control
- 2612 .....Dispatch Systems: Computer-aided
- 2619 .....Distribution Automation -  
Communications
- 2622 .....Distribution Automation Systems
- 2627 .....Distribution Management Systems
- 2630 .....Document Management  
& Workflow Solutions
- 2632 .....Dollies - Cable Reel
- 2637 .....Dollies - Pole
- 2642 .....Dollies - Transformer
- 2667 .....Drilling Augers - Earth and Rock
- 2717 .....Duct
- 2737 .....Duct - Fittings
- 2742 .....Duct - Plastic
- 2782 .....Electric Energy - Producers
- 2797 .....Electric Products - Manufacturers
- 2812 .....Electrical Apparatus
- 2817 .....Electrical Apparatus - Maintenance
- 2822 .....Electrical Boxes
- 2832 .....Electrical Equipment - Distributors
- 2845 .....Electrical Services
- 2897 .....Emergency & Hazardous  
Location Lights
- 2902 .....Emergency Lighting
- 2907 .....Emergency Lighting/Led Products
- 2922 .....Emergency Response Training
- 2952 .....Enclosures - Cabinets
- 2957 .....Enclosures - Cabinets, EMI Shielded

<a href="#">2967</a> ...Enclosures - Metal	<a href="#">3919</a> ...Heat - Treating Services	<a href="#">4654</a> ...Lighting Controls	<a href="#">5524</a> ...Padlocks
<a href="#">2972</a> ...Enclosures - Metering Equipment	<a href="#">3933</a> ...Heat Recovery Steam Generators	<a href="#">4673</a> ...Lightning Protection System	<a href="#">5536</a> ...Pads, Flat - Polymer Concrete
<a href="#">2976</a> ...Enclosures - NEMA Type	<a href="#">3938</a> ...Heat Shrink Tubing, Sealing Products	<a href="#">4688</a> ...Lights - Emergency	<a href="#">5551</a> ...Panel Meters
<a href="#">2983</a> ...Enclosures - Polymer Concrete	<a href="#">3939</a> ...Heat Treatment - Equipment	<a href="#">4693</a> ...Lights - Portable	<a href="#">5564</a> ...Paper Insulating Materials
<a href="#">2987</a> ...Enclosures, CRT Monitor	<a href="#">3973</a> ...Heating, Ventilation, Air Conditioning and Refrigeration Controls	<a href="#">4719</a> ...Linesmen - Equipment	<a href="#">5574</a> ...Partial Discharge Analysis, Detection
<a href="#">2997</a> ...Energy Management	<a href="#">3993</a> ...High Voltage Apparatus - 25 to 800kV	<a href="#">4736</a> ...Load Management	<a href="#">5579</a> ...PCB Disposal
<a href="#">3002</a> ...Energy Management Systems	<a href="#">3998</a> ...High Voltage Breakers - SF6/Air Blast	<a href="#">4737</a> ...Load Management - Communications	<a href="#">5584</a> ...PCB Handling
<a href="#">3007</a> ...Energy Savings Products	<a href="#">4001</a> ...High Voltage Cable Systems - Maintenance & Service	<a href="#">4738</a> ...Locators - Cable	<a href="#">5604</a> ...Pedestals - Secondary, Aboveground
<a href="#">3013</a> ...Energy Trading	<a href="#">4003</a> ...High Voltage Equipment - Sales and Services	<a href="#">4743</a> ...Locators - Fault	<a href="#">5624</a> ...Phase Converters
<a href="#">3014</a> ...Engineered Fall Protection System	<a href="#">4008</a> ...Hoists	<a href="#">4768</a> ...Locking Devices	<a href="#">5689</a> ...Plastic
<a href="#">3015</a> ...Engineering	<a href="#">4043</a> ...Hoses - Rubber	<a href="#">4773</a> ...Lockout Systems	<a href="#">5694</a> ...Plastic - Custom Built Parts
<a href="#">3017</a> ...Engineering - Consultants	<a href="#">4046</a> ...Hub Switches	<a href="#">4785</a> ...Lube Oil	<a href="#">5697</a> ...Plastic - Industrial Laminates (N.E.M.A. Grades)
<a href="#">3023</a> ...Engineering - Design	<a href="#">4049</a> ...Hydraulic Bolting Services	<a href="#">4803</a> ...Lubricants	<a href="#">5704</a> ...Plastic - Sheets, Rods, Tubes
<a href="#">3037</a> ...Engineering - Professional Services	<a href="#">4068</a> ...Hydraulics	<a href="#">4805</a> ...Lubricants - Environment Friendly	<a href="#">5709</a> ...Platforms - Lineman's
<a href="#">3042</a> ...Engineering - Services	<a href="#">4143</a> ...Impregnants - Cooling Dielectric Fluids	<a href="#">4828</a> ...Machine Shops - Welding, Manufacturing, Maintenance	<a href="#">5719</a> ...Platforms - Transformers
<a href="#">3044</a> ...Engineering - Services - T & D	<a href="#">4153</a> ...Indicators - Fault	<a href="#">4843</a> ...Machining - Precision Parts	<a href="#">5723</a> ...Pole - Wood/Perservatives
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<a href="#">3082</a> ...Environmental Monitoring Systems	<a href="#">4224</a> ...Induction Heating Services	<a href="#">4861</a> ...Maintenance - Batteries	<a href="#">5731</a> ...Pole Maintenance
<a href="#">3087</a> ...Environmental Services	<a href="#">4248</a> ...Information Technology and Management Consulting	<a href="#">4871</a> ...Maintenance - Preventive Maintenance Equipment	<a href="#">5736</a> ...Pole Top - Extensions
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<a href="#">3134</a> ...Fall Protection - Design & Training	<a href="#">4278</a> ...Instrumentation	<a href="#">4913</a> ...Markers	<a href="#">5784</a> ...Poles - Lighting - Concrete
<a href="#">3135</a> ...Fall Protection Training	<a href="#">4288</a> ...Instrumentation - Electrical Measures	<a href="#">4918</a> ...Markers - Cable	<a href="#">5794</a> ...Poles - Lighting - Steel
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<a href="#">3145</a> ...Fans - Inspection, Repairs & Parts	<a href="#">4313</a> ...Instrumentation and Controls	<a href="#">4928</a> ...Markers - Poles	<a href="#">5804</a> ...Poles - Lighting - Wood, Solid
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<a href="#">3152</a> ...Fasteners	<a href="#">4328</a> ...Instruments Transformers - Current and Voltage for Analogue Meters	<a href="#">4953</a> ...Material Handling Equipment	<a href="#">5824</a> ...Poles - Transmission - Concrete
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<a href="#">3194</a> ...Fiber Optic - Sensors	<a href="#">4336</a> ...Insulating Blankets	<a href="#">4963</a> ...Measurement Specialists - Electrical	<a href="#">5839</a> ...Poles - Transmission - Wood, Solid
<a href="#">3197</a> ...Fiber Optic C & A - Cable Pullers	<a href="#">4343</a> ...Insulating Boots - Electrical	<a href="#">4980</a> ...Media Converters	<a href="#">5844</a> ...Poles - Utility
<a href="#">3229</a> ...Fiber Optic Communications	<a href="#">4345</a> ...Insulating Fluid	<a href="#">4983</a> ...Metal - Copper, Brass	<a href="#">5865</a> ...Powerline - Construction
<a href="#">3237</a> ...Fiber Optics	<a href="#">4348</a> ...Insulating Oil	<a href="#">4988</a> ...Metal - Custom Fabrication	<a href="#">5869</a> ...Power - Management System
<a href="#">3242</a> ...Fiberglass	<a href="#">4363</a> ...Insulation - Engine Exhaust/ Exhaust Systems	<a href="#">4993</a> ...Metal - Custom Made Parts	<a href="#">5884</a> ...Power Conversion
<a href="#">3257</a> ...Fiberglass - Pipe, Tank	<a href="#">4373</a> ...Insulation - Valve and Steam Equipment	<a href="#">5003</a> ...Metal - Manufacturer	<a href="#">5889</a> ...Power Distribution and/or Transmission Poles
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<a href="#">3502</a> ...Gas Insulated Sub-Station - 25 to 800kV	<a href="#">4508</a> ...Labels	<a href="#">5093</a> ...Meters - Demand	<a href="#">5980</a> ...Pressure Relief Device
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**6566** ...Risk Management  
**6592** ...Rope  
**6594** ...Rope - Anchor  
**6601** ...Rope - Kevlar  
**6609** ...Rope - Non-conducting  
**6614** ...Rope - Nylon  
**6619** ...Rope - Polyester  
**6624** ...Rope - Polypropylene  
**6629** ...Rope - Safety  
**6634** ...Rope - Wire  
**6655** ...Safety - Barrier  
**6657** ...Safety - Confined Space  
**6658** ...Safety - Consulting & Training  
**6661** ...Safety - Environmental - Equipment  
**6664** ...Safety - Equipment  
**6666** ...Safety - Fall Protection - Design & Training  
**6669** ...Safety - Fall Protection Equipment  
**6670** ...Safety - First Aid Training  
**6671** ...Safety - Flame Resistant, Breathable Garments  
**6672** ...Safety - Guards  
**6674** ...Safety - Linemen Equipment  
**6675** ...Safety - Rescue Systems  
**6676** ...Safety - Shields  
**6677** ...Safety - Supplies  
**6684** ...Safety Attachment Devices  
**6689** ...Safety Equipment - Personal  
**6701** ...Safety - Tools  
**6726** ...Satellite - Communications  
**6732** ...SCADA - Communications  
**6734** ...SCADA - Energy Control Systems  
**6736** ...SCADA - Ems Engineering  
**6739** ...SCADA - Installation Services  
**6744** ...SCADA Maintenance  
**6749** ...SCADA Systems  
**6779** ...Screens-Intake  
**6782** ...Sealants  
**6784** ...Sealants - RTV Oxine  
**6789** ...Sealants, Connector - Conduit  
**6794** ...Sealants, Connector - Underground Aqua Seal  
**6804** ...Seals  
**6819** ...Seals - Meters  
**6824** ...Seals - Security  
**6844** ...Security - Equipment  
**6867** ...Sensors - Current  
**6868** ...Sensors - Current + Voltage  
**6871** ...Sensors - Fiber optic  
**6882** ...Sensors - Temperature  
**6886** ...Separators - Steam  
**6894** ...SF6 Gas Insulated Switchgear  
**6899** ...Sheaves - Conductor - Stringing  
**6939** ...Shielding, Magnetic  
**6962** ...Signs  
**6974** ...Silencers - Exhaust  
**6979** ...Silicones Grease and Compounds  
**6984** ...Silicones - Dielectric Grease  
**6989** ...Sleeves - Rubber, Lineman's  
**7009** ...Software  
**7011** ...Software - Application  
**7012** ...Software - Billing  
**7029** ...Software - Electric Design Automation  
**7034** ...Software - Engineering  
**7036** ...Software Integration  
**7037** ...Software Solutions  
**7084** ...Spacers, Overhead Spaced Cable - Plastic  
**7104** ...Spills Response Kit  
**7109** ...Splices & Accessories - Compression Joint  
**7134** ...Splices & Accessories - Tension  
**7144** ...Splicing Products  
**7149** ...Splints - Pole-reinforcing  
**7154** ...Spreaders - Conductor  
**7174** ...Stand by Power Systems  
**7229** ...Steam - Generators  
**7230** ...Steam Generators - Services  
**7231** ...Steam Boilers (Used)  
**7274** ...Steel Products - Custom Fabrication  
**7289** ...Sticks - Disconnect  
**7294** ...Sticks - Hot  
**7304** ...Storage - Bins, Steel  
**7334** ...Stringer - Sockline  
**7339** ...Strippers - Cable Insulation  
**7344** ...Structure - Prefabricated  
**7354** ...Substation  
**7367** ...Substation - Communication Equipment  
**7368** ...Substation - Communications  
**7371** ...Substation Design & Construction  
**7374** ...Substation - Gas-insulated  
**7379** ...Substation - Metal-enclosed  
**7384** ...Substation - Mobile  
**7399** ...Substation - Reactive Compensation  
**7409** ...Substation - Steel, Structure  
**7414** ...Substation - Substation - HVDC  
**7424** ...Substation - Wood, Treated  
**7429** ...Substation Automation  
**7434** ...Substation Control Buildings  
**7449** ...Suppressors - Surge - Transient Voltage  
**7454** ...Surge Protection Equipment  
**7459** ...Surge Protectors  
**7479** ...Suspension Arms, Pole - Steel  
**7496** ...Switches  
**7499** ...Switches - Air, Group-Operated  
**7504** ...Switches - Capacitors  
**7505** ...Switches - Capacitors Bank  
**7509** ...Switches - Disconnect  
**7514** ...Switches - Disconnect 25 to 800kV  
**7519** ...Switches - Gas-filled  
**7524** ...Switches - Hookstick, Disconnecting  
**7529** ...Switches - Isolation  
**7534** ...Switches - Level and Pressure  
**7549** ...Switches - Motor-Operated  
**7554** ...Switches - Oil  
**7559** ...Switches - Padmounted  
**7579** ...Switches - Submersible  
**7589** ...Switches - Test  
**7601** ...Switches - Transfer  
**7606** ...Switches - Vacuum  
**7609** ...Switchgears  
**7614** ...Switchgears - Arc Resistant - Medium Voltage  
**7616** ...Switchgears - DC Traction  
**7619** ...Switchgears - High Voltage  
**7624** ...Switchgears - Medium Voltage Range Up to 44 kV  
**7629** ...Switchgears - Metal Enclosed  
**7639** ...Switchgears - Rebuilding and Repair Service  
**7644** ...Switchgears - SF6  
**7649** ...Switchgears - Vacuum  
**7664** ...Synchronizers - Automatic  
**7669** ...Tachometers  
**7674** ...Tag Outs  
**7675** ...Tags  
**7696** ...Tanks - Steel  
**7709** ...Tap Changers - Controls  
**7719** ...Tap Changers - Transformers - Load, No-Load  
**7744** ...Telecommunications  
**7746** ...Telecommunications - Conduit  
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**7794** ...Terminators - Cable  
**7799** ...Test - Measuring Equipment  
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**7806** ...Test Equipment - Aerial Lift  
**7809** ...Test Equipment - Batteries  
**7814** ...Test Equipment - Blanket  
**7819** ...Test Equipment - Capacitance  
**7829** ...Test Equipment - Circuit Breaker  
**7839** ...Test Equipment - Electrical  
**7844** ...Test Equipment - Fault  
**7847** ...Test Equipment - Fiber Optic  
**7849** ...Test Equipment - Glove  
**7854** ...Test Equipment - High Voltage  
**7859** ...Test Equipment - HV Impulse  
**7864** ...Test Equipment - HV Test Sets, Portable  
**7869** ...Test Equipment - Instrument Transformer  
**7874** ...Test Equipment - Insulation  
**7889** ...Test Equipment - Meter Socket  
**7894** ...Test Equipment - Meter Test Boards  
**7899** ...Test Equipment - Meter Test Sets  
**7909** ...Test Equipment - Oil  
**7924** ...Test Equipment - Reclosers  
**7929** ...Test Equipment - Relay  
**7930** ...Test Equipment - Rental  
**7936** ...Test Equipment - Safety and Instruments  
**7949** ...Test Equipment - Sleeve, Rubber  
**7964** ...Test Equipment - Transformers  
**7974** ...Test Equipment - Wattmeter  
**7979** ...Test Systems/Components - High Voltage, High Current, High Power  
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**7994** ...Testing Instruments - Electronic Measure  
**8004** ...Testing Services  
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**8074** ...Thermometers - Infrared  
**8099** ...Tools  
**8104** ...Tools - Equipment/Rental  
**8109** ...Tools - Hand - Splicing  
**8121** ...Tools - Wire & Cable  
**8124** ...Tools Cable - Underground Cable Installation  
**8134** ...Tower - Trellis and Tubular  
**8139** ...Towers - Antenna  
**8140** ...Towers - Emergency T & D  
**8141** ...Towers - Poles  
**8143** ...Towers - Telecommunication  
**8149** ...Towers, Transmission - Retrofit  
**8154** ...Towers, Transmission - Steel  
**8159** ...Towers, Transmission - Wood, Laminated  
**8164** ...Towers, Transmission - Wood, Solid  
**8166** ...Towers - Wireless  
**8179** ...Trailers - Rental and Leasing  
**8189** ...Trailers - Cable Reel  
**8219** ...Trailers - Pole  
**8224** ...Training  
**8231** ...Training - Regulatory Compliance  
**8239** ...Transducers - AC Power  
**8240** ...Transducers - Current  
**8241** ...Transducers - Current + Voltage  
**8244** ...Transducers - Electric  
**8249** ...Transformer - Oil  
**8254** ...Transformer - Vacuum Dry-Out Systems  
**8259** ...Transformer Components  
**8262** ...Transformer Diagnosis  
**8274** ...Transformer Monitoring  
**8275** ...Transformer Mounting Pads  
**8276** ...Transformer - Unit Distribution Substations  
**8279** ...Transformers  
**8284** ...Transformers - Auto Transformers  
**8289** ...Transformers - Auxiliary - Dry or Liquid Filled Type  
**8304** ...Transformers - Distribution  
**8314** ...Transformers - Distribution, Padmounted  
**8324** ...Transformers - Distribution, Pole-Type  
**8334** ...Transformers - Distribution, Substation-Type  
**8371** ...Transformers - Fall Protection  
**8374** ...Transformers - Field Repairs  
**8379** ...Transformers - Grounding  
**8389** ...Transformers - Instrument  
**8394** ...Transformers - Instrument, Current  
**8419** ...Transformers - Large Power, 10,001 kVA and Larger  
**8439** ...Transformers - Maintenance/Repairs  
**8444** ...Transformers - Medium & Large Power  
**8449** ...Transformers - Mobile  
**8453** ...Transformers - Monitors  
**8459** ...Transformers - Network  
**8464** ...Transformers - Nonflammable Liquid-Filled  
**8489** ...Transformers - Painting and Flow Coating  
**8499** ...Transformers - Power  
**8509** ...Transformers - Rebuild  
**8514** ...Transformers - Rebuilding and Repair Services  
**8529** ...Transformers - Rental Services  
**8539** ...Transformers - Small Power  
**8544** ...Transformers - Small Power, 10,000 kVA and Smaller  
**8554** ...Transformers - Splitcore  
**8564** ...Transformers - Test Equipment  
**8569** ...Transformers - Used, Rebuilt  
**8584** ...Transmission and Distribution Line  
**8590** ...Transmission - Underground  
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**8650** ...Trashrakes  
**8655** ...Travelers - Conducting-Stringing  
**8670** ...Treating Services - Insulating Oil  
**8680** ...Treating Services - Poles, Crossarms  
**8681** ...Tree Trimming  
**8682** ...Tree Trimming Equipment  
**8684** ...Truck Mounted Air Compressors  
**8695** ...Trucks  
**8700** ...Trucks - Equipment/Bumpers  
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**8897** ...Uniforms - Flame Resistant, Breathable  
**8900** ...Uninterruptible Power Supplies  
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**8946** ...Valves - Gate  
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**9001** ...Vaults, Underground - Secondary Connection  
**9010** ...Vaults, Underground - Transformers  
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**9067** ...Voltage Supplies  
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**9262** ...Wire - Seals  
**9275** ...Wire, Steel Strand - Aluminum - Clad  
**9286** ...Wireless Solutions  
**9305** ...Wires and Cables - Electrical  
**9318** ...Wood Preservatives  
**9320** ...Wood Treatment



According to the American Wind Energy Association (AWEA), wind energy development in the United States is expected to grow at a remarkable 25 percent in 2003. Driven by local incentives and the federal production tax credit, the forecast for new wind energy development through 2006 is quite robust. Typically wind farms tend to be located at remote locations, driven by wind and weather patterns with little up-front analysis performed regarding the existing power grid in that location. Such locations tend to be weaker points in the transmission system, which means they require special consideration in connecting wind generation to the grid. In particular, four common problems must often be addressed:

- 1) Wind farms can cause steady-state low voltage on regional transmission networks.
- 2) Wind turbine gear boxes are sensitive to capacitor bank switching, which can cause damage and premature failure of the gear boxes.
- 3) Wind generators are sensitive to voltage transients, and can suddenly trip offline if a voltage sag of a specific depth and duration occurs on the transmission system.
- 4) Wind turbines can cause momentary voltage sags on the local distribution system, which, in turn, can cause problems for the locally served load. This article addresses these four areas of concern.

# Using FACTS Technology to Address Grid Interconnection Issues for Wind Farms

By: Tim Poor, American Superconductor

## Steady-State Low Voltage

One of the most common technologies used to convert wind power to electricity is the induction generator. Induction machines, however, tend to drain large amounts of reactive power from the grid, which can cause low voltage and/or voltage stability problems for the transmission owner. The harder the wind blows, the more reactive power is consumed, which can drag transmission voltages to unacceptably low levels. Conventional solutions would call for capacitor banks to provide the VAR (voltage ampere reactive) support required to offset the reactive power demands of wind farms. Capacitor banks, however, must be switched in "blocks" of VARs. Because the fault power in these remote locations tends to be lower, wind farm developers must use many small capacitor banks in combination with elaborate switching schemes to minimize step voltage changes and offset ever-varying VAR demands. On larger wind farms, the use of capacitor banks alone for VAR control can be very difficult to implement, and can result in hundreds of capacitor bank operations per day. This can greatly accelerate the wear and tear on the capacitor bank switches. In addition, many transmission owners now require wind power generation facilities to meet standards similar to those of conventional generators. A common requirement for wind power interconnection calls for generation facilities to have an infinitely controllable power factor, for example from .90 leading to .95 lagging. Achieving such a power factor on a wind farm is nearly impossible with capacitor banks alone.

## Gear Box Damage from Capacitor Switching

Using capacitor banks alone, both at the wind farm distribution bus and on the transmission system, can also cause other headaches for wind farm owners. Each capacitor switching event — either on or off — causes a near instantaneous step change in voltage. The step change in voltage, in turn, correlates to a step change in torque on the gear boxes of the wind turbines. Depending on the frequency and magnitude of these switching events, this can accelerate wear and tear on the wind turbines' sensitive gear boxes

and can ultimately lead to premature mechanical failure. According to European wind energy associations, gear boxes are already the number one source of mechanical failure on wind farms (see Figure 1).

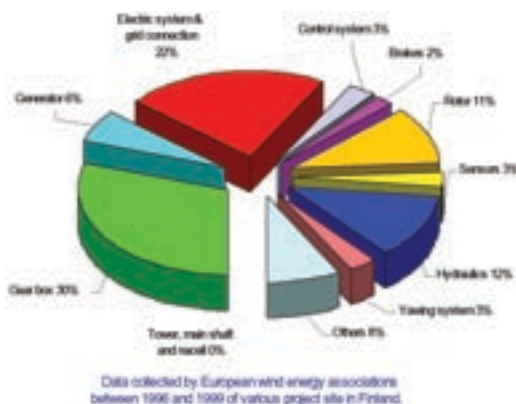


Figure 1: Frequency of component failures in wind generation systems

## Wind Generators Tripping Offline

Another common problem with wind power is that most wind generators are very sensitive to brief voltage sags or swells, which occur normally on all transmission systems. Depending on the depth and duration of the sags, the wind generators can trip offline. This unpredictability makes grid planning and maintenance more difficult for transmission owners. Most transmission owners, therefore, specify voltage sag "ride-through" requirements as a pre-condition for interconnecting a wind farm to the power grid. Achieving this "ride-through" capability requires dynamic voltage support, capable of instantaneously and precisely correcting voltage transients — effectively making them invisible to the wind turbines. This type of "ride-through" is not possible using only capacitor banks.

## Wind Generators Causing Voltage Sags on Local Distribution Network

Depending on proximity to the local load and the distribution network configuration, wind generators can cause voltage transients or flicker

on a local distribution grid. This occurs due to the inrush associated with the energization of the stators. Depending on the strength of the local grid, an undesirable voltage dip can result every time the wind turbines are started. For this reason, local utilities often require that wind generators limit the magnitude of their voltage disturbances to a maximum of 1–2%. Mitigating these voltage disturbances requires dynamic reactive compensation such as a FACTS (Flexible AC Transmission System) device that can instantaneously and infinitely vary its output to precisely counteract the reactive current being drawn by the stators.

## Solution

The most effective and economic solution to these common interconnection problems is to install a dynamic reactive power source (a FACTS device) at the wind farm collector bus. Such a device automatically maintains precise system voltages at the wind farm and provides critical protection from voltage sags. New developments in this technology have driven prices to affordable levels and lead times to just a few months. In addition, recent advances have proven that some FACTS devices can be integrated with low-cost capacitor banks to provide large-scale wind farm solutions without the problems usually associated with capacitor bank switching.

The most effective FACTS devices utilize power electronics (voltage source converters) to generate reactive power. Because they are strictly a current source, power electronic-based FACTS devices have considerably more output at reduced voltages than capacitor-based FACTS technology, whose maximum output declines by the square of the voltage. These characteristics combined with their dynamic capabilities make power electronic-based FACTS systems superior solutions for protecting against voltage sags.

Figure 2 depicts a typical wind farm solution utilizing D-VAR™ technology (power electronics). In this example, the D-VAR system constantly monitors the 34.5kV wind farm bus and is capable of injecting precise amounts of reactive power within 1 line cycle (0.017 seconds). This near instantaneous response is also dynamically variable to exactly match and offset the varying amounts of reactive power consumed by the turbine generators. This system also completely controls the shunt capacitor banks — switching them in or out depending on wind farm voltage, VAR demand, or power factor. The capacitors are “soft-switched” by the D-VAR system, which also acts as a “shock absorber” to eliminate the step voltage changes that would otherwise occur. Because of the low cost of capacitors, this hybrid FACTS/capacitor bank solution is capable of providing all required voltage and power factor control for a very large wind farm — at substantially lower cost than with a FACTS device alone.

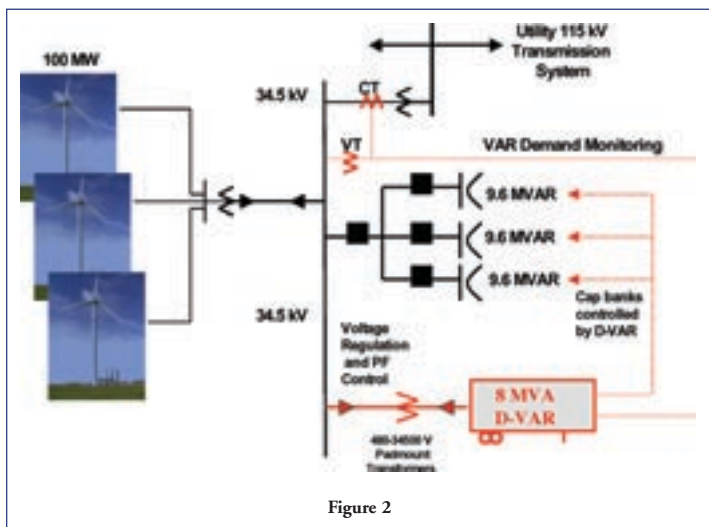


Figure 3: A D-VAR system providing complete voltage control and regulation at PacifiCorp's 135 MW wind farm in Foote Creek, Wyoming.

The solution depicted in Figure 2 is also capable of going into temporary “overload” mode, supplying up to 3.0 times its rated output for 1 full second. This extra dynamic response is an important feature which provides extra short-term reactive power for additional protection from voltage sags, allowing the wind farm to “ride-through” voltage transients that naturally occur on the transmission system.

## Summary

Wind farms today are far from “plug and play.” Several important grid interconnection issues must be addressed, and these issues vary among transmission owners. As the megawatt capacity of wind farms grows ever larger, interconnection challenges are becoming even more significant. Fortunately, power electronic-based FACTS technology can now provide proven, reliable and economic solutions for the wind power challenges of today and tomorrow. ■

## About the Author

Tim Poor is Director of Business Development for American Superconductor's Power Electronic Systems Business Unit, which is based in Madison, Wisconsin. He has worked closely with various transmission owners, wind farm developers, and wind turbine manufacturers to reliably and cost-effectively integrate wind power on the grid. Tim can be reached at [tpoor@amsuper.com](mailto:tpoor@amsuper.com).

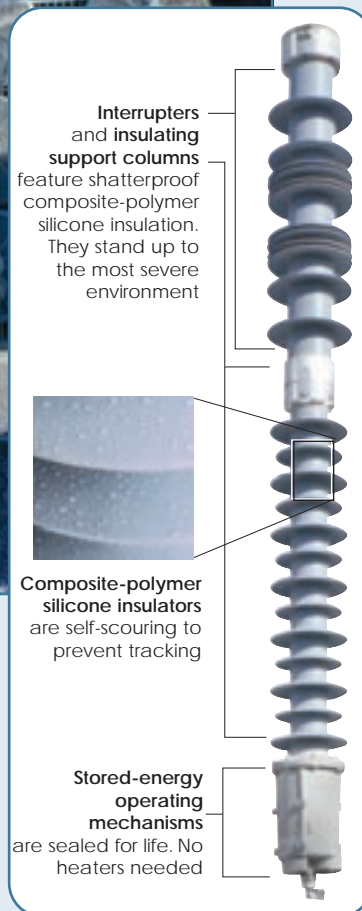
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				Model EX	Model SE
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Three-Phase Tripping		✓	✓	✓	✓
Activated by Relays		✓	✓	✓	✓
High Interrupting Ratings		✓	✓	✓	✓
No Substation Batteries	✓				✓
Mounting Flexibility	✓			✓	✓
Low Installed Cost	✓			✓	✓

Both Trans-Rupter II models offer these important benefits:

- **Electrically tripped, manually reset pole-units**—no mechanical linkage to adjust or maintain
- **31.5-kA fault-interrupting performance**—with 3-cycle interrupting time
- **Simple installation procedure and no periodic maintenance**—for lower total cost
- **Space-saving, lightweight design with superior mounting flexibility**—installs on nearly any structure, even on the transformer or disconnect switch

Trans-Rupter II 50/60-Hz Ratings

kV			Fault-Interrupting Amperes, RMS	Suitable for Transformers Rated, MVA
Nom.	Max	BIL		
69	72.5	350	31 500	30/40/50
115	123	550	31 500	37.5/50/62.5
138	145	650	31 500	50/66.5/83



Control cabinet of Model SE

Field-settable **digital overcurrent relays** provide complete time-overcurrent and instantaneous overcurrent protection



69-kV Trans-Rupter II Model SE

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By: Mike Caranfa  
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Datamatic Energy Systems  
Datamatic, Ltd.

Utilities want data, especially about when and how much energy is being used. Traditionally, the acquisition of that data has been accomplished with expensive commercial and industrial (C&I) meters that enable satellite, Internet, cellular, RF or modem transmission of usage data back to the utility. There has also been the ability to retrieve this data through expensive power line carrier (PLC) equipment and the expansive substation infrastructure that goes with it. However, this method presents an additional problem of needing to collect and store data for all endpoints on a constant basis.

# Have Your Cake and Eat it, Too!

## The Options

The continuous reduction in the cost of non-volatile memory has enabled the capability to collect and store large amounts of this interval data at the meter—until the utility is ready to use it—for right sizing transformers, customer service and billing issues, load studies, TOU billing and any number of other uses. The automatic collection and storage of desired data at every meter provides the flexibility for the utility to retrieve and use the data when and how they want, without the overhead and expense of alternative systems and specially skilled personnel. The downside is that most utilities do not have telecommunications expertise or communications infrastructure experience; they also are not usually equipped to provide effective data storage and network management.

There are limitations to traditional drive-by methods of meter reading and data collection that only collect a monthly cumulative read versus a Fixed Network (FN) method of collection. Here, “Fixed Network” refers to both the power line carrier fixed network and the wireless RF fixed networks. Many FNs, including some of the new power line carrier technologies, offer real-time or near real-time two-way communications. For some utilities the added expense of purchasing a FN solution with this two-way capability, particularly when coupled with a remote on/off control feature, has been worth the cost.

Another virtue of FN solutions is the availability of outage notification. Many FN systems can provide timely outage notification that indicates the location of the outage. For some utilities, the high expense outweighs the value of these features.

For most utilities, especially those with large industrial bases, a large percentage of revenue comes from a small percentage of customers. To address the needs of these customers, many utilities install meters that will collect and store data. The data is then collected during monthly meter readings via optical probing.

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A few more advanced meters can transmit some of that data back to the utility at various intervals via connection methods like POTS (plain old telephone service) lines, satellite, TCP/IP, etc. This allows high use customers options like web-based, real-time energy usage management tools or interactive TOU billing. The high end C&I meters can provide utilities with the "when" and "how much" answer to the question of energy usage, but they are prohibitively expensive for all but the highest revenue generating customers.



An AMR based example can be seen with one AMR vendor's second revision of their gas meter MIU. Their collected data storage capacity went from 74 days worth of data to 330 days, with no increase in the cost of the MIU itself.

## Alternatives

Most utilities have purchased, evaluated or at least inquired about AMR systems over the years. The Scott Report shows a continuing increase year over year in the number of AMR MIUs being installed by electric, water

## Weighing the Costs

Cost has been the prohibitive factor to offering a data logging or data collection type of functionality on every meter. Since the cost of non-volatile memory (generally what is used to store the collected data) has dropped significantly over the years, it has become substantially less expensive to add or, in the case of some pioneering companies that already offer this profiling ability, to increase the data logging and storage capabilities for the meter interface units (MIU).

Common examples of how much the cost of non-volatile memory has decreased over the years in the retail market include compact flash cards for MP3 players, digital cameras and PDA storage. The cost of the new key ring style USB hard drives also continues to drop (or rather the amount of storage offered for the same price increases). These are both non-volatile memory devices, and as an example the 128 MB (megabyte) compact flash card that would have cost \$150 18 months ago, now costs as little as \$40.

and gas utilities. Utilities that haven't already done so will put together cost benefit analyses that review FN AMR as well as drive-by AMR. The primary purpose of these evaluations will focus on reducing the cost of getting the read. RF based FN solutions will substantially reduce the cost of reading the meter but the infrastructure build out is costly.

Carolyn Kinsman of Automated Communications Links, an Ontario, Canada, based utility consulting firm, estimates that AMR costs for basic systems is dropping at approximately 5-7% per year. Cost justification for basic systems is more easily obtainable due to this reduction and the ability to quantify more benefits directly attributed to AMR.

The expense and complexity of purchasing and operating a FN solution doesn't have to keep a utility from getting the data that will allow them to function more effectively or provide a higher level of customer service. Inversely, the desire to have data that will allow a utility to function more effectively or provide a higher level of customer service shouldn't force them to spend the added cost for a FN if it doesn't make sense.

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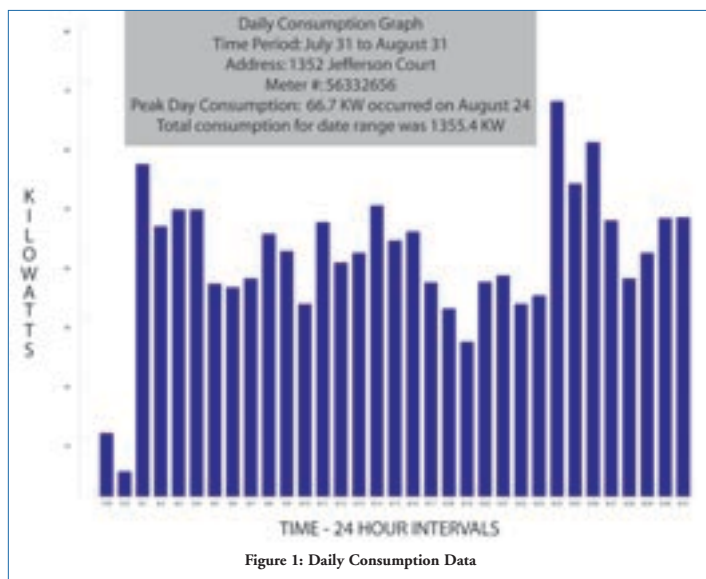


Figure 1: Daily Consumption Data

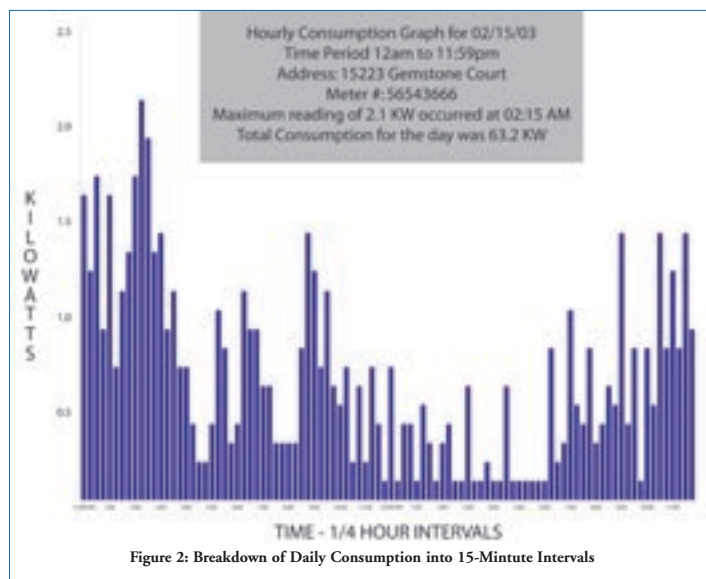


Figure 2: Breakdown of Daily Consumption into 15-Minute Intervals

Drive-by AMR MIUs are currently on the market today that allow utilities to collect interval data with a resolution as fine as every 5 minutes and allow for storage of 15-minute interval data, in the case of at least one vendor, for up to 84 days. While 84 days may not sound very impressive when gas units can store 330 days worth of data, the difference is the resolution. For gas applications, the interval data is generally collected hourly, where as in electric metering applications, the resolution is typically every 15 minutes. The number of days that can be stored in a device is a function of the interval data resolution, the amount of data for each interval being stored and total memory capacity.

## Storing the Information

The significance of the data being stored in non-volatile memory is that when the power goes out or the battery dies (in the case of a gas or water MIU), the information stored in non-volatile memory will not be lost. In many other forms of memory, a constant source of power is required for it to maintain its internal information.

The significance to the utility is twofold. First, it is important to ensure that the memory in the MIU selected is non-volatile and uses a FIFO (first-in, first-out) method of data management so the most recent data is retained. Secondly, it is critical to make sure that the electric meter MIU has a battery back-up. In cases where the MIU is powered from the meter, the battery back-up is present so the MIU can continue to record interval data and log the times during a power outage. Without a battery back-up, the interval data cannot be continuously maintained; this would keep a utility from getting accurate outage information as well as prevent being able to do any sort of TOU billing since the time accounting would be thrown off every time there is an outage.

## Collecting the Data

Now the data is stored in the meter. There are a few methods of retrieval available for AMR systems. All include some level of active communication.

Optically probing is an option that many utilities are familiar with already, but optical probing is a manual process. A more effective method is to retrieve data wirelessly using a local RF connection, such as an RF enabled field computer or vehicle based RF drive-by collection device that would be able to query selected meters for the stored interval data in conjunction with the standard drive-by read information. "Local" is stressed to illustrate that it would not be a long range RF transmission, otherwise some sort of a FN infrastructure would be needed.

An obvious question would be if the data resides in all the meters and can be retrieved wirelessly then why isn't all the data just sent each

time a reading is taken? The answer lies in the amount of data that is being transmitted. While driving down the road with a mobile receiver and collecting meter reads, collection personnel can do so and keep moving at a reasonable speed because the amount of data in a typical meter reading being sent is small, on the order of a few hundred bytes. A typical usage profile data set is on the order of 4K to 8K bytes. The most effective way to collect this data is wirelessly retrieving it during the course of standard drive-by reading from strategically selected accounts. Profile data is not collected every month from every meter.

## Knowledge is Power

Now that the data is there and available, what can be done with it? With the right data management the uses are limited by the utilities innovativeness and imagination.

The key words are "right data management". One of the values of having data stored at the meter is so it can be retrieved and used when needed; therefore, only needs to be managed as it is selectively collected.

It is critical to ensure an AMR vendor has a very flexible package for viewing and manipulating the data once it is collected. Virtually all AMR vendors currently have some number of canned reports inside of their route management/data management software. Utilities should look at least two steps beyond this to effectively manage the profile or interval data that is being collected at the meter. This means being able to customize the reports within the vendor's software without undue additional expense. Additionally, it would be important to have a "save as" type of functionality that allows the user to save collected data into some other externally manageable format such as ASCII text, delimited, CSV, .xls, etc.



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Common uses for profile data include peak demand studies, TOU billing, right sizing transformers, customer dispute resolution, theft monitoring and enhanced customer service. Users should never let the historical uses or 'group-think' keep them from using locally stored, easily retrieved and simply manipulated data in new and cost saving, customer serving ways.

### The Bottom Line

The need for energy use data can now be met due to the lower MIU costs, advances in technology and new profiling options. Utilities can now choose a cost effective AMR system that gives them the data they need to provide a higher level of customer service and better understand where and when their energy is being used. This information

will lead to more effectively managing infrastructure build out, load management and customer service all without having to build and manage an expensive network infrastructure. Utilities can indeed have their cake and eat it, too. ■

### About the Author

*With more than a decade of business and sales management experience, Michael Caranfa is a seasoned professional whose strategic business campaigns have made him successful in many fields.*

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

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

*Michael Caranfa can be reached for comments or questions via e-mail at [mcaranfa@datamatic.com](mailto:mcaranfa@datamatic.com)*

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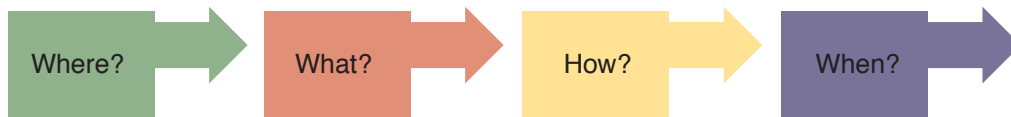
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# Outage Indicators

## - Here's the Problem!

By: Andrew Thompson, CEO and President, TVD Inc.



These 4 stages, and the numerous inputs to each, represent the essence of Outage Management.

Improving your accuracy and response times in each of these areas will support the common goals of all utilities in this area; Reduced interruption duration; Improved resource and asset management; Improved Stakeholder/Customer satisfaction. These goals and the resultant outcomes at an Operational level will (or should!) be prioritised in accordance with the core Strategic objectives of the business.

There probably isn't enough room here to address all of the components of modern Outage Management but we will look at the technological changes and analysis tools available now to dramatically improve the speed with which you can solve the "Where" component. We now call these Outage Indicators.

### Outage Indicators

Outage Indicators are the various push inputs used to expedite the identification of where an Outage has occurred, both as to the footprint of the outage, and specific point of failure.

### Traditionally this has amounted to using two components:

**1. Network Monitoring** – Typically this has meant SCADA and a related Feeder Breaker trip at the Substation. This provides a very coarse indicator of a faulted section i.e. "Somewhere on this Feeder". In the case of short Feeders (<1-2km) this may represent a sufficiently small footprint to allow for visual identification of the actual location by crews (or customers), however it is still inefficient and a short Feeder may indicate high load/customer density where any delay in identification and therefore restoration will have a proportionally greater impact on time based performance indices, e.g. SAIFI, than a lower density larger Feeder.

**2. Customer Calls** – "Human Fault Detectors", nothing is more certain than when supply is interrupted you will be flooded by an avalanche of unhappy customers phoning in. Without exception and particularly in LV faults, customer calls when related to their meter points and associated upstream connectivity have represented the widest used method of determining the footprint of the problem, and so the boundary within which to look for the actual "Where" location.

Depending on the level and accuracy of your electrical connectivity, various grouping up processes have been automated to identify the likely upstream section or isolation/protection device, but the accuracy of this is dictated by the sample size (number of calls you can actually answer and therefore capture), connectivity, quality of the customer phone number to meter lookup, and interpretation capability of the system operators.

More often than not, unless a specific customer notification of the fault location has been received, crews still end up having to "drive the line" which is the most expensive and inefficient approach to identifying "Where".

All other items being the same, it naturally follows that being able to shrink the size of the search area within the overall Outage Footprint will result in faster identification and eventual restoration. It is in this "Where" area of the puzzle that the use of Outage Indicators can provide significant benefits.

As a consequence of technology developments and the experiences gained above, a new way to look at solving the "Where" problem is available. In the same way you can improve the accuracy of a positional fix (GPS) by having multiple sources

In any Outage

Management process

one of the first chal-

lenges is to identify

where the cause of the fault is located.

Knowing "Where",

will then allow you to

identify "What" the

nature and cause of

the fault is, "How"

to manage the

restoration process,

and then "When" it

will be restored.

(satellites), so the same is true of being able to identify “Where” by having multiple Outage Indicator Sources.

**Network Monitoring** - below the breaker is now becoming cheaper and more viable, both from the hardware perspective and the control system management of large amounts of data, automated sectionalizing provides fast isolation and restoration of non faulted customers and can be valuable in certain circumstances, although the business case is still difficult based upon reliability alone. When the sectionalizers activate this will advise the SCADA system which in turn will provide valuable information to the OMS as to the “sectionalised” areas that have been isolated

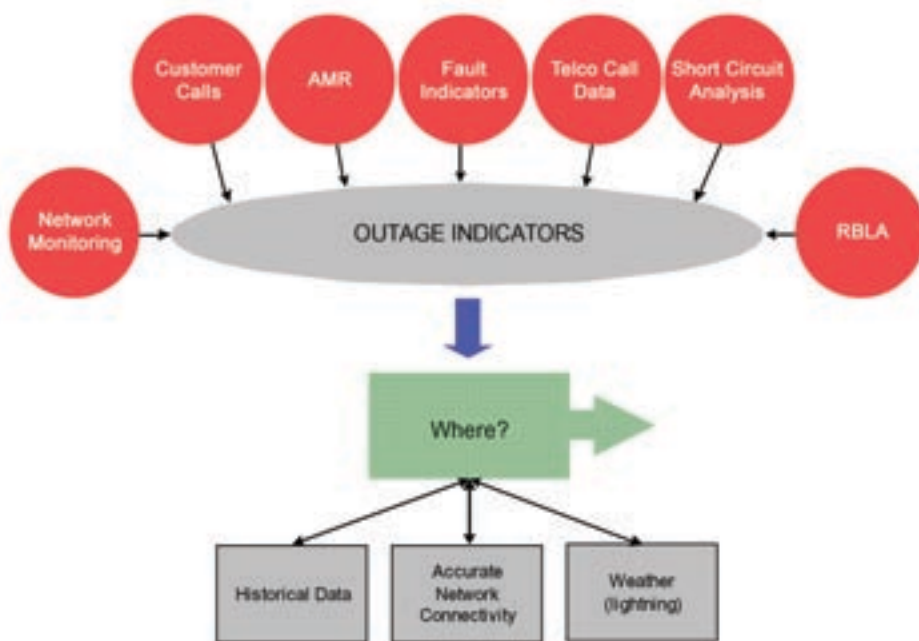
and so the clearly defined boundaries of the faulted area within which the actual event has occurred. This however can still be a large area.

**Customer calls** – These will continue to be an important part of the analysis as they not only provide a quantitative measure, but they are the only Outage Indicator which can provide qualitative data, e.g. “I saw a truck run through the pole outside my house and I’m at...”. We need to make every possible effort to ensure that these “golden ticket” callers can get through to an operator, and that Customer Calls are not just treated as a quantitative measure.

**AMR** – Most AMR meters now have the facility to forward power on and power off event notifications, which can be used in a similar manner to Customer Calls by cross referencing the meter ID to the customer premise and associated Feeder connectivity. Meters using Power line carrier type technologies will obviously have difficulty delivering that event notification if they are electrically disconnected from their upstream data consolidator; however they are excellent for confirming power is back on. Although AMR has had a tough time with cost justification a number of utilities who have chosen not to roll out AMR for meter reading, are using the technology in strategic positions throughout the network and it represents a low cost way of placing monitoring devices right at the end of radial feeders or associated laterals for power On/Off confirmations.

### The following is a list of the Outage Indicators which Utilities now have access to, to assist in shrinking the search area and pinpoint the location of a fault:

1. Network Monitoring (Feeder and lower)
2. Customer Calls
3. AMR
4. Fault Indicators
5. Telco call data
6. Short Circuit Analysis
7. Rules Based Learning and Analysis (RBLA)



**Fault Indicators** – Like AMR these devices are a low cost way to place monitoring out onto either different sides of an automatic device (e.g. Sectionalizer), or on specific sections. In some cases these units have both visual and event notification (e.g. Fisher Pierce). With a visual indicator e.g. LED, it is easy for a lineman to see the state of the section without having to get out of the vehicle. These have been particularly useful in situations where a section or sections of the Feeder are away from the road, e.g. crossing farmland.

**Telco Call Data** – This is perhaps one of the most exciting developments and enhancements to the already proven Customer Call counting and grouping process. In this instance a call record is passed from the Telco via IP the instant a call is placed from the customer to the 800 fault number. In many cases the utility can receive the phone number of the calling party (to the 800 fault line number) before the caller even hears ringing at their end! This has the profound advantage of the utility not even having to receive the call or wait for the call to be connected to the utility call center before the call record can be linked to a customer record and connectivity and used as part of the “Where” determination.

**Short Circuit Analysis** – This relies on measuring devices on the Feeder to capture the cycles pre and post event, generally at the Sub station. This real-time information is then applied to the information held in the network connectivity and asset system e.g. GIS or network planning tool, using the known lengths, ratings and types of conductor to mathematically determine the distance from the measurement point (Feeder breaker). Obviously this requires good up-to-date connectivity and asset information

about the Feeder but in many cases the level of accuracy is inside visual identification range in adverse conditions i.e. 150-200 meters. This calculation needs to be looked at in parallel with other Outage Indicators as there may be situations where laterals may cause the calculation to identify 2 or more possible locations. This methodology also requires measurement hardware at the substation which can support peak load measurements which may be normally outside the range of specified equipment for routine monitoring of load.

#### Rules Based Learning and Analysis (RBLA)

– Where we previously had only two or perhaps three simple inputs (e.g. SCADA and Customer Calls) it was relatively easy to consolidate the data and make decisions on likely point of failure using simple grouping algorithms and “operator art”. However as additional tools such as short circuit analysis are employed in real-time and there are lots of inputs, it is becoming increasingly necessary to look to rules based systems often with complex algorithms to analyse the data available to the system. This includes such items as historic data about faults on this feeder, real-time weather and in particular, lightning strike data, and of course real-time connectivity, to provide the operator either with a point at which they can send a crew with a very high degree of confidence, if not specific accuracy, e.g. 95% probability within 200 meters.

#### Conclusions

There are now a large number of options for utilities to use additional Outage Indicators to fine tune their analysis of where fault locations are and see significant improvements in outage duration, resource utilisation, and efficient management of their assets to prove their competence in maintaining an essential service.

This type of analysis also presents additional benefits such when the truck goes to the point in the network “Where” it is likely the failure

occurred they can ensure they have materials on board e.g. Cable type, that will allow them to immediately deal with the problem, rather than having to return to stores and thereby extending the outage duration.

The costs to use these types of facilities are often in the hundreds of dollars as opposed to the tens of thousands, and perhaps it's worthwhile considering quickly the value of saving even 10-15 minutes per outage by being able to identify “Where” the problems are and more efficiently deploying resources?

Better accuracy and improved speed getting to “Where” will also place you in a much better position to then determine “What”, “How” and “When”. ■

#### About the Author

*Andrew Thompson is CEO and President of TVD Inc., a world leader in the area of Trouble Call, Outage, Operations and Works Management. TVD have clients and partners in regulated and de-regulated markets globally.*

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By:  
John Pointon  
Director, Sales and Marketing  
OmniSTAR, Inc.

# GPS Choices - An Embarrassment of Riches

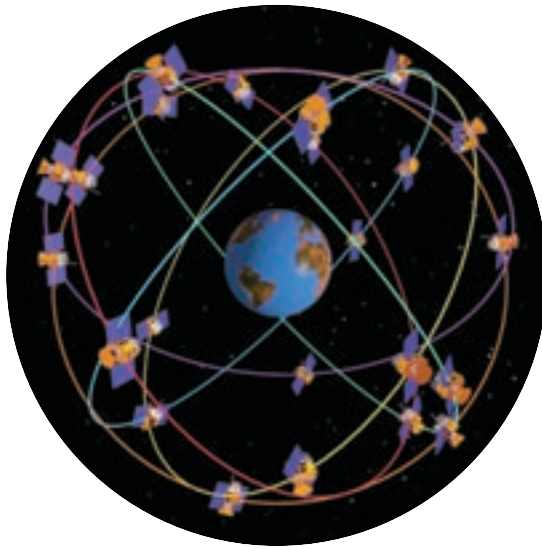


Diagram  
showing the  
GPS  
Constellation

The advent of GPS positioning technology has resulted in the general availability of high quality positioning technology at relatively low prices. Additionally the introduction of easy to use instruments means that positioning tasks may be undertaken in the field by personnel with limited professional knowledge of survey techniques.

The only disadvantage inherent in these developments is that users are faced with a wide array of options regarding equipment, methods, performance and prices. Making the wrong choices can result in work not being performed to specification or investment exceeding that which is necessary.

This article addresses some of the factors to be considered when evaluating GPS options, namely: **accuracy, method, ease of use, price.**

## 1. Accuracy

GPS is used to determine location. The accuracy of this determination depends on the type and quality of equipment used and the circumstances at the time of data collection. While it is important that the final data

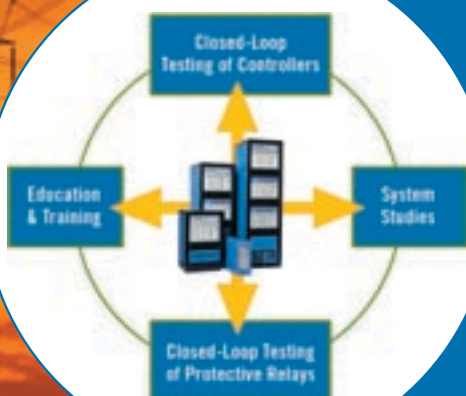


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quality should be within specification, it is also important to ensure that no more cost and effort is expended than necessary to meet the specifications reliably.

There are varied definitions of accuracy, these include: 'Average' - not very useful unless the user intends to take a large number of readings on location; 'SEP' and 'CEP' (Spherical and Circular Error Probable) - the radius of a sphere and circle respectively within which 50% of readings are expected to fall; and statistical models based on combined linear errors such as 'drms' (~ 65% of readings) and '2drms' (~ 95% - 98% of readings). When analyzing accuracy claims it is important to be aware of these differences. Those that incorporate the largest amount of data points (2drms or 95% level results) reduce the risk of the user experiencing unexpectedly large errors in the field. 'Average' and CEP readings are less useful with regard to estimating worse case conditions.

Real time horizontal accuracy at the 95% level varies from ~ +/- 10 meters with a low cost uncorrected single frequency receiver, through < +/- 1 meter with a good quality single frequency receiver using good quality differential corrections, to sub centimeter with a carefully deployed dual frequency RTK set-up using a local reference point. The price of equipment ranges from a hundred dollars or so through several thousand dollars to over fifty thousand dollars as you move through these options.

Accuracy on the vertical axis is normally ~ 2 to 3 times less good than on each horizontal axis due to the satellites required for good vertical measurements being shadowed by the earth.

Local conditions can also effect accuracy. Signal blockage from trees and buildings will reduce the positioning information available. Multi-path effects, where GPS signal reflections result in erroneous range measurements, degrade the quality of the fix, and the continuously changing satellite geometry means that at times the geometry of the satellites is less than ideal. Generally speaking, now that the full constellation of GPS satellites is deployed, satellite geometry only becomes an issue when operating at the very highest levels of GPS accuracy.

## 2. Method

GPS data collection and processing may be broken down, very broadly, into two categories - position information may be derived in real-time or through post-processing.

The advantages of real-time positioning are: the increased likelihood of errors being detected in a timely fashion, the reduction of man-hours required to post-process data, and the ability to 'navigate' while undertaking the work.

The most basic real-time operations can be undertaken using uncorrected GPS. Accuracy is likely to be in the +/- 8 - 12 meter range depending on the quality of GPS receiver. There is little advantage to using a high quality GPS receiver for these kinds of operations.

For greater accuracy a differential correction is required. These may be obtained by using a dedicated reference station and radio link; government funded signals (the Coast Guard Beacon system or the satellite broadcast WAAS system), or commercially provided correction services.

Accuracy results range from ~ +/- 5 meters with a relatively low cost hand-held unit used in conjunction with the WAAS system, to sub meter results when a high grade instrument is used in conjunction with a dedicated reference station or satellite broadcast commercial corrections.

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Very high levels of real time accuracy (potentially sub-centimeter) can be achieved using dual frequency receivers (one as a local reference) and a high speed data link. This technique, known as Real Time Kinematic (RTK) is relatively expensive and, due to the potential for error, requires knowledgeable operators.

Most recently, a new wide-area high accuracy service, which fills the gap between sub-meter L1 DGPS and sub-centimeter RTK, has been introduced. This less expensive and relatively easy to use method is uniquely achieving real-time accuracies of better than +/- 15cms at the 95% level without the need for a local base station or radio data link.

Post processing can provide higher levels of accuracy for less capital investment in equipment and is normally employed if longer occupation times are required when absolute maximum accuracy is the goal. Reference data may be collected simultaneously using a second receiver, or may be downloaded from publicly available sources such as the NGS CORS system or Community Base Stations.

### 3. Ease of Use

Not surprisingly, the more accuracy required, the more sophisticated the method that needs to be employed, and the more complex the operation becomes.

The use of uncorrected hand held devices is relatively straightforward. With the addition of real time correction data it becomes necessary to monitor the availability of the correction data and the fix quality to ensure results remain within specification. Loss of individual GPS satellite signal or differential correction data due to blockage may have an impact on the quality of the position.

One advantage resulting from the removal of SA in May of 2000 is that the rate of change of the remaining GPS errors is much slower and differential corrections remain valid for a much longer period than when SA was on. Loss of corrections for a few minutes should no longer be a problem provided sufficient GPS satellites remain in view.

Using a commercial differential correction supplier is less burdensome than operating a dedicated base station and, unlike the government correction services, technical assistance is available on demand to help with field operations. The new high accuracy services should also be of benefit for operations where the accuracy requirement cannot be met by ordinary sub-meter DGPS. Hitherto this has meant using dual frequency RTK methods, which are particularly challenging. The reference site must be properly positioned on an accurate survey point, the radio link should be such that there is an uninterrupted data stream, initialization and signal tracking must be monitored to avoid 'cycle slips', and range limitations apply.

Less hardware is required for post processing operations. However, savings in equipment costs need to be measured against any extra time required in the office for post processing. Also, although real time work requires the operator to keep a careful eye on things, field errors in post processing operations can be even more costly. If data is found to be below specification after collection it is costly, and may even be impossible, to deploy equipment for a repeat of the data collection phase.

### 4. Price

Price of equipment, and the costs associated with collecting and processing data, tend to increase directly in proportion to the quality of position data required.

The most basic handheld units are of the order of US\$ 100 and can be taken into the field by a lone operator.

A complete RTK system may cost in excess of US\$ 60,000 and requires much more sophisticated set-up and monitoring. However, it still allows for high accuracy data sets to be obtained more efficiently than with traditional survey methods.

Position information can be obtained with less equipment by using post processing techniques but there will probably be additional costs associated with the extra time required to manipulate the data.

The encouraging news is that, generally speaking, equipment costs are continuing to come down and the new GPS correction services are allowing for higher levels of accuracy to be achieved in real time at less cost and with less effort.

### Summary.

GPS is an enormous benefit to any organisation requiring position information for mapping, asset positioning, etc. If accuracy requirements are stringent then it is not recommended to try to complete the work with insufficient investment in technology. Now that SA is no longer applied to the GPS signal moderate accuracy (~ +/- 8-10 meters) can be achieved with minimal investment. At the next stage, thanks to new services and developments in differential techniques, interim levels of accuracy (sub-meter and sub-decimeter) are becoming achievable in real time without the need to go all the way to the most expensive RTK systems. However, these systems are still required for sub-centimeter work. ■



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# Austin Energy Builds Better Distribution System With Steel Poles

## Texas utility finds steel offers strength, aesthetics and customer satisfaction

By:  
Dan Snyder  
Manager Business Development  
American Iron and Steel Institute



Photo A

Just over a decade ago, Austin Energy — a municipally owned utility serving 364,000 customers in central Texas — turned to steel distribution poles when searching for an innovative and cost-effective solution to a tricky technical distribution problem. Their positive experience with steel convinced the Texas municipal utility to try the “new material” in other applications. Today, 90 percent of all new major power distribution projects at Austin Energy include steel poles. A cost analysis confirmed that Austin Energy has saved time and money with steel while increasing its system’s reliability.

In the late 1980s, the city of Austin, Texas was in a period of explosive growth, booming with the birth of new technology companies and the dot-com rush. To support this growth, new construction was everywhere. New highways were being built and existing ones widened. These roads were leading to new businesses and residential developments that would need electric power — and the pressure was on Austin Energy to deliver.

According to Jeff Padavick, Austin Energy’s Superintendent of Transmission and North Distribution, Austin’s booming economy and its burgeoning infrastructure led to the initial use of steel poles in the Austin Energy distribution system.

“At that time, we were using a three-pole wood structure to turn angles,” Padavick explains. “We couldn’t use side guys because the state required us to be within the designated assignment of right of way, and our commercial customers didn’t want to give up any more right of way than was absolutely necessary.”

He adds that the company’s typical three-pole wood installation was a headache in other ways. It congested business access, its construction and maintenance was labor-intensive, and the multiple-hole excavations and guy anchor installation increased the chances of underground utility conflicts.



Photo B

"We had to come up with a solution to turn these angles without all the poles and hardware," he says.

Padavick recalls it was then that a steel representative came to the utility with an idea. "He showed us a steel product designed to replace our three-pole structures, or our side guyed wood poles, that could turn angles on distribution-type loading. We decided to research the product and give it a try."

The utility first used light-duty weathering steel structures in the early 1990s in various 'test' applications. A cost-benefit analysis of the structures was performed to help determine if steel was a suitable distribution-pole material for Austin Energy.

## Time and Labor Savings

"We conducted a business justification, reviewing the total installed cost of the three-pole wood structure including materials, anchoring, hardware and labor, and compared it to that of the one-pole steel structure," says Padavick. "Our analysis found that we significantly reduced the time it took to install the structure, and showed anywhere from 50 percent to 73 percent savings on labor on the initial installations."

Specifically, the labor cost to install the steel pole structure was 64 percent less than the wood. The material cost for steel was 15 percent less even with the higher cost of the steel pole we were able to show a cost savings.

Economic analyses of other Austin Energy applications provided further evidence that integrating steel poles into its system was a very cost-effective practice. For instance, labor costs were 73 percent less for a double-circuit 795 steel pole application this analysts is based on using one steel pole instead of three poles and anchors to turn angles. The material costs were 43 percent lower.

## Reliability and Longevity

With this positive report on the financial advantages of the steel distribution poles, the company decided to move ahead in other areas with steel poles.

Standardized drawings were developed early on to expedite engineering and pole delivery, as was a standardized unguyed angle load chart for distribution design function.

"We started looking at using steel distribution poles in our highway crossings," says Padavick. "We had one crossing that failed when a wood pole was struck by lightning, and some conductor lines were dropped across a major highway. This was not an experience that Austin Energy wanted to repeat."

After this incident, the utility made the decision to change many of its primary highway crossings to steel. "We were looking for longevity and reliability with these structures, and for a pole that wouldn't deteriorate in the event of lightning," he says.

"We retrofitted our highway crossings with 70-foot steel poles to support the longer spans that crossed them. At this height, the poles

maintained clearance over multi-level highways. They were also comparable in cost to wood poles of the same height."

The Texas municipal utility has also found steel poles effective in a variety of other applications. For instance, light-duty poles have proven to work well in multiple-pole installations that are curved; alongside freeways with limited easements; or in situations requiring multiple unguyed turns. Padavick adds that the weathering steel poles are ideal as replacement poles in established neighborhoods, as the pole "blends right in to the existing line."p

## Aesthetics is a Selling Point

According to Padavick, the aesthetics of steel poles has proven to be a major selling point. "We've enhanced our distribution system by including galvanized and weathering tubular steel poles as wood-pole equivalent replacements." He explains that customers in locations such as residential areas and commercial business parks are now concerned with curb appeal as well as reliability. With steel poles, Austin Energy can offer options to its customers.

"Weathering poles tend to blend better in a wood pole environment because of rustic brown color scheme," explains Padavick. "We also get requests for colored poles from our customers. In these cases, we paint over galvanized steel — brown, green or even other colors — and the customer covers the painting costs."

The veteran transmission-and-distribution superintendent says that having the option to use galvanized steel poles has made it easier to obtain permission to install a distribution project alongside a road right-of-way in a commercial area. "Historically, we would have to put the wood poles in the rear property of a business, which creates a maintenance nightmare," he says. "Because galvanized steel poles are more aesthetically pleasing to these customers we're able to place the project next to the street."

Padavick cites two examples in Austin Energy's service area where the aesthetics of steel poles made a significant difference in customer satisfaction and cost savings for Austin Energy.

One such installation was at Steiner Ranch, a recently constructed residential development located in the hill country just west of Austin. Before installing a project in the area, Austin Energy made an agreement with the developer to use weathering steel distribution poles along the road.



"We were able to install the distribution line — matter of fact, double circuits — and avoid going into the canyons," Padavick recalls. "Yes, it was initially more expensive, but the ability to access those poles easily will be far better for our line crews in the long run. If we had used wood in that location, we would have had to install the distribution poles in an area much harder to access, and at a greater maintenance cost in the future. It's very difficult — and time-consuming — to change out any pole in the rear easement, especially in a hilly area."

In another example, Austin Energy saved money by not having to go underground with the utility lines. "The commercial residents of one of Austin's business parks did not want poles installed along their road, which was already outfitted with galvanized streetlight standards. So we went back with galvanized steel distribution poles that were 65 feet tall — which were 20 feet taller than the street light standards — and the commercial customers were completely satisfied. Today, the residents probably don't even notice they're there," he says.

## Austin Energy's Linemen Adjusted Well to Working with Steel

Steel poles are now a standard part of Austin Energy's distribution system, and the utility's highly trained linemen are well adjusted to working with the different types of poles.

Padavick explains that understanding the conductive nature of a steel pole as compared to a wood pole was a primary concern at first for his linemen. "Working with a live line was one of the big hurdles we encountered with learning to use steel poles," Padavick says. "Basically, we just made some procedural changes in the way we handle them. We cover more conductors and cover the pole, and our linemen always wear the proper safety gear when working with wood or steel. We do this because we're setting the steel pole in an energized conductor. Granted we could try to de-energize the line, but it takes more time and more money."

He adds that responding to trouble calls without climbing a pole was another issue raised by Austin Energy linemen at first. "The guys were unsure how they could work if they couldn't climb the poles," Padavick says they arrived at a fairly simple solution. "Typically we put the steel poles in locations where we can always use bucket trucks. This means we don't need to step them, which saves us money. However, we do have a few steel poles that are stepped for special situations."

## Configuring the Right System Takes Time

Padavick says that integrating the steel poles into the utility's distribution network has been a positive learning experience. "It took us about five years to figure out the best configuration for our system," he says. "We continued to use our standard hardware, but made sure that we had the correct insulation properties. We added fiberglass deadend arms, fiberglass three-eared-arms, the correct insulators, and fiberglass ridge pins."

Whether or not the poles are delivered pre-drilled depends entirely on the project at hand, he adds. "Each framing configuration is unique. We may drill in the field or in the air, or order pre-drilled poles," Padavick adds. "When we drill, we use a bigger, beefier heavy-duty drill to get through the thicker-plated structures (over 9/32). On the lighter tubular poles, we just use a regular 1/2-inch power drill."

## Planning Ahead

Austin Energy typically orders steel poles by the project, which means careful and detailed advance planning. "We work with the transmission-and- distribution design team up front, which allows us to know exactly what is required in an installation, and by when."

"Today, we typically order poles in five-foot increments, and usually as a two-piece pole if the pole is over 70 feet. This allows for easier transport to the job site, and no permit is required," he explains. "And in some cases steel poles are lighter than the wood pole of the same size, which makes them easier to handle."

The Texas municipal utility stipulates in its contracts that steel pole suppliers deliver the steel poles between six and ten weeks after the order is placed, depending on the type of poles ordered. There is little worry about the need for a large storage facilities, as a majority of the steel poles are taken directly to the installation site. "We utilize a small lay-down yard just for steel poles. This helps us keep excess stock on hand for emergencies and rush jobs," Padavick says.

He adds that the variety of readily available steel poles has improved Austin Energy's engineering and construction response time on unscheduled and maintenance projects.

## A Good Move to Steel

Padavick concludes that the move to add steel to Austin Energy's rapidly growing distribution system has been a good one. In fact, he says there are those who would like to see nothing but steel in

their system. "We get a call from environmental groups at least once a year asking us to use 100 percent steel. They are well aware that steel eliminates the use of preservatives and is recyclable."

"I know that our utility will always have wood and steel in its distribution system," he adds. "And the more options we have, the better. Today, steel is installed where it makes the most sense — for strength and for aesthetics — and I'm sure this will continue. Steel has helped Austin Energy build a better distribution system, solve problems and save money, all at the same time."

## About the Author

Dan Snyder is the manager of business development for the American Iron and Steel Institute (AISI), a non-profit association of North American companies engaged in the iron and steel industry. AISI comprises 35 member companies, including integrated and electric furnace steelmakers, and 145 associate and affiliate members who are suppliers to or customers of the steel industry. For more news about steel and its transportation/infrastructure applications, visit [www.steel.org/infrastructure](http://www.steel.org/infrastructure). ■

## Captions

**Photo A:** Today, 90 percent of all new major power distribution projects at Austin Energy include steel poles.

**Photo B:** Jeff Padavick, Austin Energy, Superintendent, Transmission and North Distribution



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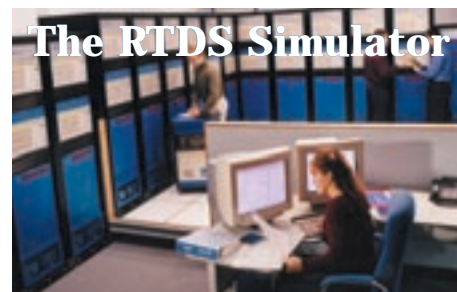
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