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Publisher:
Steven Desrochers: steven@electricenergyonline.com

Editor in Chief:
Mike Marullo: mam@electricenergyonline.com

Contributing Editors
William T. (Tim) Shaw, PhD, CISSP
tim@electricenergyonline.com
Gregory K. Lawrence, Partner; McDermott Will & Emery LLP
glawrence@mwe.com

Advertising Sales Manager:
Jimmy Desjardins: jimmy@electricenergyonline.com

Art Designers:
Anick Langlois: alanglois@jaguar-media.com

Internet Programmers:
Johanne Labonte: jlabonte@jaguar-media.com
Sebastien Knap: sknap@jaguar-media.com

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E-mail: jaguar@jaguar-media.com
Web: www.electricenergyonline.com

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Electric Energy T&D MAGAZINE

Michael A. Marullo, Editor in Chief

Innovation – Not Longer Cords!

When the telephone industry needed to address the rising sense of fashion in post-WWII America in the late 1950s, their initial response was epitomized by Ma Bell's introduction of the *Princess and Slimline* telephones – available in alluring pink and other pastels for the very first time as an alternative to basic black. Some years later, however, growing consumer demand for greater mobility was becoming increasingly problematic for an industry struggling to move telephones from their practical-and-reliable but clunky-and-boring image to something more hip and appealing. Their answer to that challenge was more colors, more shapes and sizes – and longer cords.

So after decades of being tethered to a 6-foot radius of the handset, now you could actually walk into another room without having to hang up and call from another phone or switch to a different extension. Aha, freedom at last, right? Well, not exactly, but at the time it was a refreshing change and one that was widely embraced as a huge technological breakthrough by consumers that had grown accustomed to an ugly, black and relatively stationary instrument.

Fast forward about 30 years or so, and we found ourselves still fairly limited in our ability to communicate, despite a surging need for better, faster and more efficient methods and media across a rapidly increasing calling circle. People moved around more, businesses globalized and communications moved from convenience to necessity, all in a few short decades. But this time the response was something that almost no one could have imagined 40 years earlier: Cellular Telephones. And as good as longer cords were in their day, cell phones created a whole new genre for communicating. Whereas fax machines were cool, cell phones went far beyond just being cool... to being crucial.

The point here is that we can't solve the energy crisis – or even most of the surrounding issues – by thinking in traditional terms and putting a new color or a different flavor of frosting on the cake. Indeed, most of what we read and hear today about "solutions" like clean coal, hybrid cars, renewables and so forth is stuck on old ideas masquerading as new ones. They seem to all be asking, "Is it my turn yet?" Is it time for solar to be economical? Is it time for fuel cells to be scalable? Is it time for electric cars to be viable? Is it time for wind to be taken seriously? Is it time for nuclear to be acceptable?

Can you name one of the above (or scores of other) technologies that you haven't heard something about for at least 25 years or more? I really doubt it. They're all old news in a shiny new package, but inside there's really very little, if anything, that's truly new. And in my opinion, NEW is what we need. New thinking, new ideas, new innovations and new solutions – not just retreads of arcane ideologies, many of which have already run their course yet somehow simply refuse to die.

For example, ethanol comes to mind. It has been rather thoroughly proven that despite having a marginally viable role as a fuel supplement, there simply isn't enough real estate anywhere – except perhaps in Brazil – for ethanol to serve as a replacement for our still growing dependence on fossil fuels. And when all of the costs (i.e., including production, environmental impact, etc.) are taken into account, in most cases ethanol isn't a financially sound proposition either.

I don't mean to beat up on ethanol here, however; that misses the point. The point is that we need to stop thinking small and traditional and start thinking big and creative. If the problem is transmission congestion – which is certainly a big one – then let's stop thinking about how to build bigger, better more reliable transmission lines (which, by the way, you might have heard no one wants in their backyard, in their neighborhood, in their cities or in their wilderness areas!), and let's start thinking about how we eliminate the NEED for transmission lines altogether. Sound far-fetched? Well, not really...

There are now several companies with products at various stages of development that do not rely on transmission lines at all. Sometimes called "nuclear batteries," these devices are the ultimate distributed energy resource with the capacity to power hundreds – or even thousands – of homes and businesses with a generation module the size of a hot tub. Some are scalable and can be made even smaller, using a modular building block form factor to scale up or down to meet load requirements. Companies like Hyperion Power Generation, NuScale Power Generation and Bloom Energy (the latter being creator of the "Bloom Box") are just a few examples of really thinking outside the box – way outside the box! Using various forms of high-powered sealed battery units, some of which operate on a new kind of nuclear fuel called uranium hydride, these companies have developed power cells that actually do their thing *inside* the box.

Let's call it an iReactor (Gee, I hope Apple hasn't trademarked that yet!), a small (personal?) nuclear reactor that you can bury in your backyard. Or, in the case of the Bloom Box, plunk it down in your front yard and plant a few bushes around it! And guess what? You don't need a complicated, expensive transmission system to wheel bulk power around. You just put more or bigger units at the existing distribution substations or at the individual customer premise and voilá – no transmission lines required!

I'm not suggesting that nuclear batteries are the panacea to the energy crisis, but they do represent a new way of looking at things that is radically different from traditional thinking. And I really feel like that's not only what we need but it's the kind of thinking that will eventually get us out of the mess we're in. As the old saying goes, "Desperate times call for desperate measures." But while I wouldn't classify nuclear batteries as desperate, I do believe that solving the energy crisis will require something very different – and making longer cords won't cut it. – ***Ed.***

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Industry NEWS

CURRENT Group and Beckwith Electric Partner to Deliver Grid Optimization Solutions to Blue Grass Energy

GERMANTOWN, MD, NORTH LARGO, FL, NICHOLASVILLE, KY – CURRENT Group, Beckwith Electric and Blue Grass Energy announced today that Blue Grass Energy has selected Smart Grid technology partners CURRENT and Beckwith Electric to demonstrate integrated Volt/VAR Control and Dynamic Voltage Optimization solutions that will enable Blue Grass Energy to reduce technical losses, optimize feeder voltage profiles and reduce system load through advanced voltage optimization automation.

The CURRENT and Beckwith relationship leverages the extensive experience of two leading technology providers to deliver turnkey solutions that unlock the full operational and economic power of a smart electric grid. Blue Grass Energy is a member of the National Rural Telecommunications Cooperative (NRTC), which is also sponsoring the project by providing funding and technical resources.

CURRENT will be providing its intelligent grid sensors and its OpenGrid™ software platform that features Volt/VAR Control and Dynamic Voltage Optimization using Dynamic Measurement and Verification through a real-time power flow and grid state estimation engine. The CURRENT® applications will utilize Beckwith Electric's industry leading regulator controls and capacitor bank controls to enable command and control of distribution system devices.

"CURRENT and our partners are pleased to be selected by Blue Grass Energy to deliver a market-ready hardware, software, analytics and communications solution that allows Blue Grass Energy to leverage their distribution grid to reduce energy consumption by 3 to 5 percent," said Tom Casey, CEO of CURRENT.

"By leveraging strong relationships with industry leaders such as CURRENT Group, Beckwith Electric, and NRTC, we are in a strong position to continue to deliver market-leading state-of-the-art intelligent distribution solutions to utilities such as Blue Grass Energy that help them cost effectively and quickly deploy Smart Grid today and realize ongoing benefits to consumers and the environment from these investments for years to come," said Tom Beckwith, CEO of Beckwith Electric.

"Blue Grass Energy is looking forward to working with CURRENT Group, Beckwith Electric, and NRTC as we develop our Smart Grid infrastructure. They are leading providers in their respective domains and have come together to deliver Blue Grass Energy an integrated solution that meets our business requirements for affordability, easy deployment, fast payback and demonstrable results surrounding the true benefits for distribution Smart Grid investments," said Dan Brewer, Blue Grass Energy President & CEO.

"Grid efficiency through reduced losses and voltage regulation can create significant value for our member electric cooperatives and their consumer members," said NRTC President and Chief Executive Officer Bob Phillips. "NRTC looks forward to working with Blue Grass Energy and the other project partners to make this deployment a success and share the results with our members," he continued.

The integrated CURRENT and Beckwith grid optimization solution being piloted at Blue Grass Energy is designed to be rapidly deployable and can be deployed on a substation by substation or application by application basis or as an enterprise wide solution in both the Public Power and Investor Owned Utility market segments.

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Vital New Legislation Creates Green Jobs and Puts California in Forefront of Future Smart Electric Grid

Attorney General Jerry Brown and Assemblymember Nancy Skinner Introduce AB 2514 to Make the Smart Grid a Reality with California Becoming Leader in Clean, Cost-Effective Energy Storage

Berkeley, CA – Assemblymember Nancy Skinner (D-14), Chair, Committee on Natural Resources, working in partnership with California Attorney General Edmund G. Brown Jr., has introduced AB 2514 new legislation that will create a smarter, cleaner electric grid, increase

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the use of renewable energy, provide Californians with significant savings by avoiding costly new power plants and transmission lines, and reduce air pollution. This transformative legislation will also create thousands of permanent new green-collar jobs.

AB 2514 will achieve these benefits by closing the gap between the United States and other nations in investments and deployments of energy storage, a booming "green" industry that represents a significant economic development opportunity for California.

By mandating that utilities incorporate energy storage capacity – 2.25% of daytime peak demand for power by 2014 and 5% of peak demand by 2020 - the bill will provide much-needed lower electricity costs to consumers. Greater use of energy storage will provide the State with a cleaner and less costly alternative to the high costs of generating and supplying primarily fossil fuel-based power for only part-time daytime peak demand for power.

"Energy storage is the future – it's a fast-growing clean technology industry that will save the state money and reduce pollution," said Attorney General Jerry Brown, the bill's sponsor. "What's even better is that this new technology could create 8,500 new jobs in California during the next decade."

"We applaud Assemblymember Skinner and Attorney General Brown's leadership in introducing this essential legislation. This bill will put California at the forefront of a growing global market that will spur economic development. Given major advances in energy storage, the industry is now ready to provide high-technology, affordable, reliable products for California's utilities and consumers," noted Janice Lin, Director of the California Energy Storage Alliance.

Currently, California uses fossil fuel-burning backup power plants, as well as coal-fired power imported from other states, to help meet its relentlessly growing demand for daytime peak power. This is costly, inefficient and harmful to California's air quality. Wider scale deployment of clean, cost-effective energy storage will enable California to reduce pollution from greenhouse gases and smog-forming nitrogen oxides (NOx) by reducing the need for fossil fuel-based peaking power plants and imported coal-fired power. Further, energy storage will increase the value and use of intermittent renewable power such as wind and solar, which often relies on fossil fuel-based backup power. However, California is lagging behind other states in energy storage deployment. AB 2514 is available at: www.leginfo.ca.gov/pub/09-10/bill/asm/ab_2501-2550/ab_2514_bill_20100219_introduced.pdf

Energy Storage

Cost-effective and commercially ready energy storage is a key part of the newly emerging smart grid that will transform California's electricity grid into a modern, clean, sophisticated network fully integrating renewable and distributed power sources. Modern energy storage technologies, some in existence for decades and covering a wide range of sizes, power capacity, and discharge durations, include mechanical, chemical and thermal processes for storing energy for use at a later time. Energy storage has attracted significant investment capital and federal stimulus funding, with recently announced projects representing nearly 1,000 megawatts of new capacity. This will more than double the current installed capacity of energy storage.

The California Energy Storage Alliance

The California Energy Storage Alliance is an association of companies committed to the rapid expansion of energy storage to promote growth of renewable energy and a more reliable and secure electric system. Its members include a diverse group of companies ranging from electro-mechanical, electro-thermal and electro-chemical storage companies to system integrators and renewable energy component manufacturers and developers. (*www.storagealliance.org*).

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Bluetooth SIG Brings Bluetooth Wireless Technology to the Smart Grid
New Study Group Formed to Examine Use of Bluetooth® Wireless Technology in Smart Grid Development

Now more than ever, technology is paving the way for the formation of clean energy initiatives including the Smart Grid. As this efficient, intelligent delivery of energy evolves, users and utilities will enter into a two-way communication model that will allow smart meters to provide real-time energy consumption data directly to the user for up-to-date monitoring. The next step in this clean energy initiative is to identify the importance and increase the use of wireless technology, specifically Bluetooth technology, which would allow users to remotely monitor and control their energy use.

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In order to achieve this next step and much more, the Bluetooth Special Interest Group (SIG) announced on February 24 the formation of the Smart Energy Study Group. The team, made up of three sponsoring member companies including CSR, Broadcom and Emerson, will work together to address Smart Energy initiatives sponsored by governmental entities and other organizations interested in energy management throughout the world.

"With the formation of the Smart Energy Study Group, the Bluetooth SIG and its member companies will work together to tackle Smart Grid technology and increase the presence of Bluetooth technology in this fast growing industry," said Michael Foley, Ph.D., executive director of the Bluetooth SIG. "Wireless technology is a key component of the battle to improve the Smart Grid. With proper short-distance wireless connectivity technology, the meter-to-device relationship will be one that allows users to remotely track, monitor, and adjust their energy use based on utility scales."

The Smart Energy Study Group will begin immediately studying all aspects of the smart energy market and possible implications of Bluetooth technology in this arena. To do this, the group will review current available information on Smart Grid wireless technology, formulate a strategy for Bluetooth Smart Energy and make recommendations based on their findings.

Why Bluetooth Technology for the Smart Grid

Bluetooth wireless technology maintains a significant lead in wireless technology penetration in mobile phones – the chosen device for remote monitoring and control of smart grid meters. With the recent adoption of Bluetooth low energy wireless technology, manufacturers of in-home meters and monitors will be able to build wireless devices that run on button-cell batteries and still utilize all of the benefits Bluetooth technology has to offer.

"The formation of the Smart Energy Study Group will bring to light and expand the impact that Bluetooth technology will have on the clean energy industry," said Foley. "We have the opportunity to make a difference in the way our country and the world controls energy use and it's imperative that we do all we can to integrate wireless technology into the mix – it will not only benefit the wireless market, but it has the potential to revolutionize the clean energy market as well."

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The 2010 Automation/IT Leadership Series

R. Blake Young
President/CEO

Arthur "Bud" Vos IV
CTO/Vice President-Strategy

Comverge

Norcross, Georgia USA

Comverge was founded as a merger of utility technology groups from Scientific Atlanta, Lucent/Bell Labs, and PowerCom. The company greatly expanded its real-time and web-based product offerings with its acquisition of technology company Sixth Dimension in 2003. Today, 15 patents and more than a decade later, the Comverge business model for Demand Response (DR) offers utilities all elements of a "smart megawatts" program – from participant recruitment to measurement and verification.

Over the years we've seen Comverge blossom from its 1999 acquisition of Scientific Atlanta's controls business through a continuing regimen of organic growth, acquisitions and product/service development. The appointment of Blake Young as President/CEO just last month marks a new chapter in the Company's evolution. Together with Bud Vos, Chief Technology Officer and Vice President of Strategy, we take an in depth look at one of the industry's most consistent innovators and market leaders. – ***Ed***.

EET&D: First, I want to thank you both for taking time to share your views of the electric utility industry and the demand response marketplace with our readers – and especially you, Blake, since you have just recently taken over the reins of Comverge. So maybe a good starting point would be to briefly visit the mission, goals and objectives of Comverge as relates to the electric utility industry in general and the power delivery marketplace in particular.

Young: Even though these are early days for me, I appreciate this opportunity to address your readers across the industry because I think this is a pivotal point in the evolution of both the industry and our company. The evolving Smart Grid represents an extraordinary opportunity for companies that understand how to create value from the unprecedented increase in sophistication, which we are and will continue to see. The ongoing investment in the implementation of the Smart Grid is providing the foundation for renewable energy frameworks, efficiency and conservation programs of the future – and we have only scratched the surface – so this is excellent news for us and also for the industry. To take advantage of this dynamic market opportunity, my core objective is to continue to refine our leadership position as the premier provider of mass market DR solutions.

EET&D: In reading over the resume posted in your appointment release, I noticed that you're a Louisiana State University graduate, so as a longtime Louisiana resident myself, let me say this: Geaux Tigers! But on a more serious note, I also see that you've been a Comverge board member since 2006. How will your background help you to achieve goals and objectives as its President and CEO?

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Young: My relationship with our board is excellent, and having the advice and counsel of Michael Picchi, who served as the interim President and Chief Executive Officer for the past eight months, will be invaluable to me as we make this transition. And, besides joining our board, Mike will also continue in his role as Executive Vice President and Chief Financial Officer, so that's important to our business as well. Earlier in my career I also served as the president and COO of Illinois Power Company, Dynegy's electric and gas transmission and distribution company, so I feel like that experience combined with my time on the board have uniquely prepared me to take on this exciting new leadership role.

EET&D: Do you have any immediate plans for changing the posture or position of Comverge in the marketplace, either organizationally or from a products and services perspective?

Young: Over the past two decades, Comverge has developed a rich portfolio of innovative clean energy solutions, expanding customer relationships and team of more than 400 employees, all of which provide a solid foundation upon which we can continue to build the company and our customer base. Our innovative technology and reliable demand management advice comprise the fundamental tools and resources we need to successfully serve utility and C&I customers in today's Smart Grid evolution. I'm confident that by continuing to leverage these strengths we can keep accelerating our growth as we drive towards profitability, so I cannot see any reason to change that strategy at this point.

That said, you'll see us put some serious muscle behind our Apollo DRMS software, which we recently announced to address emerging customer requirements. This enterprise-class software offers a unified solution for the integration challenges our customers are wrestling with as a result of the evolving Smart Grid infrastructure. It provides them a solution that will not only link legacy utility applications with their new smart meter and communications networks, but will provide them with a platform to support all of their complex programmatic needs going forward.

EET&D: Before we proceed, I think we should probably clarify some terminology that is often confused. Demand Response is similar to what we used to call Load Management, so perhaps we should begin by briefly explaining the fundamental differences between the two?

Young: Sure. What we generally refer to as a Demand Response Management System – or DRMS – involves new and advanced features that will help keep pace with the momentum being brought about by Smart Grid initiatives. Some of the differences between Load Management and DRMS involve greater use of open standards; millions (i.e., as opposed to thousands) of endpoints under management; two-way communications and verification; and integration of the AMI-Smart Grid network with utility back office systems.

EET&D: Comverge has had quite a ride since heading down the DR path, and I'm quite sure you've had to blaze some new trails along the way. The part of the business model for service bureau companies like yours that always puzzles me is how you show prospective customers that DR is a good deal for them, both operationally and financially, regardless of their size. How much does the scale of a given project figure into that value proposition?

Young: Scale is indeed an important factor, but not the only one. Today, we have about 500 U.S. utility clients and over five million devices deployed throughout North America. This client base includes utilities from all areas of the country, from small towns to big cities, border-to-border and coast-to-coast. We're committed to growing these programs into the future, developing cutting edge technologies and cost-effective solutions to increase grid reliability and reduce costs to the utility and, ultimately, consumers as well.

But whether it's for a 2-megawatt system or a 400-megawatt system, the successful and cost-effective launch and operation of any DR program depends heavily on experienced professionals implementing best practices throughout the process. As Comverge provides the technology and support for new programs across the country, we have realized the efficiencies and levels of expertise that can be gained by utilizing a "matrixed" project team simultaneously operating multiple programs at once. This concept engages professionals from RF communications engineers to marketing specialists to statisticians to installer trainers to quality control inspectors for each and every project, regardless of size or scope. Bud can probably add some additional detail here…

Vos: There are hundreds of factors that can influence the scalability of a DRMS system, ranging from the hardware to the communications network and even into the design of the application protocol. They all impact how the system must behave in order to deliver messages to the end devices reliably, efficiently and at an acceptable cost. Similar to the problems the industry has seen in transmission and control operations, AMI systems needed to work on the scalability of consuming communications from endpoints over a controlled communications network. The DRMS scalability problem is based on sending commands and controls to endpoints over a communications network – one that is not managed by the DRMS itself.

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Young: Yes, and all of these issues point to the necessity for longevity in the electric utility industry, as well as experience in, and knowledge of, DR technology. While many of these issues will take years to come to resolution, a customer/vendor relationship that is built on a partnership approach will best facilitate viable and proven solutions and allow the objectives of the supplier and the customer to be better aligned.

EET&D: What are the main drivers for utilities and their customers to embrace DR?

Young: With energy consumption concerns escalating, companies across all sectors are looking to incorporate elements of clean energy into their power portfolios and implement conservation programs; demand response answers both needs by enabling participants to choose to reduce energy usage during peak hours in exchange for reduced rates or rebates. This reduced demand is an excellent alternative to purchasing or producing expensive peak generation, not only helping to keep electric rates down, but reducing the generation of carbon emissions during those times.

DR programs have proven to be environmentally friendly, effectively eliminating the need to build new generation resources to mitigate peak load situations. Today, these programs can be customized to suit individual needs using only proven hardware, software, and integrated services – all essential ingredients in the success of DR initiatives. In our case, we provide a primary DR solution based on a turnkey, pay-for-performance model that is applicable to all customer classes, from residential to commercial and industrial.

EET&D: What kinds of companies are embracing DR, and what kind of acceptance have you experienced so far in this still evolving market niche?

Young: Comverge presently has 3,300 megawatts of contracted capacity across all customer classes. For our C&I customers, we provide advanced metering and monitoring products and an advanced network operations center capable of monitoring load and tailoring demand in real time. For our utility customers, we provide solutions – turnkey hardware, software, and services to allow them to remain at the forefront of providing reliable electricity to their customers. Our turnkey packages, consisting of multiple services, hardware and software, are the only integrated, comprehensive solutions available today that allow for real-time demand management and reduction across all customer classes. We assume all of the program's performance risk, and our clients pay only for the verifiable capacity we provide, thus, creating a no risk, win-win solution for utilities and their customers.

EET&D: Security – especially data security – is an issue that comes up a lot these days and for good reason. The more information we gather, handle and store, the more we invite new opportunities for security breaches and unwanted exposure. What role does security – both physical and cyber – play in the grand scheme of things for DR, where literally millions of data points are being collected, manipulated and stored?

Vos: As a provider of critical capacity to hundreds of utilities and their customers, Comverge takes security and network operations very seriously. Comverge's state-of-the-art servers are housed in Class 1 data centers at geographically dispersed locations across the country and provide the most secure and reliable communications links available today. Our servers are proactively monitored through our data network operations center, ensuring our programs operate as expected regardless of circumstances. In addition, we continuously monitor and test inbound and outbound signals to resolve potential issues before they occur.

EET&D: Blake, I'll leave the last word to you: As you know, a lot of stimulus money has been made available by the federal government through the American Recovery and Reinvestment Act to help ignite and accelerate energy conservation and efficiency initiatives, including DR programs. In closing, what's your take on how and when the effects of these funding programs will materialize in the marketplace and what impact, if any, you think it will have on adoption rates for these kinds of programs?

Young: The American Recovery and Reinvestment Act of 2009 resulted in the largest injection of capital to Smart Grid investment to date and punctuates the value our leaders, utilities and ratepayers themselves will place on creating a smarter, cleaner and more reliable power delivery system. We have already begun to see the results of that investment with two Stimulus-related contract wins in 2009, and we expect to see further positive contributions to our company and to the marketplace at large as a result of Stimulus funding.

Although I would like to be able to put that investment rollout on a definitive schedule, that's something that will be determined by many factors that are well beyond my ability to predict with any substantial degree of specificity. What I can say, however, is that Comverge is well positioned to participate at all levels of demand management expansion at whatever rate it eventually takes place. As you might expect, the Comverge perspective is that the sooner we embrace DR, the faster we can progress toward energy independence.

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La Presse

LightsOn

New Technologies for a Smart Distribution Grid

By Chris McCarthy, Product Manager
Automation Systems Division
S&C Electric Company
Chicago, Illinois USA

The Smart Grid is about serving the customer better. It gives electricity consumers options to manage and optimize their energy usage. But to really serve the customer better, utilities also need to identify ways to improve the reliability of their electrical service.

While it's impossible to prevent power outages, how the power system responds to these events determines how many customers are affected and for how long. High reliability can be designed into the distribution system – and the Smart Grid can help get us there.

Many different sources handle power generation in various locations, so end-users don't notice the loss of a generator. The transmission grid intertwines with backup lines and multiple routes for power flow to handle contingencies. Therefore, an alternate route usually can accommodate the loss of a transmission line. In contrast, many parts of the distribution system – the source of most end-user interruptions – aren't really a grid at all. And they don't have any level of backup. So, customers are susceptible to a power outage on the distribution system even when it occurs several miles away.

A basic distribution grid develops when utilities add the capability to transfer loads to adjacent circuits. A *smart* distribution grid emerges when the switching points between circuits, as well as several points along each circuit, carry the intelligence to reconfigure the circuits automatically when an outage occurs and quickly to reroute power to as many customers. More intelligent switching points yield more options to reroute power to serve the load, and communication between those points makes self-healing a practical reality.

Alternate routes, multiple switching points and communications can also help minimize power losses and manage peak loads. Further, an automatically reconfigurable distribution grid requires flexibility to accommodate the anticipated escalating levels of distributed generation and energy storage. Distributed generation comes and goes unpredictably, a dynamic activity that won't work in the traditional form of a radial circuit on a distribution system.

Smart Grid Favors New Technologies

The Smart Grid is a global effort to improve the delivery of electric power. It is backed and driven by national governments with set goals and requirements for the industry. They have invested billions of dollars to foster and forge new projects to demonstrate the advantages of fresh technologies. As such, Smart Grid favors the employment of new technologies to move the industry forward. It is not simply using "more of the same." While this focus strives to deliver better system performance, it also seeks to provide social benefits that include reduced carbon emissions, financial benefit for utilities and better service for customers.

Companies offering Smart Grid solutions range from startups with a single new idea to global giants preparing to integrate communication systems, operation systems and back office IT infrastructure. In the future, the Smart Grid will employ an intelligent, networked distribution system to operate new applications that don't even exist today. Pioneer technologies will integrate renewable energy sources and use energy-storage devices to make renewable-source energy dispatchable. Power distribution systems will undergo the most rapid transformation and will rely on innovative products and technologies.

Distribution System Response to Faults – The 'Regular Grid' Version

When a fault occurs on the distribution system, it is interrupted and cleared by a fuse, recloser, or relayed circuit breaker. If the fault is cleared by a fuse, the utility must send a crew to patrol the line, locate and repair the fault, if necessary, and then replace the fuse to restore service. On many occasions – studies suggest between 60 percent and 90 percent of the time – faults are temporary by nature, and would actually dissipate if given a short period of time with the system de-energized. But, a fuse is a one-shot device and once it melts to clear the fault, a permanent outage results for the downline sections until service is restored by the line crew.

An improvement in the 1940s came when reclosers and reclosing relays offered a dual-timing characteristic. The recloser or relay is set to trip faster than the fuse, and then wait a few seconds before it recloses. If the fault is temporary, it may be gone before the first reclosing attempt. This protection technique is known as *fuse saving*.

But fuse saving has some disadvantages. For one thing, electronically controlled devices required to measure fault currents and mechanically open contacts to interrupt the fault simply cannot perform this action as fast as a fuse link at high fault currents. Therefore, most faults on the system result in the recloser tripping *and* the fuse blowing. This is actually worse than not trying to save the fuse because the fuse blows and *all* customers downline of the recloser experience a momentary interruption.

Another downside is that a typical implementation uses two or three reclosing attempts. If the fault is permanent by nature, each reclosing attempt re-ignites the short circuit. Then full-magnitude fault current flows through the distribution conductors, switches, splices, and perhaps most importantly of all, the substation transformer. This causes undue thermal and mechanical stress on all the system components. It leads to eventual failures of splices or other weak points on the system and reduced service life for the substation transformer. Also, each time the fault is re-applied to the system by reclosing, the feeder voltage is pulled down, and upline customers experience power quality issues.

Pulseclosing: A High-Performance Fault Interrupter

Fortunately, a new and better alternative has emerged to reclosing and it is called pulseclosing. It is the first major advancement in the power-handling aspects of fault isolation since reclosing was introduced. In time, it may become the new fault-testing standard. After a conventional recloser or relayed circuit breaker opens to interrupt a fault, it typically recloses into the fault several times to determine if the fault is still present.

Pulseclosing, though, tests whether the fault is still present without creating high-current surges that cause feeder stress. The pulsecloser very rapidly closes and re-opens its contacts at a precise point on the waveform to send a very short low-current pulse down the line, then analyzes the pulse to determine the next course of action. If the pulse indicates a persistent fault, the pulsecloser will keep the contacts open, wait a user-configurable interval, and pulse again. This process can repeat several times until the pulsecloser determines that the line is no longer faulted. It then closes to restore service. If the fault persists for the duration of the test sequence, however, the pulsecloser will lock out to isolate the faulted section.

Pulseclosing uses very fast (i.e., about one- or two-milliseconds) closing and opening of the main switchgear vacuum-interrupter contacts. This controlled point-on-wave closing limits peak pulse current to about half the expected symmetrical fault current that would have occurred with a *hard* reclose into the fault. Pulseclosing uses fault asymmetry to its advantage because the first current loop is the much smaller minor loop. It then interrupts the current before the major loop occurs.

Current flows from contact touch until the next current zero, typically resulting in a pulse current of about 5-ms duration. This very fast mechanism hits the point-on-wave closing target and then quickly reverses momentum to open the contacts.

A software algorithm analyzes the pulse based on the point-on-wave closing angle, pulse magnitude, and length and shape of the pulse to project what the current flow *would* be if the contacts were fully closed. If the predicted current flow indicates load current instead of fault current, the switchgear contacts will close less than 100 ms after the pulse.

Pulseclosing does not stress power system equipment, typically reducing energy let-through by more than 98 percent compared to the energy associated with a hard reclose. It also reduces the peak fault current forces on transformer windings by up to 96 percent compared to a hard reclose. (**See Figures 1 and 2, following**)

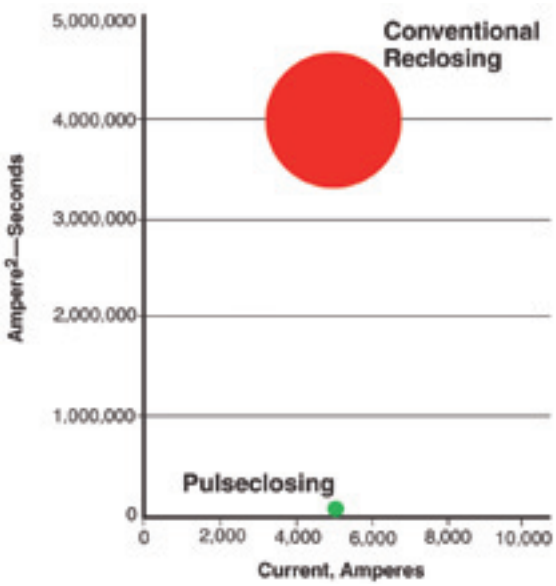


Figure 1. Relative let-through energy for a typical 5000-ampere fault

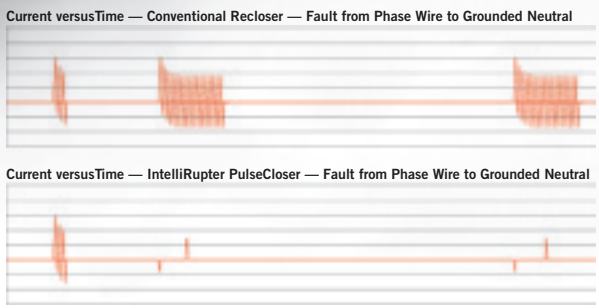


Figure 2. Oscillographs showing the difference in fault current for a hard reclose and a pulseclose on a permanent phase-wire to grounded-neutral fault

After clearing a fault, a conventional recloser or relayed circuit breaker simply recloses to test for continued presence of the fault. If the fault persists, its control compares the current to a Time Current Characteristic curve, and trips the interrupters at the appropriate time. After a time delay, it recloses again. Even the fastest recloser or breaker feeds a significant amount of energy into the fault with each reclose, producing system-damaging stress and voltage sags.

Figure 3 shows how a conventional recloser or relayed circuit breaker operates in response to a permanent single-phase-to-ground fault. The uncontrolled closing often results in asymmetric fault current, significantly increasing peak energy into the fault.

When the pulsecloser clears a fault, however, it tests for continued presence of the fault using pulseclosing technology, closing at a precise point on the voltage wave. **Figure 4** shows the typical current pulse of just 5 milliseconds; the system only experiences overcurrent stress from the initial fault.

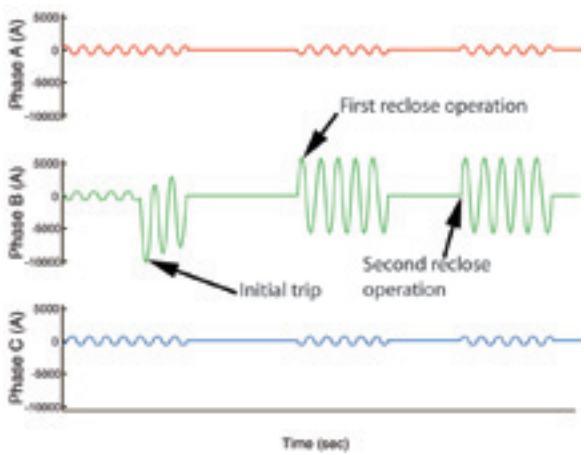


Figure 3. Conventional reclosing in response to a permanent fault

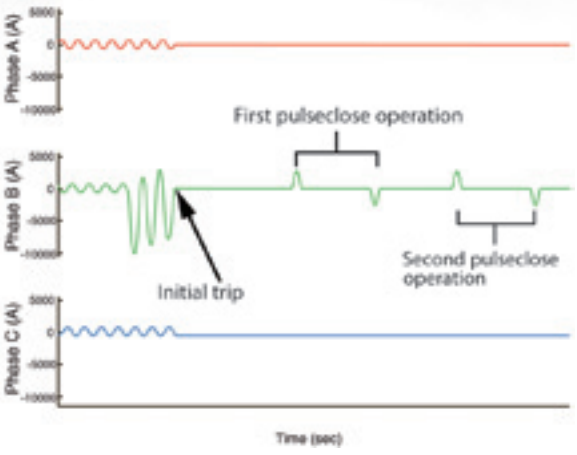


Figure 4. Pulseclosing in response to a permanent fault

The opposite-polarity pulse detects magnetizing inrush current; if the line is not faulted, the pulsecloser closes to restore service.

Automatic Self-healing for the Distribution Grid

The distribution system is the electrical link between meters (smart or not) and the transmission grid. Industry experts estimate that 80 percent of customer outages result from problems on the distribution system, which largely consists of utility poles along roadways and in alleys, or underground cables commonly found in newer subdivisions or business areas. The *self-healing* part of Smart Grid is a critical element for the distribution system.

Self-healing technology enables automated switching devices on the distribution system to reconfigure the circuits automatically to restore power to as many customers as possible and isolate only the problem section of the line. To accomplish this, automatic switch controls are deployed on the distribution system, and programmed with automatic restoration logic.

The optimal self-healing system will use a mix of decentralized fast-acting local response with a centralized system for oversight. Local clusters of automated feeders function independently of the central control to isolate problem areas and minimize disruptions quickly. The feeders may be in a reconfigured state for several hours until the crews have located and repaired the fault, so the distribution operators may want to shift load, switch capacitors banks, or modify voltage regulation to optimize efficiency.

Distributed logic also will handle multiple events. With such logic, no need exists to pre-script switching scenarios for multiple-fault contingencies. Distributed logic only requires a very simple, first-time setup, and regardless of how many events have already occurred, it will continue looking for alternate sources to restore the unfaulted sections that are without service. This is especially useful during strong storms that sweep across a service territory and cause multiple outages. It's a great advantage to have the distribution system automatically do the best restoration possible, quickly and efficiently, and report the *final* reconfigured state to the dispatchers.

High-Speed Communications Infrastructure

The industry is quickly moving toward a distribution system that monitors, records, and reports more and more data through the SCADA, "supervisory control and data acquisition," system as intelligent controls and sensors become more widespread. AMI (for advanced metering infrastructure) traffic alone requires an upgraded and expanded communication system to handle the data volume. Performance of a distribution automation system using self-healing technology depends heavily on the communication system.

A high-bandwidth radio system is advantageous today, and becoming more critical with every new technology advancement. It enables remote management functions, such as the ability to upgrade radio firmware over the air, or even update the firmware in the switch controls. The capability to remotely retrieve event log and waveform data and remotely make configuration changes saves time and expense, as well as reduce carbon emissions associated with crew and truck travel.

Mesh topology is important because it allows switching devices in the field to communicate directly with each other, rather than to the neighbor control via a convoluted process that requires routing through the SCADA Master.

For applications where speed of communication is important, the mesh network offers a superior design. Redundant alternate paths are inherent in the mesh network approach, so if one or more preferred communication links is down, the mesh network uses any nearby radios as repeater stations to reroute messages quickly and reliably to the appropriate switch location, or even back to the operations center. The ability to route automatically around a missing node provides another example of a *self-healing* system that increases the robustness of the distribution system.

Reliability of the grid will gain even more focus as AMI deploys. Customers will have greater access to outage and other service-disruption data. Automatic self-healing technology that leverages the distributed intelligence of smart switching devices and a robust, high-speed, mesh communication system will get the lights back on quickly.

About the Author

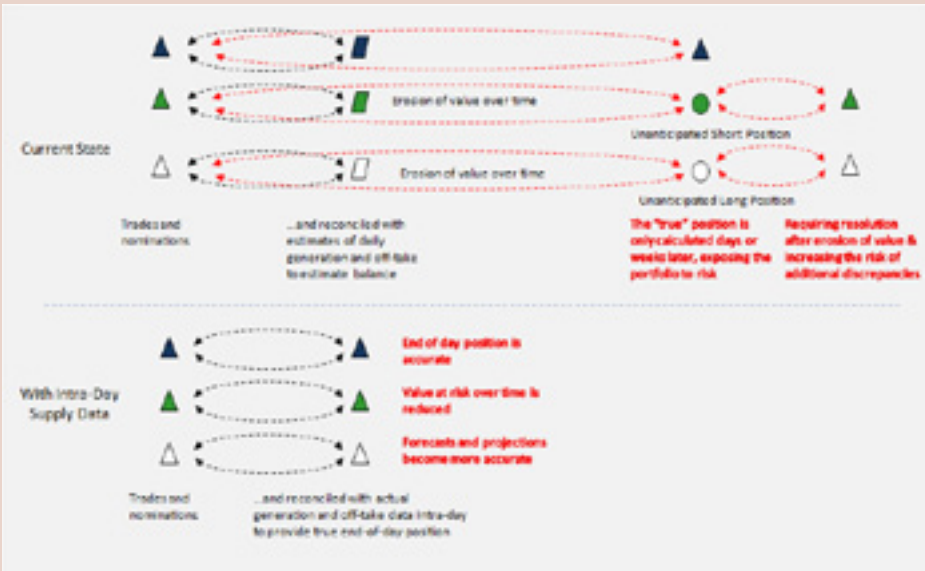
Christopher A. McCarthy is product manager for the Automation Systems Division of S&C Electric Company in Chicago, Illinois. Chris has participated in R&D, marketing, and field application support for the rollout of the company's lines of smart switching and communications solutions and is now responsible for customer service, application support, and marketing for all automation products. He received a BSEE from the University of Illinois at Champaign-Urbana; a Masters in Electric Power Engineering from Rensselaer Polytechnic Institute, in Troy, New York; and an MBA from Keller Graduate School of Management. He is a registered Professional Engineer in the state of Wisconsin.

Addressing the Intra-day Position Conundrum

New Approaches to Solving the Intractable Supply & Demand Problem

By Edward Cuoco, Director of Utilities & Energy Markets and
Victor Milligan, Chief Strategy & Marketing Officer
Martin Dawes Analytics (Boston, Mass. USA)

It's no surprise that business pressures can increase the value of optimized trading for energy companies. Specifically, lower commodity prices and more competition in energy markets have put pressure on profits and margins, which in turn, increase the importance of fast and accurate risk reporting. Internally, faster reporting and optimization cycles are required in order to maintain a competitive position.



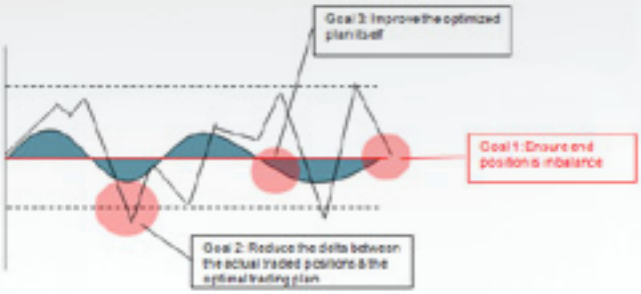
Simultaneously, position reporting must maintain a high level of granularity as regulators and auditors seek balance at 60, 30 and sometimes even 15-minute intervals. While organizations continue to move towards intra-day position reporting, the breadth of detailed data and the frequent time increments in which they are provided are not adequately leveraged through the normal risk reporting process.

As the illustration above shows, positions are generated daily and intra-day, and these reports leverage estimates of generation and off-take data. While the actual data (particularly generation data) is often available, neither the existing tools nor processes used by energy trading companies allow them to be leveraged in this reporting cycle. Consequently, these data elements end up as part of manual portfolio optimization, occurring days or even weeks after the initial position was reported. It is possible, however, to enhance risk reporting with tools found in other industries, allowing for faster integration of detailed supply and demand data.

Companies that look outside of traditional trading tools will be able to rapidly assess, evaluate and react to this critical data and put themselves in a stronger position to make more timely and informed decisions about future trades and contracts.

The value of integrating supply and demand data at intra-day increments to intra-day risk reporting lies in reduced risk in the portfolio, lower fines and/or penalties for being out of balance and ultimately, in the improved optimization of trading strategy (and by extension, a more competitive advantage in the market). Operationally, integrated data improves the firm's ability to adapt trading strategies to account for unexpected supply changes more quickly. Furthermore, timelier accounting for supply and demand data will reduce the value at risk (VAR) of short- and long-term contracts and provide improved insight into counterparty and contract profitability.

Yet few organizations are actually using either supply or demand data on an intra-day basis despite the obvious benefits. Processes for position reporting are organized around intra-day schedules, but supply and demand data are often unaccounted for in these processes.



In each case, trading desks are forced to perform a "true up" by means of manual reconciliation of the data to position reporting days or weeks after the fact, sacrificing margin or even moving from profit to loss due to "unexpected" changes. Therefore, the choice facing trading organizations today is between an analytic capability that allows one to look backward and report what happened, and a capability that allows an organization to understand what is happening now and adapt and react to it in real time.

Current Systems Are Not Sufficient

The difficulty trading organizations face when assessing the data in a more timely fashion stems from a perceived inability to apply the data to risk reporting more frequently, while ensuring that the data is granular enough to revise the position in quarter hour increments. Attempts at systemic solutions to this problem end up in one of two untenable outcomes; that is, either the information can be processed intra-day, but at insufficient granularity which limits the solution's ability to remove the need for post-day adjustments or, the data is granular but the time to acquire, process and analyze the data is too long to allow it to be used same-day.

For most trading organizations, it has not been possible to create a systemic solution for these problems within a time and price range that reflects value. Further, attempts at integrating this data within the risk reporting process have taken more time and cost more money than has been gained in profitability. For those that have been completed, many other attempts have failed or simply been prematurely abandoned due to either the exorbitant expense or lack of demonstrable success.

The myth prevalent within many trading organizations is that these issues cannot be resolved without a massive IT investment. This myth leads trading organizations to believe there are only two possibilities; either repeated and increasingly expensive attempts to create tools to integrate this data or, alternately, to give up altogether and implement work-arounds or reduce risk limits to allow the enterprise to simply live with the existing problem.

In reality, companies are simply trying to solve the problem with the wrong tools; focusing on using the typical tools of the trading world which inevitably leads to a dead end and include implementing enterprise systems such as Commodity Trading & Risk Management (CTRM) tools or back-office financial systems. These options, besides being large and complex, also require a significant investment of time and money and cannot be quickly adapted. While Excel-based tools are flexible, they lack both the ability to handle larger volumes of daily incoming data and the transparency and auditing ability needed to provide confidence at scale.

Casting Light on Suitable Solutions

In order to leverage the full range of available supply and demand data on an intra-day basis, trading organizations must look outside of typical CTRM or BI (Business Intelligence) tools. As an example, industries such as telecommunications and manufacturing make good use of process-driven analytic tools in order to address analogous issues in their spaces. These process-driven tools have many of the key elements needed to ensure that detailed data is quickly and granularly analyzed. Specifically, they are data-architecture independent, they allow business users to create and change analytics quickly and without a major IT engagement, and they allow both logic and data to be modeled in the same tool.

Equally important is that process-driven solutions support an analytic methodology where discovery and analysis happen simultaneously – occurring when business users create analytic tools collaboratively even as they investigate the data itself. This combination of technology and methodology enables energy companies to enhance their risk reporting and fulfill their core need for integrating supply and demand data intra-day.

When looking to acquire this type of technology, organizations should consider the following critical criteria and select a solution that:

1. Enables the organization to access and apply data quickly, including acquiring and analyzing data in near real-time
2. Allows the organization to maintain sufficient data granularity in order to improve position reporting at quarter-hour increments
3. Is able to analyze supply/demand data in the context of trading and contract logic
4. Supports an agile analytic methodology, allowing business teams to adapt and tweak analytics and explore new data sources quickly and easily
5. Creates output that can be audited and tracked – providing confidence in output and reducing the likelihood of needing revisions
6. Delivers value within 3 to 6 months and be able to consistently adapt itself to new data inputs and analytics within days or weeks.

By leveraging this class of tool, it is possible to create a solution that is managed and maintained within the process analytics team or perhaps in the mid-office. This eliminates the risk and expense of a large-scale IT implementation but does so without sacrificing the ability to convert these analytics into standing operational controls and maintains transparency and audit capabilities.

Illuminating Profits and Reducing Risks

It is easy to ignore solutions from other industries when attempting to expand the analytic capability for energy trading. Indeed, both heads of trading and IT management often raise objections to such an approach, believing that trading is unique or too mathematically complex to find guidance in other industries, or that only companies steeped in trading and risk management expertise can possibly provide solutions in a timely, cost-effective manner. However, these objections do not stand up to investigation. In telecommunications, these solutions are already in use, having been proven in maximizing revenue for billion dollar industries and working with millions of records across multiple systems.

Simply put, experience in other verticals has shown that complex analytics can be implemented quickly and efficiently by leveraging solid technology, and proven best practices and expertise in process, logic and data.

In order to successfully adapt solutions from other vertical industries into trading, organizations should take an approach based on quick timelines and minimal risk. Big-bang solutions should be avoided and more attention should be focused on small systems that address core parts of the risk reporting process such as the integration of generation data, analytic, etc. Companies should begin by working with proofs of concept as a way to confirm a technology's ability to perform a function and through proofs of value to test logic, data and analytics.

By keeping initial timelines and investments short, organizations will maintain more flexibility to mix and match technologies and avoid becoming trapped in a substandard solution due to large investments of time and money. Finally, along with these new tools, existing trading and risk management technologies also have a role to play. When investigating technologies, organizations should pay attention to the ease in which they can be integrated into existing architectures and data models. After all, even the most simple, elegant tool can result in a blown budget caused by complex and expensive integration tasks.

Market, industry and organizational pressure all suggest that organizations able to successfully improve the accuracy and timeliness of their risk reporting stand to benefit from improved margin, reduced controls and the ability to more quickly move in the market. New tools from outside the traditional trading or utilities space can provide the needed functionality to quickly and cost-effectively create this expanded analytic capability for any trading desk. With a little technological planning, the future can be very bright, not only in terms of profits, but also in the form of reduced risk.

Conclusion

An analytic approach to issues of risk management is inherently familiar to energy trading primarily because risk management, pricing and supply teams perform complex analytics on business critical data every day. Improved analytic tools from outside the typical set used by merchant energy and utilities allow this approach to be extended to the integration of supply and demand data to intra-day position reporting.

These tools make this extension possible by combining an enhanced set of analytic functionality with a design and architecture that allows organizations to "de-risk" upfront implementations. Further, this design allows Utility companies to integrate these technologies into the existing suite of trading and operational tools in short, inexpensive phases that reduce the impact on IT budgets and reduce both the likelihood and costs of potential over-runs. It is this combination of functional robustness and operational flexibility which provide real value to utilities without the attendant risks or large-scale system changes. ■

About the Authors

Edward Cuoco is the Director of Utilities and Energy Markets and **Victor Milligan** is Chief Strategy and Marketing Officer at Martin Dawes Analytics, a leading global, data-driven process analytics software provider. For more information, contact Ed at *ecuoco@mda-data.com*; Victor at *vmilligan@mda-data.com*.

EXECUTIVE Directions

Association of Energy Services Professionals

Meg Matt, AESP, President & Chief Executive Officer

Meg Matt and I have been acquainted professionally for many years, and during that time I've known her to be an insightful and informed market observer; a talented and creative writer; and an experienced industry professional. For those and many other reasons, I wasn't really surprised when she took over at the helm of the Association of Energy Services Professionals (AESP) in 2006. My first thought was how fortunate AESP was to attract this highly qualified individual, never doubting for a moment that she would be successful. One of the not-so-secret keys to Meg's success at AESP was the assembly of a top-notch staff, as I learned first hand when making the initial preparations for this interview. And with AESP celebrating its 20th anniversary, this seemed a perfect time to catch up and learn what's new! – *Ed.*

EET&D: First of all, happy anniversary to AESP! For those readers who may not know as much about your association as its constituents and members, let me suggest that we start with a quick overview of what AESP is and what it does…

MATT: Thank you! This year marks our 20th anniversary, and going into 2010, AESP is stronger than ever. We are a non-profit, professional development association with over 1,800 individual members and more than 150 group members.

Founded in 1990 as a not-for-profit association, AESP is member-based and dedicated to improving the delivery and implementation of energy efficiency, energy management and distributed renewable resources. Among the many valuable services we provide to our members – and in the broader sense, to the industry at large – are professional development programs; a network of skilled, experienced energy practitioners; promotion of the benefits of energy service initiatives; and the transfer of knowledge and experience of energy service professionals all across the industry.

EET&D: Briefly, what was the genesis of this association; how did it get started?

MATT: AESP was originally formed as the *Association of Demand Side Professionals*. In 1994 the name was changed to more accurately describe the full scope of its services.

Our founding president, Bill LeBlanc, was just 31 years old and when this nascent field – then widely referred to as "DSM"– was little more than an industry term coined by Clark Gellings at the Electric Power Research Institute to describe the budding field of demand-side management.

Because DSM was a new term and not something that utilities were broadly supporting at that point in time, the notion of a separate DSM association was of questionable value until Clark took the podium on Bill's behalf during a meeting at the 4th National DSM conference and asked if anyone was interested in a professional association for demand-side management professionals. A few hours later, about 25 people showed up, and as they say, "The rest is history."

In one sense the name change to AESP broadened our scope, but we are still fundamentally engaged in the "demand side" of the business, which is where the strength of this organization has always been from its very beginnings.

EET&D: When we originally met you were already a freelance writer and independent industry consultant, as I recall. What was it that led to your personal involvement with AESP and eventually the leadership role you now hold? Was there anything in particular that led you there?

MATT: I started out in AESP as a member and had the privilege of serving on the board before assuming the position of president and CEO. What I really love about AESP is that it's an individual-member association. That means everyone has an equal voice, regardless of the size of the company or the geography in which they are located. It's empowering to know that you can really make a difference in this industry with the help of AESP's professional development conferences and programs and the many networking opportunities it provides.

EET&D: What would you say is the typical profile and/or business characteristics of an AESP member today?

MATT: Our members are primarily focused on developing, implementing, pricing, and marketing and evaluating energy efficiency and demand response programs for end-use customers.

EET&D: Can you give us a little more perspective on how those kinds of things manifest themselves and what kinds of people and organizations make up AESP membership?

MATT: Yes, of course. We represent energy professionals who are engaged in a myriad of energy services including energy efficiency, demand-side management, demand response, Smart Grid, technology, marketing communications, research and evaluation, and of course, program design and implementation. Our members work for electric and gas utilities, consulting firms, federal and state agencies, public benefits agencies, academia, manufacturers, vendors and lots of other industry-centric companies and organizations.

EET&D: Meg, I know that you have a lot of irons in the fire this year, so what's been keeping you busy lately?

MATT: Our board and staff are responding to our growth in membership with new services and programs including training, continuing education credits, professional certification, an interactive supplier directory, and an enhanced Web site. Also, our member topic committees and local chapters are an integral part of AESP, which involves a lot of coordination and communication on both an organizational and individual level. And, we've just released a special report on the State of the Industry, which we make available to our members as an AESP member benefit. We've also recently developed several new social media tools including Twitter, LinkedIn and Facebook.

EET&D: What are some of the initiatives, events, and programs you currently have under way, and how do you decide which ones to pursue at any given time?

MATT: One of the key challenges facing our members is an aging workforce at a time when more investment and growth is taking place in energy efficiency. To help meet our members' needs, we've implemented several new training courses to help them get new employees educated about program development, evaluation, marketing, and more. It's also important to understand that AESP is a member-driven organization. That means that our members directly drive our industry agenda and the specific initiatives, events and programs in which we engage and/or sponsor.

For example, many of our members share their thoughts, expertise and opportunities with industry leaders, addressing some of the industry's most pressing issues today. We also provide tools and information dedicated to advancing best practices, all the way from service concept through delivery and resulting in increased service efficiency and effectiveness.

Each year we hold a national conference – which, as you know, was held last month in Tucson. We are now working on the agendas for the spring and fall conferences, which will be in Boston and Portland (Oregon) in May and October, respectively. We will also continue to produce our popular "AESP Brown Bag" Webinars, which take place throughout the year. Our education, training and professional papers are available for all levels of experience providing tangible, actionable information that helps everyone do their jobs more effectively.

EET&D: Is there anything else that you'd like to comment on before we close? What is the vision for your next 20 years?

MATT: Yes, The other major initiative we will be working on over the next 20 years and beyond is the newly created AESP Foundation. The Foundation has several goals, and we are currently seeking funding from a variety of sources. Our members will also see AESP offering Continuing Education Credits (or CEUs) next year, and the board is working on developing a professional certification program.

Bill LeBlanc commented recently that when he and his colleagues were laying the groundwork for the Association in 1990, they weren't thinking 20 years, or even 10 years, down the line. Today we're definitely experiencing growth, and we feel a sense of urgency to get content out to our members to let them know that they can continue to look to AESP now – and in the years to come – as an important tool in their professional development. ■

Bringing Utilities Into the Next Wireless Age with Mobile Resource Management

By Ravi Acharya, Associate Director of Marketing for B2B Products
TeleNav (Sunnyvale, Calif. USA)

Utility companies have depended on remote technicians to complete repair jobs, monitor usage and meet customer needs for longer than most other field service industries have existed. Managing remote employees has historically presented a challenge to supervisors responsible for knowing when and where employees are at any given time. To meet this challenge, utility companies have traditionally turned to wireless technologies. CB radio technology, introduced more than 50 years ago, was the first generation of wireless used to communicate with technicians. Wireless technologies have evolved significantly in recent years, allowing for the real-time exchange of both critical data and voice communications from a single device. Today, mobile resource management (MRM) takes center stage in the evolution of wireless communications, allowing management to view the GPS location of all technicians on a Web-based map as well as receive job-related information directly from the field – all while improving the efficiency of remote workers.

Any organization with a mobile workforce understands the challenges that come with having an employee base that is out of sight working at remote locations. Management has little enforcement over behavior and no cost-effective way to ensure employees are working according to company guidelines. Many utility companies have no idea whether their technicians are acting responsibly or not while in the field.

Many processes are paper-based, often requiring technicians to track their hours and mileage by hand and spend time printing out job details that may get lost while at the job site. This results in widespread inefficiency and productivity losses.

Such inefficiency affects businesses on many levels. Most technicians want to do the jobs they were hired to do, but when they are mired in paperwork, morale drops and customers are negatively impacted. When customers are without power, when they themselves must fill out forms or when inefficiency drives costs up, customer service lags. Ultimately, inefficiency has a direct impact on the bottom line of utility organizations and the level of service they provide.

Mobile Resource Management Solution

While these challenges may seem insurmountable, an integrated mobile resource management product addresses them in an easy to implement, affordable way. MRM provides the flexibility and features that enable utility companies to improve every component of the way their mobile workforce operates in the field. From their mobile phones, technicians can clock in and out, get turn-by-turn directions to the job site, receive automated job details and provide job status updates. Supervisors can use GPS data to manage and dispatch technicians, reduce fuel waste, monitor vehicle and equipment usage, ensure timecard accuracy and improve customer communication.

With MRM, management and dispatchers no longer need to call technicians for their location. They can locate technicians and equipment in real time via GPS. Technicians don't have to waste valuable time making trips to and from the office to turn in time sheets or job reports. They can track their time, mileage and job status updates through their cell phones. MRM also enables the automatic update of a utility organization's back office inventory management system by providing an easy way for field technicians to report parts and equipment being used on each job in real-time.

MRM helps technicians spend less time on paperwork and other tedious tasks and more time doing what they do best. Management benefits from a mobile workforce that is more productive, saves costs and provides a higher level of customer service.

"Anything we can do to get an advantage over our competition and provide quality customer service is a good thing," said Glenn Grossman, Service Manager of West Side Electric. "With MRM we got everything we needed and then some."

GPS Tracking Improves Accountability, Productivity

The ability to monitor technicians with GPS data is critical to the effectiveness of mobile resource management. Knowing exactly where technicians and assets are can drive significant productivity increases. Without MRM, managers and dispatchers must call technicians on their wireless phones to determine where they are at any given moment. This interrupts technicians and can significantly reduce their productivity. Managers aware of this loss in productivity may be reluctant to contact technicians, leaving them in the dark about their whereabouts.

Mobile resource management resolves both of these issues. As noted by the Aberdeen Group in its December 2007 study, mobile resource management improves workforce utilization by 26.1 percent.[1] By tracking their technicians on a Web-based map, managers are fully aware of the exact, real-time location of every technician in their fleet. Managers can ensure field technicians are where they say they are and doing exactly as they should, without interrupting their work. This improves both accountability and productivity for all parties.

Affordability Improves MRM Accessibility and ROI Potential

Adding to their appeal, mobile resource management solutions are available at a fraction of the cost of hard-mounted devices that provide the same functionality. This makes them a viable option for utility companies looking to improve operations on a tight budget.

In a 2008 white paper on MRM, Frost & Sullivan stated, "In previous years, proprietary MRM systems required customized design, dedicated servers and software packages, and hundreds of thousands of dollars to deploy. The ability to now monitor and track from any Internet-capable PC and the explosion of low-cost GPS-enabled mobile devices has injected affordability and flexibility into today's MRM purchase decision."[2]

Not only is MRM affordable, but it also allows companies to save money in many areas of the business, providing great ROI potential. Accurate timecards and overtime alerts reduce payroll expenses. Navigation and GPS-guided dispatching reduce mileage, vehicle wear and tear and fuel expenses. Improved customer service allows companies to improve revenue opportunities.

These factors amount to substantial savings. The Aberdeen Group conducted a survey of companies using MRM products and found that firms reported reduced overtime costs that equated to savings of an average of $496,493. The study also identifies savings due to tighter inventory control. The survey found that a 26 percent reduction in parts inventory loss alone equates to an average savings of $1.02 million. [3]

With a relatively small investment in a mobile resource management solution, utility provider West Side Electric was able to save approximately $13,000 per year through reduced time and mileage alone, demonstrating MRM's strong ROI potential.

"MRM's ROI story is straightforward and impressive," said Frost & Sullivan, "with customers reporting significant reductions in operating costs, increased employee productivity, and improved customer relationships."[4]

Fuel Conservation

As further proof of its ROI potential, MRM enables utility companies to cut excess mileage and fuel costs. Fuel will always be a significant expense for utility companies, making it a key target for cost savings. The Aberdeen Group has found that MRM offers the following benefits:

- 13.2 percent reduction in fuel costs
- 19.2 percent decrease in miles traveled
- 27.4 percent improvement in fleet utilization [5]

MRM provides these savings by allowing utility companies to efficiently dispatch technicians, eliminate extra trips to the office and monitor idle times. Plus, technicians reduce excess mileage with voice-guided, turn-by-turn GPS navigation.

Using Wireless to Improve Business Intelligence

With such evidence of its ROI potential, mobile resource management is just as compelling as a business intelligence tool. With MRM, technicians are able to refer to a wealth of information that enables them to perform the job quickly and properly. Up-to-date customer information can be transmitted to the worker's device, which results in a prepared technician and an increase in first-call resolution rates.

With easy-to-use wireless forms, technicians can send data to the back office by simply selecting from drop-down menus, checking boxes or entering free-form text. Other data collection methods can include barcode scanning, electronic signature capture and image capture.

[1] The Impact of Location on Field Service, Aberdeen Group, December 2007
[2] Maximizing ROI with MRM; Selecting the Right Mobile Resource Management Solution, Frost & Sullivan, July 2008.
[3] Ibid, Aberdeen Group.
[4] Ibid, Frost & Sullivan.
[5] Ibid, Aberdeen Group.

Without mobile resource management, technicians are left with paper, pen and a clipboard to capture information about the job. This detracts technicians from their work and can cause an administrative nightmare.

When MRM is integrated with back-office software – such as enterprise resource planning (ERP), inventory, payroll and customer relationship management (CRM) systems – the data must only be entered once. This eliminates data entry payroll expenses and reduces costly data entry errors.

More important, however, is the business intelligence that the company can glean from this information. By gathering data into reports, mobile resource management allows managers to review technicians' work history. This helps with payroll inaccuracies, employee or customer disputes and job status notifications. Reports range from simple time stamping and event recording to more complex reports customized by business segment. Managers can run reports at will or have them scheduled to be delivered via email at pre-determined times.

In addition to reports, automatic alerts provide further data for managers who need to keep close tabs on their technicians. Alerts notify management when technicians are speeding, whether they entered or exited a pre-defined area, whether they forgot to clock in or out, and if the application is turned off during business hours.

Wireless Timecards Reduce Payroll Expenses

While reports and alerts notify management of technicians' activities, mobile resource management also enables utility companies to get a better handle on their payroll expenses. Typically, technicians record their time on paper timesheets, which need to be mailed, faxed or handed in. The data must then be manually entered into the payroll system. Plus, there is simply no accountability to verify technicians are working the exact hours they say they are working.

Wireless time tracking allows technicians to remotely clock in and out of their shifts. It allows management to track the time required for specific tasks as well as gather accurate timesheet reports. Each time stamp is associated with the technician's GPS location, so management can ensure that the technician was clocking out from the job site, for example, and not from home.

Wireless timecards also improve attendance and reduce payroll costs. Detailed wireless timecards include labor codes, overtime and double time, and seamlessly integrate with payroll systems. And possibly most important is the fact that instant transmission of timecard data can cut the billing cycle from weeks to days, significantly improving the company's cash flow.

Scheduling, Dispatching and Work Order Management

While payroll highly benefits from mobile resource management, dispatching is equally improved. MRM can significantly increase dispatch efficiency and ensure technicians are routed in a way that reduces excess mileage. Without MRM, dispatch is processed manually and dispatchers must call technicians when a customer calls with an urgent need.

With MRM, dispatchers communicate with technicians through their handheld devices and assign new jobs based on their locations.

Dispatchers transmit real-time job details including the job type, job priority, customer history and more. If a technician is running late or a high-priority call comes in from a customer, dispatchers can look to the Web-based map to determine which technician is closest to the job and send the job details to that technician. Technicians can reply to the job request indicating they received it, and when the job is finished, they can select the job status from a simple drop-down menu.

Enhancing Customer Service with MRM

In addition to reducing costs and improving efficiency for dispatchers, mobile resource management allows utility companies to greatly improve customer service. One of the most important elements of providing great customer service is being able to service utility customers efficiently and attend to their needs without delay.

Without MRM, customers may need to call to check on the whereabouts of a technician, experience long wait times, fill out tedious paper forms and even lose wages if they are forced to take time off work to wait for a technician.

With efficient dispatching and wireless forms, technicians are more productive. As a result, they can complete more jobs in the day and provide faster customer service. As noted by the Aberdeen Group, MRM results in a 23.8 percent improvement in response times.[6] Plus, with exact GPS locations of their technicians, utility companies can provide customers with accurate arrival times, reduce wait times and even resolve billing disputes.

GPS Tracking and Speed Alerts for Safety

While the cost and efficiency benefits of MRM are important, ensuring the safety of technicians offers no comparison. Driving at high speeds has a direct correlation with vehicle wear, fuel waste and accident risk. According to the 2010 U.S. Federal Fuel Economy Guide, every 5mph a driver drives over 60mph reduces fuel economy by 7-8 percent.[7] Speeding alerts help companies enforce safe driving practices and reduce fuel and insurance expenses.

GPS tracking contributes to safety advantages because managers can monitor the driving behavior of field technicians. In the case of extreme weather conditions or if a technician hasn't been heard from in a few hours, managers can refer to their GPS locations to verify their safety and even help route them away from unsafe weather conditions.

Without these measures, technicians are left to their own devices to ensure their own safety, and managers must conduct their business without the true peace of mind that MRM can provide.

Conclusion

The use of MRM in the utilities industry streamlines operations and provides a substantial and quantifiable return on investment. With an affordable price, strong ROI, reduced operating expenses, improved customer service and safety enhancements, MRM can help utility organizations gain a competitive edge.

While no one will argue that the old wireless technologies of the past weren't beneficial in their day, technology that traditionally was nice to have has now become a critical element in a utility organization's ability to maintain steady profits. As Frost & Sullivan forecasts, 2013 will see more than 11 million MRM users in the U.S. alone[8]. Early adopters recognize the need to evolve operations and bring the way we communicate, and more importantly, the way we exchange information, into the next wireless age.

About the Author

Ravi Acharya is associate director of marketing for TeleNav's business-to-business products. Ravi oversees product marketing for TeleNav's Mobile Resource Management (MRM) solutions developed for the enterprise. Prior to TeleNav, Ravi served as a senior product marketing manager for AT&T Mobility. Ravi holds an MBA, Technology and Management from the University of Washington and a Bachelor of Science in Computer Engineering from the Pune Institute of Computer Technology. He can be reached at *ravia@telenav.com*.

[6] Ibid, Aberdeen Group.
[7] US Dept. of Energy Fuel Economy Guide, October 2009.
[8] Ibid, Frost & Sullivan.

Beyond Smart Meters

Pushing the Envelope of Demand Response

By Mary Miller, Marketing Director Z-Wave Alliance/Sigma Designs, Sunnyvale, Calif. USA and Ruth Littmann-Ashkenazi, Marketing CopperGate (A Subsidiary of Sigma Designs)

Every year, power outages cost American consumers $150 billion – approximately $500 for every man, woman, and child in the United States – according to the U.S. Department of Energy). Overwhelming demand for electricity during peak hours is terribly expensive and has caused power utilities to use rolling blackouts and brownouts as a method of "load shedding."

Utilities clearly need a smarter, more practical way of managing and responding to energy demand. One potential way is the nationwide deployment of smart meters, a project costing an estimated $40-$50 billion dollars, according to the Congressional Research Service Report.

However, to realize the full potential of the smart grid, utilities need to engage consumers in a partnership that will lead to better energy management in the future. To make that possible, smart meters need a way of "speaking" with devices and appliances within the home. Without connecting energy-consuming devices to the greater Smart Grid, utilities will still be unable to manage peak demand.

Utilities also recognize the importance of building good will among their customers by offering them user-friendly, in-home networking solutions that help them embrace smart energy while enjoying other lifestyle benefits of a connected home.

A fully functioning smart grid must make financial sense. Smart meters that can speak with end devices will empower consumers with information about their daily energy usage. This, in turn, will help them design ways of cutting back and saving money. Utilities will benefit by receiving information that enables them to predict energy usage, develop better pricing models, and load-shed without resorting to rolling blackouts and brownouts.

To reach these goals, the deployment of smart meters isn't enough. Utilities need to reach people's end devices, such as lighting systems, thermostats, and water heaters. That is ultimately where the energy demand comes from. Until now, utilities haven't reached all the way to these end devices for three main reasons. First, there has been no single standard for communicating from the smart meter into the home. Second, the standard communications protocol used inside the home didn't talk to the smart meter. And third, there has been a lack of interoperability that has slowed the implementation of Home Area Networks (HANs) and has raised the cost of implementation.

Smart Meter to HAN: Bridging the Gap

Achieving an affordable, practical solution to the smart grid is within the grasp of any utility. What is missing is a simple way to connect the smart meter to the consumer devices within the home. The best way to do this is by using a Home Area Network. HANs already are installed in millions of homes. All that is needed is a HAN gateway that enables a *bridge* between the smart meter and the end devices.

Before further discussing this bridge, it is helpful to take a glimpse within a HAN-enabled home.

Home #1 has a HAN that guarantees the resident will never enter his house in darkness. A small, light-weight fob, which attaches to a keychain, acts as a garage door opener and more. When the resident arrives home from work, he simply presses the button on this fob and the garage door opens to let him in.

The garage door opener is connected to a HAN so it is able to send command signals to other devices in the home. For instance, when the resident opens the garage door, the interior lights automatically come on. This offers the resident the security of being able to enter a home that is well lit and secure. In addition to the lights coming on, the thermostat goes into action and adjusts itself from energy saving mode to a comfortable climate setting. This entire "Arrive Home" scenario is enacted with the push of a single button – one button and the garage opens, the lights turn on and the thermostat adjusts itself.

The HAN-enabled sequence can reverse itself when the resident leaves the home for work in the morning: He closes the garage door with one button, the lights go out, and the thermostat adjusts itself again for maximum energy efficiency.

Clearly, the benefits of a HAN include energy efficiency, cost savings, and convenience for the consumer. The most widely used HAN is Z-Wave. This wireless mesh network technology is used in millions of installed devices and is built into more than 350 interoperable devices from lighting to doorlocks to thermostats and various other in-home devices – and the list is growing.

These devices enable whole-home control while also facilitating demand response by sharing energy consumption data with the consumer through energy monitors and user displays on PCs, laptops and other in-home screens. Consumption data is also shared with the smart meter. This communication link could enable utilities to load shed non-essential devices during peak hours.

One challenge for utilities, whose business models have traditionally stopped at the edge of the house, is that the home's interior is new, frightening territory. In fact, many utilities are loath to cross the threshold because they lack experience, they worry their smart meters won't interface with different protocols within the home, and they perceive the HAN as labor intensive, requiring the deployment of professional installers.

Thermostat doubles as in-home energy monitor

"The more utilities can get consumers to do, the better," said Michael Kuhlmann, president of Residential Control Systems. "Utilities don't want to be the guys to sell users all of these energy management things."

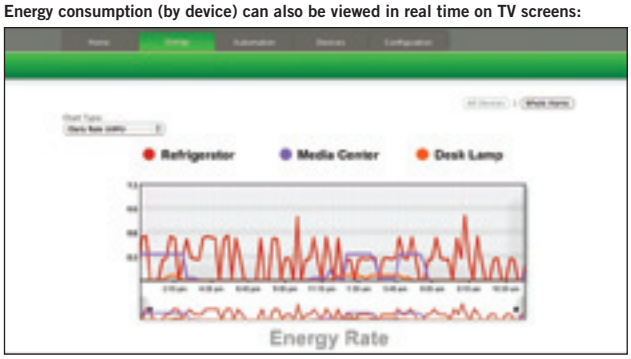
Yet, utilities have nothing to fear. These concerns are addressed by a plug-and-play HAN that empowers the consumer. With consumer-based products, users have easy access to do-it-yourself solutions. Adding a device to a plug-and-play HAN is simple. The user simply presses a synch button on an existing device and then on the new device. Furthermore, the best HANs create a mesh (rather than point-to-point) network with no new wiring. That means, if one device falters, it doesn't bring everything else down with it. The rest of the HAN keeps working.

Indeed, certain HANs let residents manage their home electronics from anywhere. Just about anything they can do with a remote control or an on-off switch they can now do off-site. Now let's enter a different home – one with a HAN that enables command and control from within the home and *remotely* via the Internet and mobile devices...

Consider Home #2. It's around the time the kids should be getting back from school. When they arrive, the HAN-enabled door locks tell the interior lights to come on and the thermostat to re-adjust to a comfortable setting. An alert is then sent to the parents' cell phones or PCs to let them know everything is all right; the kids are safe and sound. Having this kind of control from anywhere gives consumers a new sense of confidence. It's like being home even when they're not.

Another important feature of a HAN is "set and forget." This refers to the resident's ability to create a HAN that he, himself, configures to respond in a specific way to load shedding events and demand response signals from the smart meter. Once the resident "sets" the devices, he can "forget" about the HAN and go about the business of day-to-day life. If a grid event occurs, everything will be done automatically.

Energy consumption (by device) can also be viewed in real time on TV screens:



For example, suppose the resident sets his lights to dim, thermostat to drop, and pool pump to cease in the event of an "orange alert signal." When the utility issues this signal, the resident will be alerted via his mobile phone or PC. He might be asked to accept or reject the automatic load shedding and/or demand response measures. A read-out might even remind him about what he set: in this case, lights, the thermostat, and pool pump.

If he chooses accept, his smart meter will dim his lights, lower his thermostat and stop his pool pump. However, he might choose to override this response by pressing "reject," a helpful option if, for instance, a child is home sick and needs the in-home climate to stay warm.

Home #3 is an electronic jungle. On a typical night, the kids are upstairs watching a movie, playing video games, and – just maybe – doing their homework on the computer. The wife is blow-drying her hair while bread bakes in the oven. The husband is enjoying a football game on his widescreen plasma TV in the living room.

At some point that evening, the husband decides to open the mail. He goes into sticker shock upon seeing the past month's electricity bill and vows to cut the next month's bill in half with the help of his HAN. Here's how he does it:

PC-based remote management capability lets consumers control their home energy usage from anywhere in the world.

At the push of a button on his remote control, he brings up a transparent overlay at the bottom of this TV screen. This overlay tells him the real-time energy usage of every device within the home. He doesn't even have to change the channel! While still watching the game, he'll see how much electricity the kids are using upstairs, how much his wife is using to bake bread and blow-dry her hair, and how much he's using to watch TV. The read-out will reveal the energy consumption of devices that no one's using, like lights left on in the basement. These can be turned off at the push of another button on his simple HAN remote control.

Clearly HANs provide many conveniences to the end-users, and HANs that are plug-and-play and accessible from remote locations over IP and mobile phones offer the additional benefit of being easy to install and remotely accessible. Plug-and-play and remote access, however, are not the only requirements of an effective HAN. Interoperability is also vital. Different device vendors use different HAN protocols. Somehow, they all need to be able to speak to each other – and the smart meter, too.

Indeed, one of the reasons many utilities aren't delivering on the smart grid promise is the concern about interoperability between the smart meter and the HAN. With the development of bridge devices, this issue becomes easier to solve. Utilities need a gateway that supports the smart meter and bridges to the technology that supports the HAN.

The earlier utilities are able to realize the full potential of the Smart Grid, the more quickly and effectively they will be able to manage the public's demand for energy. They'll also be equipped to predict energy usage in the future, when recharging electric cars and other doing other tasks that will amplify the need for better energy management.

Other benefits of implementation of the Smart Grid – from head-end to HAN – include the ability to achieve demand-based pricing models for energy. When smart meters are able to speak with end devices, utilities will be able to load shed on specific, high-consumption devices, thus sparing the need for rolling blackouts. Beyond that, the Smart Grid – when fully implemented – will bring participation and empowerment to consumers, who want to enjoy the conveniences of a connected home while keeping track of their energy usage and reducing their utility bills.

About the Authors

Mary Miller has been marketing director for Sigma Designs and the Z-Wave Alliance for nearly three years. Prior to coming to Silicon Valley she worked in consumer electronics, both in retail and on the manufacturing side. She has collaborated on nationwide consumer energy research projects and represents Sigma Designs in many of their Smart Grid and energy management initiatives, both domestically and internationally. Mary holds a BA in English from University of Louisville and has done post-graduate work at UC Berkeley.

Ruth Littmann-Ashkenazi works in marketing at CopperGate, a wholly owned subsidiary of Sigma Designs. Prior to joining CopperGate, Ruth worked for Citala, a technology company enabling flexible displays. Ruth holds a Masters in Business Administration from Boston University and a Bachelor of Arts from the University of Michigan in Ann Arbor.

Systemic Work Management Approach at NV Energy: A Better Way to Get Things Done

By Ty Kiisel, @task Inc., Orem, Utah USA

The President asked, "How are you?" The janitor replied, "I'm doing great. I'm putting a man on the moon." The President left the restroom, got back on Air Force One, and flew back to Washington. There was NO problem at NASA.

Success isn't rocket science. President Kennedy's visit to NASA taught us the two keys to implementing a better way to get work done:

- Align corporate strategy with workforce execution
- Engage the workforce in the project management process

As energy consumption per capita continues to increase and producers are under pressure to keep energy affordable, the need to maximize every dollar spent is a priority for every organization. The biggest challenge facing executives is making certain that initiatives undertaken at every level of the organization are focused on meeting the sometimes-competing demands of providing the electricity required, at an acceptable price.

Making Data-Driven Decisions – Doing the Right Projects, Not Just Doing Them Right

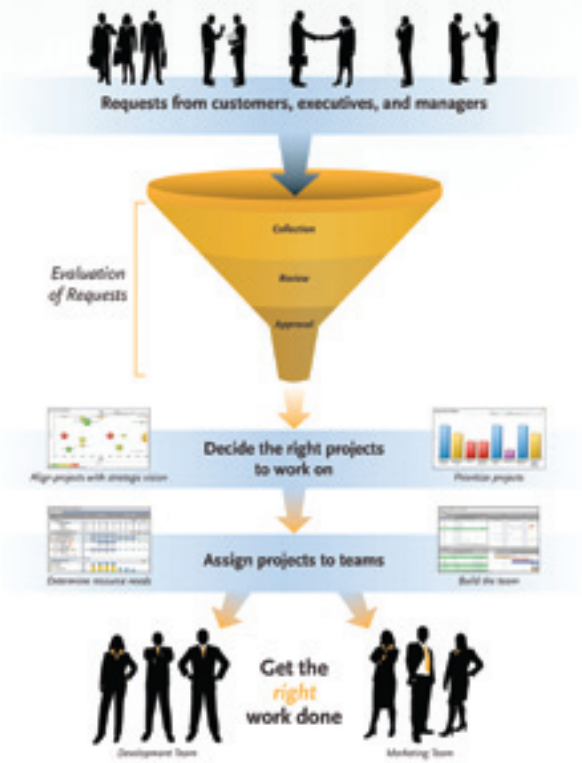
To efficiently produce electricity, business leaders need reliable and up-to-date information. When markets are down and budgets are under increased scrutiny, an organization's need for trustworthy information becomes even more critical. However, the challenge is not in obtaining more information, but in obtaining the *right* information. Many organizations are surprised to discover that the solution requires a systemic approach that addresses the tactical needs of the workforce in concert with the strategic and business intelligence needs of executive decision-makers.

Knee-jerk reactions can be expensive for organizations. In fact, as many as 80% of project-based work fails to meet objectives – which means making decisions without trustworthy data can be very expensive. History has taught us that creating a formalized evaluation process, for potential and current projects, based upon alignment to corporate strategy and financial goals is the first step. Regrettably, in most organizations, it's the squeaky wheel that gets the grease. In other words, if a powerful stakeholder has a project that he or she supports, it's more likely to gain approval – regardless of whether or not the project provides the most business value.

Establishing a process that requires every potential project to meet pre-determined criteria for acceptance allows executives to have confidence that they are making data-driven decisions – instead of knee-jerk reactions to the demands of an influential stakeholder. Some important questions that should be asked when evaluating any project include:

- **What are the high-level objectives of the project?** It's not uncommon for a project to morph into something very different from what was originally intended. Specifically identifying the goals of every project helps project teams, sponsors, and stakeholders stay on track.
- **What are the estimated costs of the project – and the anticipated rewards?** Without the answer to these questions, it becomes difficult to determine if the potential project will provide any business value, let alone the greatest business value.
- **Does the potential project align with the mission, vision, and values of the organization?** Individual projects *must* represent the execution of strategic direction and financial goals if the desired result is to maximize every dollar spent in the pursuit of the greatest ROI.

- **What are the risks associated with pursuing the project under consideration?** If potential project risks can be identified and evaluated while in the consideration process, actions can be taken to mitigate risk and increase a projects probability of success.



A formal evaluation process helps decision-makers evaluate projects to focus the workforce on doing the right projects.

Establishing a formalized evaluation process for potential projects makes it possible for business leaders to prioritize and weight different initiatives to determine if they are worth pursuing.

Managing and Allocating Resources

Once the goals, costs, alignment, and risks, of a potential project have been addressed and defined, the project can be *objectively* evaluated to determine whether or not there are adequate resources available to execute the proposed project. In a perfect world, every potential initiative that provided business value would be pushed forward – however, the limits of available resources force executives to make decisions regarding the projects they will prosecute and the ones they will abandon.

Best-fit capacity planning is critical as resource pools diminish. Creating "what if" scenarios, which can be pushed around a timeline to determine which projects are feasible, allow decision-makers to objectively consider the resource implications of every project. Understanding the value of potential initiatives when measured against available resources make it possible to prioritize projects and optimize the value of an organization's portfolio of projects.

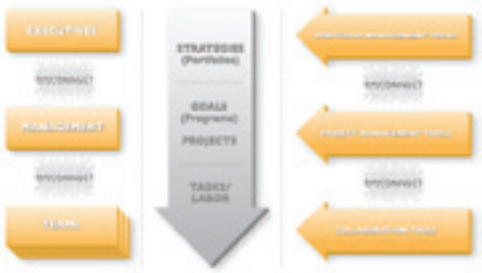
Prioritizing and Optimizing

This is where the rubber hits the road. By weighting proposed projects, organizations can take a strategic approach to project implementation. Executives must consider their risk tolerance, the importance of return, the costs, and the potential project's alignment to the mission, vision, and values of their organizations – and make a comparison to the answers found in the valuation.

The Hidden Secret of Successful Project-Based Work

The traditional top-down approach to work management simply doesn't work. This is evidenced by an unacceptable failure rate of individual projects as well as a disheartening rate of failure in the Project Management Office (PMO). Some estimates actually place the PMO failure rate at 50% – about the same odds of success as flipping a coin.

To provide real business value, project-based work needs to fit within the overall business context. In other words, strategies at the executive level become the goals of the management level, and the work done in the field or on the plant floor. However, many organizations struggle with communication between the executive level, management levels, and the workforce – creating a lack of visibility, lack of foresight, and inefficiencies within the organization.



Communication disconnects between decision-makers and the workforce create a lack of visibility, a lack of foresight and inefficiencies within the organization.

Organizations working in silos that attempt to address their work management needs without addressing the disconnected communication issues are doomed to fail. To ensure that organizations are able to enjoy visibility, accurate business intelligence, efficiency, and the optimal use of resources, they need to employ a top-down and bottom-up management approach.

Organizations Need to Change the Way they Manage Project-Based Work

Top-down project management focuses on resource utilization, but fails to gather ground-up intelligence. The secret to successfully implementing a better work management methodology requires that organizations engage the workforce – allowing information to seamlessly flow up to executives and across departments.

The secret to successful work management requires that organizations engage the workforce – allowing information to seamlessly flow up to executives and across departments

Any methodology that fails to engage the workforce handicaps its ability to collect accurate and timely information for decision-making. Executive dashboards and project reports are of no value if the information isn't trustworthy or is out of date. The secret to successful work management resides in an engaged workforce. User involvement enables good decision-making. Implementing a top-down and bottom-up methodology gives organizations visibility, accountability, and operational effectiveness.

NV Energy's Vendor-Managed Inventory Project – A Systemic Work Management Approach

NV Energy has supplied the power needs of northern Nevada and northeastern California for more than 150 years, and Southern Nevada since 1906. With the help of BDM Consulting, a global supply chain management consultant, the company strategically transferred thousands of internal inventory items used for maintenance, repair, and operations on plant systems, from a company-owned inventory to a consigned vendor-managed inventory (VMI) model.

Because NV Energy's power generation system spans a service area of 54,500 square miles, the initiative required a work management solution and methodology that accommodated a geographically diverse and departmentally dispersed workforce. To successfully implement new business processes, the new work management methodology needed to:

- Provide transparency into the VMI initiative so BDM, NV Energy, the individual power plants, and the selected vendor had complete visibility and accountability into the new inventory management process and its implementation.
- Enable BDM to efficiently manage the new inventory management implementation processes vertically with NV Energy's selected supplier and horizontally across the plant fleet and supporting departments.
- Facilitate collaboration among NV Energy management and power generation locations hundreds of miles from each other.
- Quantify the cost savings of the VMI initiatives and manage issues throughout the project.

A Successful Implementation

Taking a top-down *and* bottom-up approach to managing the process enabled NV Energy to obtain:

Immediate visibility and accountability – Engaging the workforce in the process allows NV Energy to capture real-time business intelligence. Every time someone on the plant floor or their inventory vendor updates task status, executive reports and dashboards are instantaneously updated – and everyone involved in the project is notified via time-stamped email anytime status changes. This gives NV Energy visibility into every initiative, enabling them to efficiently manage issues with suppliers in real time. Their work management solution keeps everyone in the process accountable – if anyone misses a deadline or milestone, everyone on the project team knows about it. It also allowed NV Energy to collect key data used to negotiate corrective action with the vendor when challenges developed during implementation.

Streamlined implementation of the new inventory control system – Total project transparency empowers NV Energy to keep their selected supplier accountable for performance and provides an effective metric for evaluation.

NV Energy is able to implement the new VMI initiative across the company, ensuring that the implementation meets the needs of their organization and plant management.

Real-time collaboration – Regardless of location, BDM, NV Energy, and vendor project teams are able to collaborate in real time. An Internet-based, on-demand work management solution allows project teams throughout the system to access accurate and up-to-date information every time they log into the system.

Verifiable ROI – Configurable reporting allows NV Energy to capture direct and indirect cost savings of the VMI implementation with reporting that can drill down to the task level. By consolidating vendors and reducing the number of individual transactions flowing through NV Energy's Accounts Payable (that average between $25-$50 per transaction), NV Energy was able to quantifiably reduce inventory expense on maintenance items by 10x.

By addressing this project with a top-down and bottom-up solution, NV Energy is able to successfully collaborate with team members and vendors – regardless of where they are located. Complete visibility into the VMI initiative allows NV Energy to efficiently manage inventory requests and keeps vendors accountable to the needs of every power generation facility in the system. Their work management solution also provides a means to verify ROI with metrics that demonstrate substantial cost savings for NV Energy.

NV Energy and BDM Consulting jointly presented these results at the National Utility Supply Maintenance Conference in May of 2008. "The vendor-managed inventory control initiative was successful, it enabled NV Energy to realize the value of thinking in terms of fleet-wide, value-added, strategy, which is paying off from them," said Damon De La Pena, Co-Founder and Managing Director, BDM Consulting.

Organizations struggle when execution by the workforce doesn't align with the strategic vision of their organizations. Accomplishing this requires a work management solution that addresses the business intelligence needs of executives, the process management needs of managers, and facilitating the capture of accurate and timely data from the workforce. Any solution that fails to meet these criteria will ultimately fall short.

About the Author

Ty Kiisel writes about project management for @task project management software. @task places business intelligence tools in the hands of executives and makes team-collaboration accessible to the front line. @task clients include Central Hudson Gas and Electric, DTE Energy, NV Energy, Pacific Gas and Electric, Schneider Electric, and Trilliant.

Hawaiian Electric Tests Energy Savings Opportunities in Small Commercial Markets

By Steve Smith, Director-Sales & Marketing, Honeywell Utility Solutions (Danvers, Mass. USA)

The customer is always right. Or, in the case of the Hawaiian Electric Company (HECO), the more appropriate saying might be "the small commercial customer is always *ripe*" – as in ripe for energy savings opportunities. That's the thinking behind HECO's small commercial direct load control pilot program. HECO had long suspected that this typically underserved market was also an untapped area for significant energy savings. So, in August 2008, the utility embarked on a five-month pilot program to test this assumption. The pilot not only served as a blueprint for how to reach the small commercial market and drive high levels of customer participation while addressing a mix of challenging factors – including the Hawaiian energy landscape – but also laid the foundation for a future large-scale program.

Peak Situation

Hawiian Electric Company has long sought ways to curb peak energy use and improve efficiency given its energy needs. The utility and its subsidiaries, Maui Electric Company, Ltd. (MECO) and Hawaii Electric Light Company, Inc. (HELCO), serve 95 percent of the state's 1.2 million residents on the islands of O`ahu, Maui, Hawai`i Island, Lana`i and Moloka`i. Each island's generating system operates independently of the others.

Unlike utilities on the mainland United States, HECO and its subsidiaries are not interconnected to each other or any other utilities. Additionally, they cannot tap into the national grid to buy more power when demand outpaces supply. Instead, the islands are solely responsible for generating their own power, and utilities must build additional backup capabilities into their systems. This results in higher electricity rates in Hawaii than rates on the U.S. mainland.

Further complicating Hawaii's power reliability is the fact that year-round moderate temperatures mean air conditioners also run year-round. This creates more chances for periods of peak demand, when energy use strains the electric supply and can result in disruptive brownouts and blackouts.

These circumstances prompted HECO to establish more reliable and affordable electric service – especially during periods of peak demand and system emergencies. Among HECO's earlier efforts was the implementation of a residential load control program, beginning in 2005.

The program involved installing remote-controlled switches on in-home electric water heaters and cooling systems. The devices enabled HECO to temporarily turn off the heaters and cycle off the cooling systems during peak demand periods and generation emergencies, when electricity demand far outpaces available supply. It also allowed HECO to obtain more control over electricity use among its residential customers, which puts the utility in a better position to supply power across the island without interruption.

When program enrollment soared and HECO reached the initial program goals, curtailing 27 megawatts as of Dec. 31, 2009, the utility turned its sights to its small commercial customer base to test a similar program.

"After the success of our residential program, we wanted to see if we could achieve the same results with small commercial customers," said Keith Block, Program Manager. "But, would they participate? We knew the potential for savings was there, but we also knew this would be a more challenging market to reach."

HECO representative reviewing program details with business customer

Commercial Appeal

HECO tapped Honeywell to help implement the small commercial pilot program. The pilot targeted customers with demand levels typically ranging from 10 kilowatts to 200 kilowatts. HECO singled out these customers for the installation of load control devices on various appliances, including water heaters and air conditioners with a minimum of three tons in capacity. This excluded small commercial customers with window air conditioning units.

The program's components were similar to those of the residential load control program and centered on the installation of a radio-controlled device near air conditioners or water heaters. Each device is enabled with an under-frequency relay. If energy demand on the island threatened to exceed the utility's ability to supply electricity, the device would sense the emergency and shut down the power supply to the equipment in less than a second, according to Block.

Small commercial customers who enrolled in the free program would receive the device at no cost. For their participation, they'd also receive a credit on their bill each month for the duration of their involvement; thus, further helping them save money while driving the utility's ability to provide uninterrupted power.

HECO aimed to offset 340 kilowatts of load by the end of the pilot's five-month run – equivalent to the installation of devices on 127 water-heating units and 290 air-conditioning units, respectively. HECO based these unit goals on its own assumptions for how much load it could control given its experience with the residential load control program. The utility also tapped engineering calculations from an outside consultant and ultimately came to the conclusion that it could control 0.67 kilowatt per water heater and 0.88 kilowatt per air conditioner.

In mid-August 2008, the pilot began with the formation of a customer support team and the implementation of a management tracking system to help administer the program. HECO also developed the necessary marketing materials to help drive program interest among its customers.

Before trying to sell the program to customers, however, the program team needed to pre-qualify potential candidates. This entailed gathering information on customers' air conditioning units and water heaters via phone or obtaining the air conditioner or water heater vendor service contracts.

Efforts also included physically observing the customer's business – and, if possible, its individual water heaters and air conditioning units – to assess the size and ensure the customer would even qualify for the program. For this reason, HECO cites expertise and prior experience in the field as key factors to getting the program up and running.

HECO sales person walking perimeter of building to pre-qualify business

"We had a limited amount of time to reach our goals and enroll often difficult-to-reach customers, so having a good sales and technical person in the field to quickly pinpoint controllable loads was especially useful in the process," Block said.

For example, field personnel immediately ruled out customers they observed with high heat loads in small spaces, like small bakeries, where temperature comfort levels are critical and even slight adjustments to a customer's heating load could wreak havoc on normal operations.

Technician on roof reviewing A/C units

Surround-Sound Recruitment

When the time did come to contact customers about enrollment, HECO took an approach slightly different from those typically taken with other customer load control programs.

"Small commercial customers are always a bit more of a challenge and require more services than other customer segments," Block said. "You're usually trying to get the attention of one or two people who wear many different hats within their organization, and they don't have the dedicated time like a facility manager might to figure out everything on their own."

Specifically, field personnel dedicated more time to speaking with the targeted customers to carefully explain the benefits of the program. HECO also put in place a dedicated team member in the field to talk with customers and help solve issues when necessary.

To capture the attention of potential participants and set the stage for these conversations, HECO used two distinct direct marketing pieces. The first piece, targeted at small business customers, simply informed them of the program, how it works and its various benefits.

For the second piece, HECO targeted 19,503 residential customers enrolled in the residential load control program. This approach was largely driven by the residential program's high satisfaction levels and low dropout rate of less than one-tenth of 1 percent, according to Block.

The piece led with a question asking if the customers would recommend the program to friends and associates, and then probed deeper, asking if they thought their employer would be interested in the small commercial pilot. This approach ultimately resulted in 212 customers responding yes, and became a primary lead source for the pilot.

"We saw an opportunity to leverage the residential program's success and took a more innovative, grassroots approach," Block said. "Personal recommendations can be powerful, and we wanted to tap into that."

Driving general awareness and spreading the message about the small commercial load control program ultimately led to customers enrolling at higher-than-expected rates. Overall, the direct mail pieces garnered more than 600 leads, and to complement these efforts, canvassing work also generated 400 leads.

Flexible Forces

HECO found the balance between minimal interruptions and the bill credit proved especially appealing to small commercial customers. Beyond the initial interest, though, were additional challenges for getting the pilot up and running that required special adjustments and flexibility.

"Our small commercial customer targets were receptive to the idea of saving money, and convincing them to sign up for the program — once we made contact with them — wasn't that challenging," Block said. "Closing the deal and doing our homework to ensure each customer was cut out for the program, even after they expressed interest, proved more time consuming."

Ultimately, a bulk of the pilot program's set-up efforts came after the initial marketing and canvassing, beginning with the enrollment process. The pilot required all participants to sign a program application indicating their approval of the load control device installation. For those sites not occupied by the owner, HECO required the signatures of both the tenant and the landlord, which accounted for nearly half of the pilot's participants. This added time on to the closure process, and the rate of closure fell behind the sales lead generation rate. As a result, HECO shifted the bulk of its attention to enrolling owner-occupied properties.

Shifts like this affected the types of customers targeted for enrollment due to both timing and available loads. For example, franchise sites added an extra layer of approval in the decision-making process and extended the sales cycle. Despite the timing issues, franchise sites offered potential high-yield installation opportunities due to the multi-unit installations typical for these locations – just the kind of installations HECO sought in order to reach its pilot goals.

HECO also approached food establishments with caution, knowing this segment would make for a less-than-ideal pilot participant due to comfort concerns, and industry health and food preparation standards. For example, when HECO cycles air conditioners off during events, the temperature can rise, altering comfort and acceptable temperature levels. Also, turning off water heaters for even a small amount of time could lower water temperatures enough to put a restaurant in violation of regulations.

Remote-controlled switch on water heater. This device enables HECO to temporarily turn off heaters during peak demand periods and generation emergencies, when electricity demand far outpaces available supply.

Knowing the potential for issues like these, program engineers implemented manual "practice" load-shedding events at customer sites during the sign-up and installation periods. These practice tests entailed mimicking what would happen during an actual load curtailment event for two to three hours in order to determine what affect it would have on business operations and ensure no major issues would occur. This included a test event at a restaurant during the noon rush, for example.

"We wanted to ensure there would be no surprises during an actual event," Block said. "Some customers really aren't a fit for this type of program, and we did our homework in trying to make sure we didn't enroll a site that would only experience adverse effects during an event."

Measurement and verification also played a critical role in the program. During the installation process, personnel measured and verified the curtailable load and added each calculation to the cumulative total. This helped measure installations against HECO's target and ensured it was on track to meet its goals.

Remote-controlled switch on A/C. This device enables HECO to also temporarily cycle off cooling systems during peak demand periods and generation emergencies.

Diverse Considerations

This kind of due diligence was especially important given the diversity of the customers HECO evaluated for the program. Of those who fell into HECO's "small commercial" category, all displayed different needs and characteristics that influenced if they fit well with the pilot.

For example, industrial parks served as a consistent source of air conditioner-packaged units, typically featuring 1 to 3 packaged units per business. Also, most of these businesses do not have exposure to the public, which made them better fits for the program due to fewer comfort concerns. And, because property management companies typically oversee office parks, the sales cycle was relatively short due to one main point of contact.

HECO found that other ideal candidates included hair salons because of their water heaters, as well as doctors' offices and other health services. Condominium common areas qualified and typically featured a high number of water heaters in one location, with significant available loads.

HECO found that other ideal candidates included hair salons because of their water heaters, as well as doctors' offices and other health services. Condominium common areas qualified and typically featured a high number of water heaters in one location, with significant available loads.

Schools and churches were also very responsive to the program and typically qualified, while food and beverage stores were not ideal candidates due to their perishable items. Also, very small stores often did not qualify for the program since they mostly rely on either window air conditioners or wall units.

In addition to specific customer needs and characteristics, Block also emphasized that having a diversity of curtailable loads was critical for the pilot.

"We realized early on in the pilot that we needed to diversify so that if one type of load didn't respond, we could still curtail enough load during an event to achieve our goals," he said. "Fortunately, the benefit of working with small commercial customers is that they are so diverse."

Proof in Results

By the end of the pilot period in December 2008, 127 customers had enrolled and personnel installed 417 switches, resulting in 755 kilowatts of curtailable load.

The actual load captured was more than double the expected load, despite the number of installed switches being equal to the original goal. HECO attributes this difference to encountering larger-than-expected air-conditioning systems during installation — another result of the diverse small commercial customer base. Moving forward, HECO plans to begin a full load control program for its small commercial customers once it receives regulatory approval.

"The pilot helped show us the market is there for a full program and that the technology works with this kind of customer," Block said. "We now have a better understanding of all the nuances specific to our small commercial customers and are confident that we can replicate this success on a broader scale for greater energy savings in the future."

About the Author

Steve Smith is the director of sales and marketing for Honeywell Utility Solutions <*http://www.honeywell.com/utility*>, which has 25 years of experience designing and implementing demand response programs for utilities. The business has installed more than 950,000 load control devices to date, which makes it the largest implementer of residential demand response in North America. It also provides smart metering, and energy and water conservation solutions to utilities. Steve has been working with utilities for more than 17 years. He has an MBA from Northeastern University, as well as a bachelor's degree in Electrical Engineering from the University of New Hampshire. Steve can be reached at *stephen.smith7@honeywell.com*.

Smart Networking for the Smart Grid

By Bernie Nelson, Director of Service Development – Utilities, Energy & Transportation
Hughes Network Systems, LLC (Germantown, Md. USA)

It appears 2010 will be a banner year for the "Smart Grid." In 2009, analyst firm IDC estimated $10.75 billion was spent on computer hardware improving the nation's electricity grid, up from $7.56 billion in 2008[1]. With cost savings, secure management and greater intelligence in energy distribution among the many benefits of a smarter grid, it is no surprise that continued improvement of the nation's electricity grid will dominate spending in the utility market during 2010 and beyond.

Critical to the level of intelligence achieved in making the grid smarter is its backbone – the network and communications infrastructure. Indeed, requirements of the communications network are very demanding – encompassing issues such as scalable bandwidths, robust security, high network reliability, availability and cost-effectiveness.

Many in the industry conclude the most cost-effective approach to meet these requirements is leveraging the wide range of transport technologies available, while relying on common open standards, such as IP, to integrate into a single overall network. This article discusses the value that advanced, satellite-based networks can deliver as part of the smart grid communications infrastructure, across areas ranging from substation (SA) and distribution automation (DA), to mobile work flow.

Not Your Father's Satellite

Unknown to some, satellite networks have evolved at a similar or even faster pace than other networking technologies, making huge strides in improving performance, reliability, and cost. In fact, some of the highest availability networks in the enterprise market, such as for lotteries and emergency preparedness/recovery, are based on satellite and its fundamental advantage – ubiquitous coverage. And now when combined with high performance IP and other standards-based capabilities, satellite networks today deliver high-quality private, broadband connectivity.

Indeed, very high network availability, in excess of 99.99 percent, can be achieved through innovative dual frequency, dual access solutions by utilizing Ku-/Ka-band satellite service in conjunction with L-band satellite service as backup. Smart grid network elements, such as remote substations and distribution elements can now be connected using satellite without compromising on the expected benefits driving the smart grid.

Additionally, new satellite technology can cost-effectively deliver benefits such as on-the-move vehicle connectivity, allowing those out in the field to connect directly with headquarters and eliminate costly trips to the office obtaining information. Looking forward, satellite holds the potential to facilitate distribution automation, meaning utility companies can proactively monitor their distribution elements for outages and service demands. Utility managers and technology decision-makers should take into account the benefits satellite technology can deliver for these applications and the benefits they can deliver to smart grid efforts.

A Quick "Spark" on Satellite

Before jumping into utility-specific benefits, it may be helpful to take a quick look at the evolution of satellite communications in the recent past. Satellite communications for commercial purposes began roughly 25 years ago with the advent of Very Small Aperture Terminal (VSAT) technology, passing voice and/or data traffic between multiple locations. Small, back then, typically meant six feet in diameter or so. Six feet is hardly small, but certainly much smaller than the 15 to 40 foot dishes used previously.

The result of drastic reduction in diameter meant satellite communications became a viable means for voice and/or data communications in areas that had limited alternatives.

[1] Rebecca Smith and Ben Worthen, "Stimulus Funds Speed Transformation Toward 'Smart Grid'," Wall Street Journal. September 28, 2009.

In subsequent years, satellite technology advanced and dishes became smaller, with transmission faster and less expensive. For example, in the past, speeds of 9600 bits per second using six to 10 foot dishes were considered cutting-edge satellite technology. Today, download speeds of multiple megabits per second are routine using compact, sub-meter size antennas, operating with high performance, multi-user routers on customers' sites, fully integrated with their LAN networks and security firewalls – and with a range of affordable service plans to choose from.

A critical area of continuing improvement is in cost of satellite bandwidth. Access, modulation, and coding techniques are becoming ever more sophisticated, leveraging the maximum throughput out of the fixed amount of bandwidth on a given satellite, in some cases approaching Shannon's information limit. Although transparent to users, these advanced methods have dramatically improved the efficiency of bandwidth utilization, which translates into higher speeds at lower costs.

Certain other mobile satellites operate in the L-band (1-2 GHz spectrum) and S-band (2-4 GHz spectrum); the low frequency enables them to be more resistant to rain fades and to provide mobility services. Companies in this field are introducing portable (laptop-sized) terminals and hand-hand devices, providing high-quality voice and data communications on-the-move (OTM). Some of these handsets are designed to operate in dual mode – cellular and satellite. Terrestrial cell technology provides coverage where available and satellite elsewhere. These services are well suited for applications requiring portable coverage in even the hardest-to-reach areas and do not require the transmission or reception of large data volumes.

Satellite networks can be designed for residential-grade or enterprise-grade broadband service delivery, or anything in between, just like terrestrial fiber, DSL or cable. But there are significant differences across this spectrum in terms of performance, reliability and cost. When exploring satellite solutions as an option to serve WAN requirements, organizations should correctly identify and evaluate the commercial-grade services offered by satellite providers.

Ku-, Ka-, and L-band services are provided as a fixed satellite service (i.e., the satellite terminal is installed and fixed in one location while it sends and receives information from the satellite). Fixed-mobile – also referred to as transportable – and OTM solutions refer to a car, truck, or trailer equipped with satellite communications technology. In the case of fixed-mobile, the vehicle must come to a stop and the dish unfolds and automatically points to the satellite with the push of a button. In the case of the OTM solutions, communications to and from the satellite can occur while the vehicle moves. Spherical-style antennas are mounted on the roof of vehicles and are 18 inches in diameter and getting smaller – a very appealing feature of OTM antenna design.

How does this all apply to the utility industry? Companies can utilize satellite solutions for a variety of applications: substation connectivity, distribution automation and mobility are three areas where satellite connectivity is especially beneficial.

Substation Connectivity

Satellite connectivity has been used for years to provide Supervisory Control and Data Acquisition (SCADA) connectivity to and from remote locations in the oil and gas pipeline industry and related energy exploration and production applications. The data requirements are relatively low in volume (i.e., as compared to many electric utility SCADA systems) but regular in frequency or periodicity. Private satellite networks served this need well delivering secure, custom network bandwidth profiles and ubiquitous coverage. The solution worked well, both technically and economically, for hard-to-reach SCADA and SCADA-like requirements in these industries.

This still holds true today. Satellite is a great fit for these types of applications and is in use to support SCADA and other applications at substations. The performance of the applications is consistent and effective. However, with the increasing goal of achieving near 100 percent uptime, conventional Ku- and Ka-band satellite solutions fall short. A typical commercial satellite connection is generally engineered to deliver 99.7 percent to 99.9 percent link availability, which means on average, 0.1 percent to 0.3 percent of the time, a satellite connection will be lost.

That percentage coincides with a certain intensity of precipitation. When it rains or snows to a certain degree of intensity, the satellite connection will drop for the period of that critical intensity. Unfortunately, substation connectivity is most critical during storms where electricity outages increase, thus making a conventional satellite solution not optimal to achieve near 100 percent availability – until now.

With any type of connectivity solution, it is very difficult to achieve 99.99 percent or 99.999 percent availability with a single-thread connection.

To address this problem, many utility companies employ a backup connection, which can increase the availability of any connectivity to nearly 100 percent. So how can the same availability be achieved with a satellite-only solution?

The answer is with a L-band based service that backs up the primary Ku- or Ka-band satellite connection. L-band is in the 1-2 GHz range and is not susceptible to degradation during precipitation. So when the primary Ku- or Ka-band satellite service fades during rain, the backup path, L-band, will be available to pass traffic. The L-band service is usage-based and can be expensive with heavy usage. However, since it is used as the exception, rather than the primary connection, it only is used a small percentage of the time passing low-volume traffic, keeping costs to a minimum. A comparably configured terrestrial solution might cost three times or more for the same level of availability.

Combining L-band with Ku- or Ka-band satellite technology as a high-availability solution can deliver the performance that has always been delivered for SCADA-like applications, but with near 100 percent availability that is required for substation connectivity. Additionally, satellite still provides its inherent advantage – 100 percent nationwide coverage. Simply put, there are no "dark" spots.

Moreover, satellite supports broadband applications such as Voice over IP (VoIP) and video surveillance. Network bandwidth can be tailored to specific requirements and the solution is completely private, meaning no traffic crosses the public Internet. L-band and Ku-band satellite technology has been available for some time, but until now has not been combined in this manner to provide a singular solution. A "perfect storm" of requirements exists such that the traffic profile, the remote locations and the need for very high availability make this an ideal solution for the utility industry.

Distribution Automation

Similar data requirements as those in substation connectivity exist to support monitoring elements along distribution lines. Fortunately, the attributes of private

satellite connectivity also apply well for substation connectivity. However, a dual path, high-availability solution may not be cost-effective. A single, high-availability connection at an access point fed by distribution devices may be a better solution for monitoring and control.

There are a couple of options. One is using the L-band solution. It has a very small form factor, is hardened, can be mounted anywhere and is easy to install. The downside is usage costs. Depending on the volume of traffic, it might be cost-prohibitive to use the L-band solution at all locations. Locations in more densely populated areas are likely better served with an alternative licensed or unlicensed wireless solution. However, in rural, less dense areas, the same wireless technologies may be more costly or unavailable, and the slight premium that might be incurred using an L-band solution may be justified.

The second alternative is to use advanced antenna technology for fixed satellite service. The emerging advanced antenna designs offer a very small form factor, install and point easily, and have the advantage of fixed operating costs. In most cases, availability can be designed to approximately 99.9 percent.

Mobile Workforce

Gone are the days where a company's workforce is not connected at all times. With so many options for field personnel to stay in touch, there is no reason not to equip them with the right technology. So what is the "right" technology? Cellular coverage is quite extensive and affordable but may require multiple providers to cover larger geographic areas. And although cellular data delivers a few hundred kilobits-per-second performance, speed fluctuates and coverage may not be complete.

Radio networks are also a ready option, but are limited in range and bandwidth. So what currently happens if personnel, using cellular or radio networks, are out of range? They typically drive somewhere to find connectivity, certainly not an ideal situation for personnel on location supporting customers with restoral efforts outside of a utility company's immediate service region.

These "dark spots" are where satellite technology can provide the solution. Vehicles, as small as compact cars, can be equipped with fixed mobile or on-the-move satellite technology. The vehicle is equipped with a router which first tries to connect via cellular service, then private radio, and lastly, satellite. The router automatically finds the service that is available, so field personnel are constantly connected. The solution supports all data needs – work orders, dispatch and repair support.

Satellite also supports higher bandwidth requirements than other technologies, such as multi-Mbps downloads – an attribute unique to satellite technology in mobile applications. Finally, the same satellite infrastructure can be used for other aspects of an organization's communications infrastructure, mobile or otherwise.

Conclusion

Satellite networking technology has developed rapidly and now delivers the combination of high performance, availability and security that can greatly aid smart grid efforts for the utility industry. Substation connectivity, distribution automation and smart trucks are three key areas in which a satellite solution can provide the most cost-effective communications solution. Indeed, satellite solutions are an essential part of the multi-technology approach required by the utility industry to achieve an end-to-end, smart grid communications infrastructure – one that is reliable, fast, secure and cost-efficient.

About the Author

Bernie Nelson has been in the satellite and data networking industry for over 16 years. His various positions at Hughes have included international and domestic product and service development utilizing the latest technologies developed and manufactured by Hughes. He is currently responsible for the development of services in the utility, energy, and transportation industries. Bernie holds BS and MS degrees in Electrical Engineering from Virginia Tech with a graduate research focus on satellite communications. He can be contacted at *bernie.nelson@hughes.com*.

SECURITY SESSIONS
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With William T. (Tim) Shaw, PhD, CISSP

Keeping the bad guys away from our important stuff…

The usual mental and emotional response when someone brings up the subject of security, is that this issue is about nebulous "outsiders" attacking and trying to break-into our systems or facilities to cause harm. (Think ninjas hacking computer equipment to pieces with their swords!) In the world of security the term "threat agent" is used as a generic description for anyone/thing that can be a threat to security. The folks at the National Institute for Science and Technology (NIST) define a range of threat agents that might not instinctively come to mind, including natural disasters, weather and even social unrest. (Hmm, I don't recall seeing ninjas on their list). Floods, earthquakes, tornadoes and civil war are not usually what we think of as threat agents, but we routinely take measures to protect ourselves – and our critical cyber assets – from such faceless threats. This month we'll discuss possible threat sources and how we isolate them. – ***Tim***

Major EMS/SCADA control centers are usually situated well away from flood and earthquake zones (or backup, geographically-separated facilities are put in place if that isn't possible.) They are usually housed in structures built to handle weather extremes and which generally even incorporate basic physical protective measures (like guards and gates) against physical assaults. 'Threat agents' can, of course, be actual terrorist organizations, criminal organizations or even mindless malicious software such as worms and viruses. One broad categorization that can be used for defining threat agents is to divide them as being either 'directed' (intentional) threats and 'non-directed' (accidental) threats. As of today at least, no one knows how to send a tornado or an earthquake your way, so if you get hit by one, as terrible as the resulting consequences may be, it is still just an unfortunate accident. When an organization puts a security program together and implements plans to provide the necessary level of protective measures, one of the hardest parts of such an undertaking is to identify the credible threat agents against which the security program needs to implement defenses. Spending time, money and other resources to protect against non-credible threats is simply a waste. But failing to protect against a real, credible threat may leave an opening (a 'vulnerability' as it is called in security circles) that can be exploited by that threat agent. So what constitutes a credible threat?

That question cannot be fully answered without knowing the specifics of your situation. Certainly you can provide defenses against the weather and avoid placing your control center on the slopes of an active volcano. But, do you really need to worry about someone crashing a bomb-laden truck through your front gates or hacking into your automation systems? To answer that question, several factors must be considered, but the prime consideration is this: What will be the consequences of a successful attack? Accidental threats don't really care about that, but if your system gets infected by generic 'malware' (i.e., malicious software such as viruses and worms), that malware doesn't concern itself with what happens when it disables the computer or device it is infecting.

In other words, whereas a tornado doesn't care about the type of business you're in, an intentional, directed, threat agent does. That's because potential targets of attack – like your plant facilities and automation systems – are more attractive as targets, and may be 'worthy' of the necessary time and energy to stage an attack, based purely on the potential outcome of a successful attack. So if you make bricks, and a successful attack on your plant (or its control system) will shut down brick production for a couple of weeks with no one being otherwise harmed, then you are probably not a very attractive target for terrorists or activists. On the other hand, if you are a generating plant that provides base-load power to a large number of customers, then you might well be an attractive target. This is the reasoning behind the NERC stipulations that define a "critical asset" and associated "critical cyber assets."

If an asset's loss would cause a major long-duration outage, destabilize the grid or result in a threat to the public welfare, then it (whatever 'it' is) may well be a highly attractive target to those who wish to make headlines and/or terrorize the populace in a particular locale or region.

So far I've been discussing threat-agents as being either intentional (directed) or accidental (non-directed). But there is a further useful differentiation we can make by taking the directed (intentional) threat agents and further dividing them into two additional sub-categories: Internal and External. Most security efforts tend to focus on 'external' threats; that is, preventing the 'outside' people/organizations that want to do you harm from breaking through your physical and electronic security perimeters. Unfortunately, it's a sad truth that today we also have to be concerned about 'internal' threats, the "evildoer" who is actually one of your own; is angry or disaffected; and is probably already working within your security perimeter.

This person may be upset about a missed promotion, a pay cut, a disagreement with management, or any of many other such real or perceived transgressions. This might not be a direct employee, but rather a contractor or even a hired consultant. The point is that such a person has access to facilities, information, networks and even computer systems that an outsider wouldn't ordinarily have.

A different motivation for such an insider is greed; that is, being willing to assist an external attacker in exchange for monetary or other compensation. A different but related insider threat is human-error. Untrained or improperly trained employees can potentially cause as much damage as an intentional attack, while simply trying to do their job! Thus, the sub-category of insider threat-agents has itself two further sub-categories: Intentional and Accidental.

So, what can you do about addressing the insider threat, both the "evil" (intentional) kind and the accidental kind? Naturally, there are some things you can do with technology, such as using key-card access systems and electronic surveillance to monitor personnel traffic in and out of restricted areas. You can also review system logs to monitor user access to networks and computer systems. Or, you can even go to the extent of installing monitoring software in all of the PCs used by your personnel. (Note: Make sure that you provide the legally-required warnings about this possibility!) You can also institute physical searches of bags and briefcases and of personnel themselves. The risk of course is that treating people as if they are dishonest has been known to be a factor in employees becoming disgruntled. Anyone going through an airport today knows that feeling.

What has proven to work well for this issue is the use and enforcement of clear policies regarding acceptable behavior, and making workers aware of the consequences for violating policies. Also, the use of pre-employment background checks (criminal and financial) and drug testing, helps in weeding out potentially untrustworthy personnel (including contractors and consultants.) Those checks may also need to be repeated periodically, especially for people with the highest levels of physical and electronic access. Well-written and tested procedures also form a viable defense, particularly against that other internal threat sub-category: accidental damage.

The same goes for employee training. Develop good security policies and procedures and conduct effective, regular training to help mitigate human error and the corresponding problems. If employee training includes awareness of insider threats and understanding of security-related company policies, an evil insider will find it more difficult or impossible to launch any serious attack because co-workers following those policies and procedures will be better equipped to block such insidious efforts. These strategies fall under the category of administrative countermeasures, and there is a range of those that can be applied to the insider threat problem. But we'll address that dimension in a future session... – ***Tim***

About the Author

William T. "Tim" Shaw (PhD, CISSP) has been active in industrial automation for more than 30 years and is the author of Computer Control of BATCH Processes and CYBER-SECURITY for SCADA Systems. Tim has contributed to several other books and is a prolific writer and presenter on a range of technical topics. He is currently a senior security consultant for SecuriCon, an information security solutions firm, based in Alexandria, Virginia. Tim has been directly involved in the development of several DCS and SCADA system products and regularly teaches courses for ISA (International Society of Automation) on various topics. Inquiries or comments about this column may be directed to Tim at *Tim@electricenergyonline.com*.

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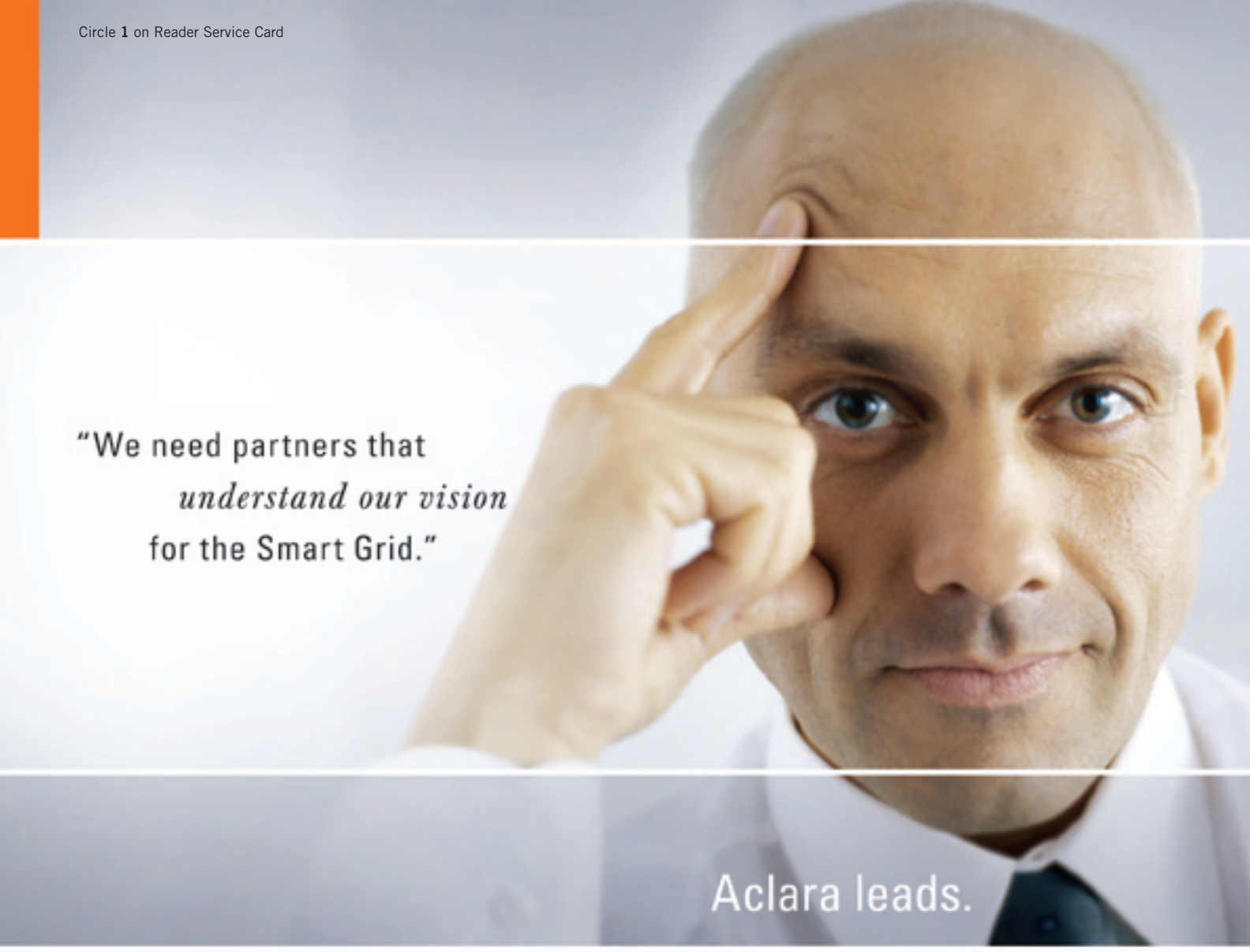

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