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June 2009

Smart Grid Special Issue

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Publisher's Note

Patsy Wurster

Welcome to a very special edition of Platts *Insight* magazine focusing on one of today's hottest topics in electric power—smart grid and its technologies. Based on the 2008-2009 Platts/Capgemini Utilities Executive Study, North American utility executives believe the level of government funding will be extensive for renewable energy use and smart grid technologies. However, executives are split on the short-term impact of government initiatives such as smart grid on the profitability and structure of the electric power industry. You can read the full Executive Summary for this study on page 13.

The key question now: Will President Barack Obama's request "to act without delay" to pass legislation that provides for the building of a new electricity smart grid actually occur and spur enough near-term development for the timely and effective impact he and the industry seeks?

Early signs of progress include the Department of Energy's (DOE) offer of up to $200 million for projects aimed at building a national smart grid, which is well above the $20-million cap proposed previously by DOE, as well as the naming of George W. Arnold as the first National Coordinator for Smart Grid Interoperability. While these initial steps are encouraging, there are many hurdles to navigate before notching any major successes to the smart grid scorecard.

"The competition for Energy Department funding under the smart grid program is shaping up to be one of the most intense DOE contests for the $39 billion in funds it received under the economic-stimulus bill. Electric utilities, in particular, appear enthusiastic over the program now that DOE has raised the cap for individual awards to $200 million," said Bill Loveless, Editorial Director of US Energy Policy for Platts. "At the same time, those involved in exploring new options for transforming the US grid understand well the importance of developing standards for smart grid devices and procedures, a process that's still evolving in the government and one that will determine how quickly the smart grid will become prevalent across the US."

We are pleased to bring you in this special edition of *Insight* a variety of perspectives from numerous experts regarding the challenges to developing a newer, smarter electric power grid nationwide.

If you'd like to learn more about our upcoming issues, visit our web site at http://www.platts.com/Magazines/Insight/

I hope you enjoy this very special edition.

Sincerely,
Patsy Wurster
Publisher, *Platts Insight*

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Inside

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John Ferrare has worked in the energy industry as a marketing and communications specialist for over fifteen years. He began his career with Pacific Gas and Electric Co. and worked extensively with PG&E Corporation and PG&E Energy Services in the development of marketing and communication strategies. In 1995, John joined Enerdynamics to manage its educational services. He is co-author of *Understanding Today's Natural Gas Business, Understanding Today's Electricity Business* and *Understanding Today's Global LNG Business*.

Allen Freifeld has recently joined Viridity Energy Inc. as senior vice president external affairs. Previously, he was a member of the Maryland Public Service Commission and had served on the commission since 2004. During that period he had concentrated on increasing the deployment of energy efficiency, demand response and distributed resources. He has served as chairman of the steering committee of the Mid-Atlantic Distributed Resources Initiative for over three years.

Jim Greer joined the Texas Utilities Company system in 1984 after completing his BS in electrical engineering at the University of Texas at Arlington in 1984. In 1990, he obtained his MBA from Texas Christian University. Jim is currently serving as senior vice president of asset management and engineering for Oncor, the largest regulated electric delivery business in Texas. Jim is a registered professional engineer in the state of Texas, and was appointed to the Texas State Board of Professional Engineers. He is a member of the Texas Society of Professional Engineers, and is a past president of the Fort Worth chapter of TSPE. He is also a member of the Institute of Electrical and Electronic Engineers.

Katherine Hamilton is president of the GridWise Alliance. The Alliance advocates for a smarter grid for the public good—one that uses integration and two-way communication from power plant to meter so that energy can be generated, distributed, and consumed more efficiently and cost effectively. Alliance members include utilities, IT companies, equipment vendors, new technology providers and educational institutions. Katherine has worked for more than 25 years in the energy industry as a policy advisor for Good Energies, Inc., co-director of the American Bioenergy Association, government relations manager for the National Renewable Energy Laboratory, and distribution system designer for Virginia Power (now Dominion Energy). She has degrees from Cornell University and the Sorbonne.

Edward N. Krapels is a leading authority on energy issues, markets, and policy. He is a principal of several transmission projects, including the Neptune Project and the Hudson Transmission Project. In 2008, he helped found Viridity Energy LLC, a company dedicated to synthesizing intermittent energy sources with demand response programs for large campus-like institutions.

Jim Taylor earned a BS in electrical engineering from the University of Wyoming and obtained his professional engineering license shortly thereafter. He is also a licensed journeyman electrician. After being recruited by Tucson Electric Power (TEP) to work on substation design, he worked as a senior substation engineer and then as metering services supervisor. Jim is now the superintendent of engineering, overseeing the R&D for smart grid. TEP is an investor-owned utility in Arizona.

Audrey A. Zibelman is the president and chief executive officer of Viridity Energy Inc., an innovative demand side management company whose technologies integrate, optimize and convert behind the meter generation, demand and storage resources into fully dispatchable virtual power plants. Previously, Ms. Zibelman held positions as executive vice president and chief operating officer of PJM, LLC and various executive responsibilities at Xcel Energy.

Smart Grid: Key to the Future of Electricity

Katherine Hamilton, President, GridWise Alliance

AFTER TRANSFORMING ALMOST EVERY OTHER aspect of our lives, modern information technologies are about to change the ways in which we receive and use electricity. The integration of technologies and a holistic vision of the electric transmission and distribution grid is commonly termed a "smart grid." A smart grid is a platform to integrate the disparate parts of the electric grid enabling efficient generation and distribution of energy while providing reliability and cost benefits to consumers. The realization of a smart grid is a key element for our continued prosperity and advancement, and underscores the importance of rapidly expanding activities surrounding smart grid projects.

Our Current Grid

Just as the internet exemplifies the nimble and interactive technologies of our current Information Age, the existing US power grid represents the powerful but somewhat inflexible technologies of the Industrial Age. The power grid, primarily designed half a century ago, has been called one of the greatest engineering marvels of our time, but as times have changed, it is increasingly unable to accommodate the needs of our technologically complicated and information-rich society.

Back in the 1950s and 60s, when the power grid was designed and built, the population was smaller, technologies were less sophisticated, alternative energy sources were almost unheard-of, and the typical electricity users were private homes, apartment buildings, factories, office buildings, and commercial centers. Television and air conditioning were still relatively new, and most goods and services throughout the economy were standardized and mass-produced to take advantage of economies of scale.

Fast-forward to 2009. There are twice as many Americans now as in 1959, and the average adult uses 13 times the electricity. Consumers rely on a vast array of consumer electronics such as personal computers, high-definition televisions, and communications devices. Add to this the rise in automated manufacturing and what accounted for roughly 10% of electricity usage in the 1990s now has grown to 40% of current electricity consumed. This usage is expected to reach more than 60% by 2015.

The change in our society requires energy that is both efficient and reliable. Currently, when demand for electricity increases dramatically, as it does on the hottest days of summer, most electrical utilities have no other way to respond, except to push out more power in an effort to meet consumer demand. In some cases, this has resulted in blackouts or brownouts. While our electric grid is 99.97% reliable, that seemingly small amount of outage time costs our economy billions of dollars every year. Moreover, in today's world, our vast array of electronic devices requires a steady and quality supply of electric power. Even voltage dips that last less than 100 milliseconds can ruin an industrial process or piece of sensitive equipment.

Finally, today's transmission grid was not designed to accommodate renewable energy sources such as wind, solar power and geothermal, which cannot be relied on to deliver a constant rate of power every 24 hours. With national and state mandates and societal demands for cleaner sources of energy, our grid will need to integrate these additional sources of energy in a consistent and reliable manner.

Our ingenuity and innovation must once again be brought to bear on this urgent and massive challenge. Fortunately, we have already made similar changes in other industries with similar technologies and similar benefits. The digital age that we've come to depend on throughout our economy and our lives, will once again transform an industry. We must transform the way we deliver and consume power … and we will with a Smart Grid.

A Smart Grid

A smart grid is a comprehensive and innovative way of adapting our current grid to fit the electric needs of our culture. A smart grid will proactively allow utilities to reduce peak demand by actively managing production and consumer demand. It will also identify efficiency opportunities ensuring that consumers and utilities have accurate, timely and detailed information on the energy being used. A smart grid is inherently safer than our current grid. With its two-way communication, a smart grid can quickly identify, respond to, and recover from threats and interruptions. The smart grid will seamlessly integrate all clean energy technologies from roof-top solar systems to wind farms to electric vehicles. These benefits are also a step toward becoming more energy independent.

Let's consider two familiar features of electric power use—the meter and the bill—that will be transformed from "dumb" to "smart." Conventional electric meters are one-way devices that track the number of kilowatts of electricity a consumer uses. At the end of the month, the consumer receives a bill for the electricity. Customers have no way to identify how this energy was used throughout their homes. With the use of a smart meter, a consumer appliance that provides electricity usage information, consumers will be able to see in near real-time how energy is being used in their home and how much it costs. With this additional information, consumers will have the necessary information to make wise energy decisions. As consumers make these different choices, or set different preferences, they can see the impact on their bill. Studies have shown that when consumers have information about how much energy they use on a daily basis, they will shift their energy consumption and become between 5-15% more efficient.

Let's take this a step further. As appliances and other technologies align with a smart grid's capabilities, consumers will be able to create home area networks (HANs) of smart appliances, thermostats, security systems, and electronics that will "talk" with the grid. You might get a voicemail message during a peak-energy-use time that encourages you to turn off certain appliances for which you may receive a financial incentive. Or, you might have a setting on your dishwasher so that it will automatically run when peak demand has eased. And all this is fully automated and interoperable, with the "plug and play" ease we enjoy with our modern electronics. These capabilities allow consumers to save energy and money. They also help the utility smooth out power use in a region or even nationwide—so that the power supply is more reliable for us all.

While the smart grid allows the consumer to be a part of the solution, the smart grid also allows the utility to better manage its energy distribution system. Automation of the energy grid will give utilities the ability to protect, communicate with, and control the elements of the grid, quickly identifying problems and then resolving them. Consumers will no longer have to call their electricity provider to inform them of a power outage. Utilities also will have systems in place to reroute energy in order to reduce outage response time from hours to seconds. With this added information, utilities can also self-manage their output during times of day when electricity costs more to generate and distribute. Utilities, working together with consumers, will be able to make more informed decisions about how we get and use electricity.

Reality of a Smart Grid

The smart grid is not just a vision. It is being implemented all over the United States and the world. Successful smart grid projects have been completed in California, Texas, Colorado, and Florida. Smart grid is also a central piece of the President's energy platform and has seen increased public and private funding. In addition to the many benefits of a smart grid on how we use and receive energy, it will also provide a significant economic impact. In the Energy Independence and Security Act of 2007, Title XIII calls for the creation of a smart grid, and the economic stimulus program proposed by President Obama and enacted by the Congress as the American Recovery and Reinvestment Act, appropriated $4.3 billion in matching funds for large regional smart grid demonstration projects and a variety of investment projects. This funding—and the efforts that it is encouraging—represents a true down payment on the cost of realizing a smart grid.

Making our grid smarter is an evolutionary process requiring tens of thousands of skilled workers needed to operate, service, maintain, repair, expand, and update the grid. With federal stimulus funds combined with local government, public utility and private investment, nearly 75,000 new jobs could be created within the first year alone. Over the next four years, KEMA, Inc., an international consulting firm, has projected as many as 280,000 new jobs will be created. These jobs will include technicians, field installers, software and communications professionals, analysts, engineers, manufacturing workers, and employees of firms supplying the products and services.

Fortunately, the nation already has developed much of the technology needed to make our grid smarter. The other efforts include the development of interoperability and cybersecurity standards by the National Institute for Standards and Technology. In addition, many universities have smart grid technology research programs, including Florida State University, the University of Colorado, Washington State University, North Carolina State University, and Northern New Mexico College. The association of shareholder-owned electric companies, the Edison Electric Institute, has established centers that train workers in the skills that they need for building, operating, maintaining and repairing a smart grid, as has the craft union, the International Brotherhood of Electrical Workers. With $100 million in stimulus funds dedicated to workforce training for smart grid, these schools and centers can begin to feed highly trained employees into this continuing effort.

Conclusion

With each passing day and the continued support of government and businesses, the vision of a smart grid becomes more tangible. By smoothly engaging consumers and purposefully empowering utilities, a smart grid clearly holds the key to a healthier economy, a cleaner environment, and a more prosperous future. ■

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Smart Markets for Smart Grids

Audrey Zibelman, President and CEO, and Allen Freifeld, Senior Vice President of External Affairs, Viridity Energy

THE WIDESPREAD DEPLOYMENT OF SMART grid technologies in the coming years holds the promise of significant benefits to end-users, utilities, and to the functioning of our economy. However, this promise will be realized only if the market rules governing the participation of demand response are as smart as an intelligent grid. Market rules must fully value the economic benefits that demand response brings to the market. And the market rules must be stripped of all artificial barriers to the full participation of demand response in all organized markets—energy, capacity, and ancillary service markets. The societal benefits associated with demand response are well known. Countless studies and actual experience have demonstrated the capacity of demand response to reduce peak loads when called upon and to therefore reduce clearing prices in capacity markets—and to delay the need for new power plants and associated transmission system infrastructure. The benefits are established: current prices for capacity are reduced due to the added competition supply-side resources face from demand response resources. Customers reap the economic benefits, and the reliability of the electric system is enhanced precisely when the system is most stressed, at times of peak load. Demand response can also reduce the burden on market participants to raise capital to build new peaking plants. This latter benefit is particularly valuable in times of credit market turmoil, such as we are currently experiencing.

Demand Response as an Energy Resource

While the benefits brought to capacity requirements by demand response are great, the benefits that demand response can bring to energy prices are even greater. This isn't surprising: the energy markets are larger than the capacity markets and the energy portion of a typical customer's bill is much larger than the capacity portion of the bill. On average, fuel costs alone represent about 50% of the all-in costs of energy. Market rules that allow the full capacity and energy value of demand response to be realized by participating consumers are an essential component of efficient, competitive markets. One 'data point' from the PJM interconnection illustrates the potential value: During the August 2006 heat wave, when PJM experienced its all-time peak, the participation of demand response bidding into the energy market reduced Locational Marginal Prices by as much as $300/MWh at the peak. Payments were reduced by $230 million on the peak day alone and by $650 million during the month.[1] These customer savings were experienced in one RTO, in one month. The potential savings nationwide from full-scale participation by demand response in day-ahead and real-time energy markets is profound.

Demand Response and Elasticity

Efficient markets are two-sided. That is, they have both supply sides and demand sides that respond to transparent, clearly transmitted price signals. However, the electric industry was designed and has largely operated under the paradigm that load was immutable, that it was inelastic. Recent events and the enthusiastic participation of all customer classes in demand response programs of all types have disproven this assumption. Demand is in fact elastic—and customers can and do respond to price signals based upon individual preferences. The key to maximizing the value of this customer participation is to have markets which convey real time price signals to customers *and* to have markets rules that encourage and fully value market participation by customers. The smart grid stimulus funding will facilitate the introduction of technologies that support increased investments in distributed energy resources—supply, demand management, and storage. In a distributed resource environment, the concept of demand elasticity will take on a greater and more significant influence in the system topology and markets. Consumers will have the opportunity to avail themselves of suitable sub-

[1] Demand Response in Wholesale Markets, FERC Docket No. AD07-11-009; Testimony of PJM witness Andrew Ott, April 23, 2007

stitutes to purchasing power from the grid—the economic use of "behind the meter resources." As a result of this penetration, we can expect to see changes in load shapes and customer usage patterns that can be coupled with and extend the value of renewable resources as well as create a more optimized and secure system infrastructure. In short, the technology will do its part. The other necessary component is the market design that allows participating customers to receive the full value of the products they bring to the market. It is worth reiterating that when some consumers voluntarily commit to turn to behind the meter resources and modifications in demand in response to price signals and reduce their load on the grid, the benefit of this decision flows to all customers—including the non-participants—because of the mitigating effect which demand response has on the locational marginal price. That mitigating effect is, of course, particularly dramatic on high load days because the supply curve is so steeply sloped in its upper reaches, but is valuable all of the time. Unlike demand response, traditional generation does not mitigate the locational marginal price paid by all customers. The generation used to meet demand in an economic dispatch system is always the next, most expensive resource available.

The Golden Rule

The Mid-Atlantic Distributed Resources Initiative (a group of State Regulators) recently said that the compensation to demand response "should be available often enough, stable enough, and large enough to support robust, ongoing investments in end-user demand response capability." The States further indicated that they "have recognized the importance and the value of demand response, as a cost-effective capacity resource and as a cost-effective means of mitigating peak prices in the energy market."[2]

Specifically, the States have been critical of an RTO pricing mechanism that deducts customers' retail energy price from the LMP payment for demand response. The reason for the States' position is straightforward enough—we should encourage demand response because it increases the reliability of the grid and mitigates LMPs and supply-side market power. The basic design criteria of the wholesale energy markets is the use of locational marginal pricing to ensure optimal pricing and fair and efficient dispatch of supply and demand resources. Under this design, the rule that should be applied so as to maximize the amount of demand response offered into the markets is apparent: An offered, cleared and actual reduction in kWh consumption in the energy market has the same value as a kWh increase in supply at the same location and should be paid the same amount. The notion behind this rule also is straightforward. In the day-ahead energy markets, market participants offer the market operator (the RTO or ISO) a certain amount of energy at a notional price. If this offer is accepted, i.e. it is cleared in the day ahead energy market; the participant is required to provide the product in the real-time market or pay for that same amount of energy at the real time prices. In the case of consumers, the markets provide them the option to consume as much energy as they need to meet their demand at the locational marginal clearing price. A demand response customer in the day-ahead market is offering to sell back that option by committing to reduce their consumption on the grid to a set level. If the market operator accepts that offer, the customer will reduce the predicted hourly demand, and the value of that demand is the marginal price for the decrement in the demand curve. As in the case of a generator, if the customer reduces demand to the offered level, they are entitled to the payment for the sold and delivered energy. By the same token, failure to perform should require the customer to pay the real-time price of the energy they are now consuming.

Conclusion

The smart grid is intended to support the integration of distributed generation, storage and demand optimizing resources into the integrated electric system. Through these investments, we can hope to achieve a more efficient, secure and environmentally sustainable power system. The competitive markets can support achievement of these goals by providing consumers the accurate price signals that will support initial and continuing investments. Once customers can both see and realize the market value of their investments, the market for these resources will be created and the objectives of the stimulus bill will be achieved. ■

[2]MADRI Letter to PJM regarding Economic Load Response and Demand Response Compensation, March 12, 2009

Smart Grid University: The Role of Campuses in the Mass Implementation of Energy Efficiency

Edward N. Krapels and John M. Edwards, Anabaric Transmission LLC

EVERY SEPTEMBER, IN GREATER AND GREATER numbers, we usher our young adults into colleges and universities across the country. What was once a privilege reserved for the wealthy has practically become a right for everyone. Dormitory life, fraternity parties, library research, and late-night cram sessions have become a common denominator for a large portion of American youth today. And as an increasing number of graduating seniors head off to college, our institutions of higher education expand to incorporate a larger portion of each generation.

Funny we should use that word, generation. Because as student populations and endowments increase in size, so too do campuses. They say, in the university business, that if you're not building, you're dead. New biotechnology research facilities spring up on top of old parking lots. Information Technology Centers with brand-new servers appear practically every two years as if synchronized with Moore's Law. Twenty-four hour lit study spaces replace the traditional 9am-9pm library atmosphere. Each generation of students requires expansion, and each expansion of the campus requires generation—*of electricity*!

College and university campuses have gotten so large that they often have their own facility and physical plant managers dedicated to the engineering and electrical demands of the institution's buildings. Some even have their own cogeneration facilities. It is not rare to see a university with its own 20MW or 50MW profile—the size of a small city.

The universities and their plant managers are keenly aware of their energy growth, and the consequent expansion of the size of their carbon footprint. While the financially shrewd endowment managers and budget planners have ensured that their institutions run as economically as possible, they also know that much can still be done to become more energy efficient campuses, as well as to contain and then reduce their carbon footprints.

What most of the higher education community still doesn't realize, however, is that our colleges and universities are the perfect setting for the next big energy revolution: Smart Grid. The setting for innovation is ideal: thousands of bright and concerned teenagers and twenty-somethings, technologically proficient and forward-thinking professors and staff, and a network of buildings geared for community living. All of the raw materials are readily available to synthesize the 20th century electrical network with the 21st century digital network. On top of that, the trickle-down effect from these institutions could have a tremendous impact on the country for years to come. Our colleges and universities can teach a skeptical electricity industry full of nay-saying utilities that change is possible.

If we assume that the latest proposed federal legislation goes through, then energy efficiency will make up a large part of the federal renewable portfolio standard (RPS). In reaching the federal RPS of 20% by 2020, 5% can be in the form of new energy efficiency measures. That is to say, a quarter of the nation's sustainability goals in the sprawling electricity sector can come from efficiency measures. Thus, "demand side response" (defined as the ability and willingness of consumers to reduce consumption in response to a signal) and energy management may see growth comparable to wind and solar development over the next ten years.

With so much stimulus money available, however, and so little understanding of what "smart grid" actually is, the risks are high. From coast to coast, expect to see old diplomas stapled to some chicken wire and sold as "smart grid." What exactly *is* a smart grid?

Smart grid is the synthesis of the traditional electrical system with digital networking and controls. Energy efficiency through intelligent load profiling and tracking, demand side responses, and plugging buildings into computer networks are all part of the smart grid, but so are existing technologies, like high voltage direct current transmission technology (HVDC), which allows for more control over the flow of electricity. "Controlled power" is now becoming available: the long-awaited marriage of computing power, traditional and renewable energies, and demand controls with HVDC as an anchor technology.

One company that encompasses all of these elements is Viridity Energy, Inc., which was launched in 2009 by a team of engineers, software developers, and power systems experts. Viridity uses demand-side software and technology to agglomerate buildings into virtual campuses. Those buildings may be actual campuses, like a major university, or a less-traditional campus, like an office park or group of downtown office buildings. Viridity software incorporates (1) the existing energy controls on each building, (2) existing small-scale power generation within the campus (whether it's solar arrays on rooftops, or emergency generators in buildings), (3) power imported into the campus (preferably "green power") and plugs them all into a network. That network then subsequently turns those devices into a single energy machine that can be dispatched into and out of the grid much more efficiently than the old, disorganized campus. The potential savings of energy in a typical campus are in the range of 10 to 20% of total energy demand.

In essence, this rendition of a smart grid finds the power system at the same place personal computers were twenty years ago. In the computer world, there was a pre-network era that was ultimately (in the 1990s) completely consumed by networks. Similarly, we are at the end of the pre-network era in electricity. We are about to array our campuses much more intelligently, for the purpose of optimizing their energy use and reducing their carbon emissions.

Moreover, the Viridity software program integrates wind and solar energy via algorithms that balance the newly responsive demand with the intermittent renewable supply. Over time, these algorithms can help decide where and how to install targeted efficiency improvements that compensate better for the increasingly well-understood vagaries of renewable energy. The net effect would be reduced peak demand, which would greatly reduce the amount of capital spent on electricity generation and transmission facilities.

Smart grid is the synthesis of the traditional electrical system with digital networking and controls. Energy efficiency through intelligent load profiling and tracking, demand side responses, and plugging buildings into computer networks are all part of the smart grid, but so are existing technologies, like high voltage direct current transmission technology ...

The greatest difficulty is not technical. Rather, the greatest challenge will be convincing the members of our community that the end result is possible. Can we reduce the amount of electricity we use as a society? Can we work to incorporate intermittent renewable energy over the next decade? Can we work with the next generation of America to correct the errors of the last? The answer is yes, and America's institutions of higher education will lead the way. ■

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Key areas to be investigated:

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Platts/Capgemini Utilities Executive Study

IN THE WAKE OF A WEAKENED ECONOMY and a new US presidential administration, the North American energy industry is facing mounting challenges on multiple fronts—ranging from regulatory uncertainty and the environment to the lack of critical infrastructure and increasingly restricted access to capital. Focused on meeting these challenges, utility executives have strong opinions about how the administration should approach setting energy policy, according to the latest industry study from Platts and Capgemini.

Completed in April 2009, the Platts and Capgemini study of over 100 senior utility executives from the North American electric and natural gas industry was developed to (1) identify and prioritize current industry trends, (2) assess opinions about the future of the energy industry, (3) measure the steps utility companies are taking to prepare for the future, and (4) gauge perceptions about the Obama administration's impact on the industry. Based on the study data, the key findings are revealed in the following pages.

Key Findings

- The five most critical issues facing the energy industry today are regulation, the environment, infrastructure, finance, and workforce management, according to the respondents.
- Over the next two years, executives plan to increase spending on government/regulatory affairs, risk management, building new transmission, information technology and capital expenditures.
- Executives have mixed opinions on whether the Obama administration's initiatives will have significant short-term impact on the profitability and structure of the electric industry. They believe the speed and level of funding will be much greater for renewable energy use and smart grid technology than for nuclear energy.
- When considering the goals outlined in the Obama plan, executives are most supportive of the new administration's initiatives for promoting safe and secure nuclear energy sources (e.g. fuel, waste, storage), setting national building efficiency standards and the responsible domestic production of natural gas.
- In the next five to 10 years, executives predict environmental regulation will increase, electricity prices for end-users will rise, more renewable generation will be built, the focus on energy efficiency and demand-side management will intensify, and the emphasis on risk management will continue to build. In addition, the respondents expect the industry's use of technology and conservation/energy efficiency advocacy to increase.

Top Five Industry Issues

Regulatory Uncertainty Still Looms Large

More than any other issues, industry regulation and the environment are on the minds of today's utility leaders. The surveyed executives are especially concerned about how regulatory uncertainty for new and existing assets is hampering initial steps to build critical infrastructure. When they were asked to rank specific issues on a 10-point scale (with 1 as "Not At All Important" and 10 as "Very Important"), local rate recovery and the uncertainty around emissions/carbon regulations emerged as the industry's top two challenges. Specifically, more than half (55%) of the respondents rated local rate recovery as either a 9 or a 10, while just less than half (49%) rated emissions/carbon regulations similarly.

The Environment is Increasing in Importance

Compared to just two years ago, the utility industry's focus on the environment has increased significantly. In fact, 42% of the respondents said building new generation and transmission assets to support renewable energy sources is the industry's leading environmental issue. Increasing energy efficiency and customer conservation programs is becoming even more important, and seen as the second most important environmental issue (39%). Following close behind is building future power plants to meet yet-to-be defined environmental standards (36%).

Infrastructure, Infrastructure, Infrastructure (Build, Baby, Build)

Utility executives continue to view the need for new and upgraded infrastructure as the most critical issue impacting the current and future state of the industry. Within this issue—which has surfaced in each of the Platts/Capgemini studies conducted over the past three years—the respondents are particularly concerned about how to recover new construction costs (58% of them rated this either a 9 or a 10) as well as how to finance new construction (43%). Asked about the most critical transmission infrastructure needs today, 48% of the respondents identified new siting permits, while 45% cited new transmission construction.

The Financial Picture (Not a Pretty Sight)

In the current economic environment, executives are, not surprisingly, laserfocused on maintaining liquidity (55%), obtaining cost recovery (54%) and gaining access to capital/financing (53%). The respondents said these challenges are being compounded as operational costs increase while access to credit and the ability to maintain liquidity declines. As a result, the executives say their focus on financial matters has increased substantially in the past year.

Workforce Adequacy—Knowledge Transfer

Nearly one out of three study respondents (29%) identified the aging utility workforce among the industry's most critical issues. As a result, executives continue to underscore the importance of effective knowledge transfer (31%) and capture (25%). The knowledge garnered from years of experience is invaluable and needs to be shared with incoming talent. Experience across a variety of utility roles and functions is needed to ensure capable leaders are in place to guide the industry in the future.

A New Era: The Obama Administration

Industry leaders appear to be enthusiastic—but by no means, unanimous—in their opinions about the Obama administration's energy and environment initiatives. They want the new president to articulate a clear roadmap for the industry on carbon and other environmental concerns. They are looking for a pragmatic, balanced approach to supply side issues, and many think the approach should include safe and secure nuclear energy sources.

Utility executives are split on whether they believe the plans being discussed by the Obama administration will have a significant near-term impact on the profitability and structure of the electric industry. More than half (54%) believe the impact on industry profitability will be significant. They share concerns that the initiatives will be costly and linked to governmental mandates without needed increase in funding. The primary impact to industry structure surrounds the use of smart grid technology. The impact of this technology could have far reaching effects, but participants stressed the need for due diligence and business planning to ensure this technology is implemented to its fullest potential and not just a response to the current industry "trend."

When considering the elements of the Obama plan outlined in January, executives express the most support—saying they either "strongly" or "somewhat" agree—with these elements of the plan:

- Safe and secure nuclear energy (e.g. fuel, waste, storage) (88%)
- Setting national building efficiency standards (79%)
- Promoting responsible domestic production of natural gas (77%)
- Investing in smart grid (74%)
- Developing and deploying clean coal technology (70%)
- Reduction of federal energy consumption (69%)

Executives are least supportive of these elements of the administration's plan:

- Requiring 10% of electricity to come from renewable sources by 2012 (39%)
- Implementing cap and trade program to reduce greenhouse gas emissions (43%)
- Prioritizing the construction of the Alaska natural gas pipeline (45%)
- Making the US a leader on climate change (46%)
- Investing in a clean energy economy and the creation of new green jobs (48%)

Future Industry Issues: Leaders' Predictions

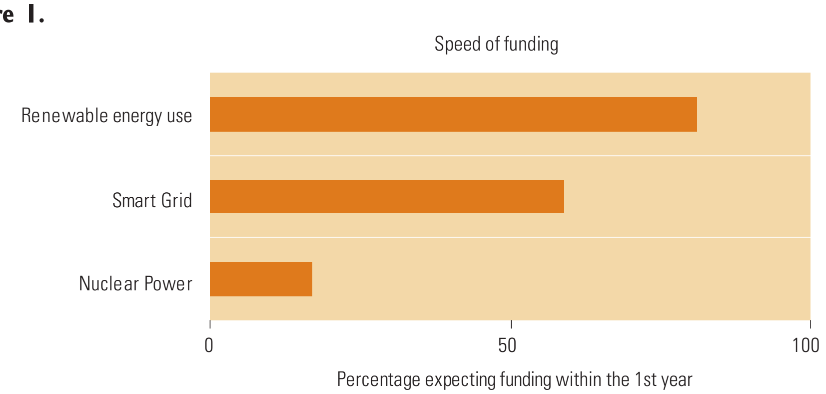
When asked to predict the direction of the energy industry, utility executives offered a wide range of opinions. On a 10-point scale (ranging from 1 as "Strongly Disagree" to 10 as "Strongly Agree"), 58% of the respondents rated the prediction that environmental regulation will increase as either a 9 or a 10. The prediction that electricity prices for end-users will increase was rated similarly by 53% of the respondents, an increased focus on energy efficiency (47%) and more renewable generation built (47%). In addition, the industry will increasingly be known as an advocate, or voice, for energy conservation/efficiency, according to 37% of the executives.

Utility leaders are far less confident about other critical industry issues which they believe will be left unresolved. According to the study, executives are unlikely to think there will be:

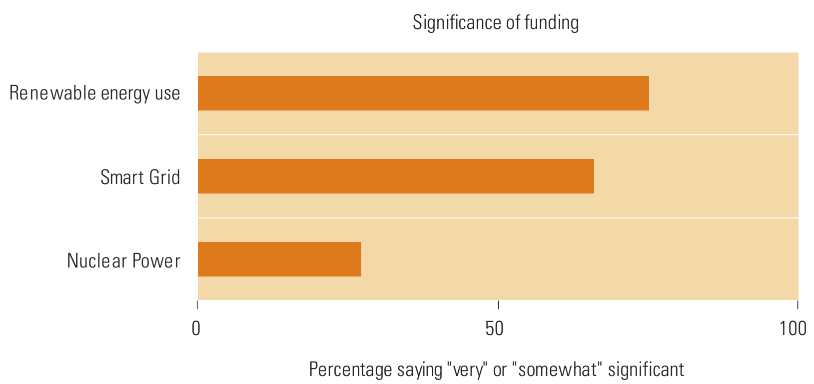
- More coal generation built (0% rating 9 or 10)
- Additional access to capital (3%)
- Resolution on how to finance new generation construction (4%)
- Ability for renewable energy to cover base load needs (5%)

The study was conducted in two phases. Phase I was qualitative and consisted of in-depth telephone interviews. Data for the quantitative Phase II was collected via online survey. To download the full study results go to: www.us.capgemini.com/PlattsStudy ■

Figure 1.



Q4: How soon do you think that the new administration and congress will appropriate additional funding to the following initiatives?
Note: Percentage shown indicates those marking "First 100 days" and "1st year".



Q5: How significant will the level of funding be from the new administration and congress for the following initiatives?

Why We Need Active Nodal Power Markets

Paul Cusenza, Chief Executive Officer, Nodal Exchange

THE SOURCING, COST AND ENVIRONMENTAL impact of meeting energy needs continues to dominate our headlines and blogs. We all generally want the same thing: access to energy where and when we want it, at the lowest possible cost (both short and long term) and without harming our environment. However, there are many debates about how to achieve this and how to evaluate and balance the trade-offs as they might arise. In general though, it is clear that we will need fair and efficient electric power markets in order to ensure efficient pricing of electricity and to help support the development and maintenance of reliable and effective electricity infrastructure. In particular, the transient nature of electricity dictates a nodal (locational) structure for electricity markets. Only with this nodal market structure can we best achieve the promise of demand response and renewable energy programs. Furthermore, structuring the nodal markets so that entities can properly manage their business risks will be key to ensuring that nodal markets are able to meet our common objectives.

The Transient Nature of Power

Unlike oil, which can be stored for the future in barrels, or natural gas, which can be stored in tanks, electricity is transient. With a few exceptions, such as hydroelectric pump storage systems, electricity is not generally stored and must be consumed as it is generated. Thus, the economics of electricity are intimately linked with the distribution of electricity. Given there are usually significant barriers to locating power generation at the same location as power consumption, the limits of the transmission grid play a key role in determining which power plants must be used to satisfy demand. During peak times, transmission lines connecting less expensive generators to urban centers can often become congested, creating the need to turn on more expensive peaking generators located closer to the urban area—driving up the cost to serve the area. It should also be noted that loss of electric power, which increases in proportion to the distance it travels, is another factor that affects transmission system economics. Managing electricity (and especially the pricing) without nodal markets would be comparable to managing traffic by analyzing cars and never looking at the roads.

Locational Marginal Pricing of electricity has been developed to ensure that the price of electricity at each location on the transmission network properly reflects the limitations of the transmission grid. By considering the congestion and loss factors at every point on the grid, the Locational Marginal Price (LMP) provides an important economic signal for management of the grid. While the system-wide cost of energy on average forms the majority of the notional value of LMP, the variability of LMP is driven as much by the congestion and loss factors as by the variability in energy cost, highlighting the economic effects of the transient properties of electricity.

Nodal Markets

Over the majority of the United States, organized Regional Transmission Organizations / Independent System Operators (RTOs/ISOs) price power on a nodal basis. These markets comprise ISO New England, New York ISO, PJM Interconnection, Midwest ISO and most recently California ISO. More markets, such as the Electric Reliability Council of Texas (ERCOT) plan to go nodal in the near future. These organized markets permit the trading of electricity on a nodal basis. Through conducting both real-time and day-ahead auctions for power on a nodal basis, the RTO/ISO markets price power at thousands of granular locations on their network. These auctions result in Locational Marginal Prices that appropriately reflect the cost of energy, congestion and loss at a given location on the grid.

Demand Response is Locational

Nodal markets are key to enabling the Demand Response concepts that have been put forth as a means to moderate expensive peak demand. Demand Response programs involve managing power consumption on a local basis in response to supply conditions in order to achieve greater efficiency. Rather than simply have supply rise or fall to match demand, electricity consumers can be given price signals that would encourage them to reduce demand at peak times. For example, if demand is peaking in a location, perhaps the electric car in the garage can be re-charged at a later time. Demand Response programs need to be based on a nodal construct (often coupled with a smart grid). Active nodal physical and financial markets will help support the naturally locational perspective involved in demand response.

Scarcity pricing and variable nodal pricing create the best, and perhaps only, incentive for enterprises and individuals to sensibly manage consumption. While we all want low prices, we also need to recognize that prices need to reflect the true economics of marginal production if we expect consumers to efficiently allocate scarce resources. When consumers are given a flat price that is not economically transparent, it should not surprise us to find that we end up with peaks and valleys in consumption which require expensive generation that is often left unused.

Nodal Pricing Supports Efficient Capital Deployment

Nodal pricing is fundamental to having the right electricity pricing. Where to build a plant is a function of nodal prices, not the regional or hub average. How much transmission to build and where to build it is also a function of nodal prices. We want to limit congestion, but it would be a waste of the consumer's money to spend more on transmission than the cost of congestion—for the very same reason that it is uneconomic to build roads to the point that we never have traffic delays. We need a diverse range of generation types and a robust transmission grid to cope with large uncertainties in demand, technology, and fuel costs. Nodal pricing is a key tool in balancing this economic equation.

Nodal Markets Also Support Renewable Energy

Expanding renewable energy sources such as wind and solar are a major element of current energy policy as well as consumer and industry interest, and also demonstrate significant locational qualities. Location is a strong determiner of where renewable energy can be sited: wind farms are best placed in certain locations such as west Texas, and solar energy is most efficiently produced in the deserts of the southwest. The renewably generated power will need to be transmitted to where the key demand load is located and this will mean creating new transmission lines, and/or additional congestion on existing lines. Renewable energy can also be highly intermittent depending on how the wind is blowing or the sun is shining, creating significant management challenges in matching supply to demand and greater LMP risks across the power grid. Active Nodal markets help entities manage these risks and ensures that the proper economic signals are sent to develop the appropriate infrastructure. The creation of innovative and entrepreneurial renewable supply depends upon open access to the market at fair prices which is made possible through nodal markets.

Financial Planning

Allowing owners of generation and those who purchase power to financially manage their risks is an important component of ensuring that robust nodal markets serve their purpose in furthering our energy policy goals. When power is priced on a nodal basis, the most appropriate way to hedge it is also on a nodal basis. In addition to the real-time and day-ahead markets, the RTO/ISOs offer a forward market for financial transmission rights (FTRs) which allows entities to address the congestion component of the LMP. However, to fully support the need to hedge the full LMP, a nodal futures product is also necessary. Nodal Exchange, which launched in April 2009, is offering nodal futures contracts which financially settle against the day-ahead LMP to meet this need.

In addition to offering additional contract options, an exchange format for trading nodal futures also allows a fuller development of the forward market. Given the complexities of nodal trading, an auction format, such as deployed by the RTO/ISOs and Nodal Exchange, helps to pool liquidity. In addition, exchange-supplied daily marks on nodal contracts can help valuation in mark-to-market accounting. Finally, a cleared exchange, in which a central counterparty replaces bilateral counterparty risk, greatly mitigates credit risk. Greater focus on credit risk is a key element to ensuring viable nodal markets for power. Indeed, there are movements to create legislation, including a letter from Treasury Secretary Geithner to Congress on May 13, 2009, that would require all standardized over-the-counter bilateral trades to be central counterparty cleared in order to avoid the credit risks that have damaged our economy over the past year.

Summary

Active nodal power markets, both physical and financial, are critical to the nation's electricity future. Because electricity is generated and used at a nodal level and cannot be stored, nodal pricing is the key information that is needed to manage demand, supply and investment. It is a fundamental enabler of demand response and the development of renewable energy sources. Fair and efficient nodal markets are part of the foundation for addressing the next generation of electricity challenges. ■

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Source: MRI, Spring 2009.

Section Highlights:

1. The Role of Utilities in Daily Life.
2. An Overview of State and Federal Policies Affecting Today's Market.
3. The Coming Smart Grid Economy.
4. The Economic Implications of a Greening Energy System.

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Tucson Electric Power Takes on the Smart Grid

Jim Taylor, Engineering Superintendent, Tucson Electric Power Co.

INCLUDING ITS SURROUNDING AREA, THE population of Tucson, Arizona recently exceeded 1,000,000 people. With its burgeoning population comes demand for affordable housing and subsequent development. As engineering services superintendent for Tucson Electric Power (TEP), Jim Taylor's involvement in ensuring new homes have access to electricity and are metered accordingly gives him a front row seat to Tucson's rapid development. The city's continual expansion, in addition to the utility's innovative culture, is what ultimately led Taylor and his team to begin formulating its concept of a smart grid.

Granted, smart grid, as a concept, has come a long way in the last 18 months. In fact, the Department of Energy developed a task force that was able to define some of its key characteristics including:

- Enable active participation by consumers
- Accommodate all generation and storage options
- Enable new products, services and markets
- Provide power quality for the range of needs in a digital economy
- Optimize asset utilization and operating efficiency
- Anticipate and respond to system disturbances in a self-healing manner
- Operate resiliently against physical and cyber attacks, and natural disasters

And although these seven items define a future power delivery grid that should meet the needs of the next generation of Americans, Taylor wanted to customize TEP's vision for the smart grid. As an investor-owned utility serving nearly 400,000 customers in southern Arizona, his team wanted to apply its own perspective and take into account the unique needs of its customers when formulating its smart grid initiative.

For TEP, smart grid refers to six separate concepts/technologies that allow for remote control and monitoring of equipment. Each item comprises potential benefits to the utility and to its customers. The concepts are comprised of:

- Substation automation
- Distribution circuit remote switching
- Distribution capacitor switching with communications
- Advanced meters and meter data management (MDM)
- Demand response (DR)
- Home area network (HAN)

Substation Automation

Interestingly enough, the word *substation* comes from the days before the distribution system became a grid. The first substations were connected to only one power station where the generator was housed, and acted as subsidiaries of that power station. Automation of today's substations propels them closer to the burgeoning smart grid. Indeed, substation automation allows for remote monitoring and control of substation equipment, reducing material and installation costs by utilizing communications between devices rather than hardwired points. TEP has a design philosophy for all new and modified substations to incorporate these capabilities as well as synchrophaser equipment for grid monitoring.

Distribution Circuit Remote Switching

This is utilizing communications to a distribution switch mounted on a pole to switch loads to different circuits or to isolate a faulted section of line. The system can be installed so that an operator controls the switching sequence remotely and new technologies are being introduced that allow the system to attempt to self-heal or isolate from a fault or outage automatically. This market space is maturing and TEP is alongside the momentum, in the field exercising devices that would allow manual operation remotely by system operators.

Distribution Capacitor Switching with Communications

By implementing distribution capacitor controllers with communications, the system voltage can be controlled and prevent excessive transformer tap changer operation. This can also lower distribution system losses while providing better customer voltage and system reliability. The operation control of these devices can be done with a system operator or with software for automatic control. TEP is installing radios in all its new and replacement capacitor controllers. This method will allow system operators to monitor and control the capacitors remotely. With an energy management system (EMS) upgrade that is in progress, TEP intends to integrate the control into the geographic information system (GIS) to allow for automatic control and indication. Currently, the controls operate on voltage, temperature and schedules without remote communications.

Advanced Meters and MDM

Installing a meter reading system that allows for remote meter reading and storage of each customer's energy usage pattern is also integral to TEP's smart grid concept. Its solution collects the interval data required for time-of-use (TOU) programs while utilizing its existing deployment of advanced meters. Foundational to its smart grid is technology that allows them to build in redundancy from the meter to the collection engine with exceptional system reliability and energy diversion notification, and also helps improve their outage response. This also addresses the high costs and efficiency issues associated with their off-cycle reads. Utilizing a fixed network, in combination with meter data management (MDM) software, satisfies these requirements while still helping control operational costs.

At TEP, fixed network technology is already utilizing wireless communication to automate interval data collection from its meters. It relies on the utility's deployment of its MDM system to aggregate the intervals for time-based rates and serve the data up to the utility's customer information system (CIS). It also provides positive outage and restoration notification to improve outage response and grid reliability. The settlements processes associated with contract and wholesale billing are also now automated. As well, many additional software applications can be integrated with the MDM system to provide better decision-making capabilities or study data and automated capabilities to reduce field work or automated design. It also allows for strategic implementation of the additional applications as the business units are ready.

Demand Response

Utilizing its fixed network and advanced meters, the utility can remotely turn off customer devices during pre-defined events. This allows for the reduction of system super peaks and provides for cost deferment of generation implementation. TEP is also looking into the use of the demand response system to provide short term delivery cycling for renewable energy resource changes. TEP is working on a strategy that integrates with its MDM system and EMS for operation and confirmation of desired load reduction.

HAN

A home area network (HAN) is a networkable device that a customer can control and operate remotely or automatically utilizing a utilities communications infrastructure or a customer-owned and operated device to reduce or indicate energy consumption. TEP is looking into devices that would initially offer indication of energy consumption as part of a demand side management project.

Overall, TEP has developed a smart grid strategy that allows for the use of existing installed equipment in conjunction with communications and MDM technologies that allow for a flexible implementation of any technology or application that will bring value to customers and investors at a speed that is appropriate. TEP feels this approach to the smart grid is unique in that it is affordable and allows for a surgical implementation strategy. ■

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Smart Grids — A Smart Move for Consumers

Jim Greer, Senior Vice President, Asset Management and Engineering, Oncor

Oncor is leading the drive to transform the nation's electric grid.

SMART GRIDS ARE A SMART MOVE FOR YOU, me and every consumer in America. Technology is sweeping away reactive, one-way electric grids in favor of proactive, intelligent systems that put consumers in control of their electric use. President Barack Obama's call for a national smart grid initiative adds even more urgency to the movement.

In Texas, Oncor is leading the drive to reinvent the way consumers use energy through the Smart Texas[SM] initiative. Smart Texas, Oncor's term for the remaking of a rotary phone-era system into a sophisticated, interactive electric grid, is well underway. Smart Texas[SM], like smart grid, broadly describes many interwoven technological advances and services that improve reliability and customer service.

Smart grid initiatives, such as Oncor's Smart Texas[SM], will allow consumers to see how much they are spending and why, real time. The ability to monitor electricity use around the clock promises to be both empowering and revolutionary.

By the end of 2012, Oncor will replace every existing meter in Oncor's system, more than 3 million overall, with advanced meters. Each day, Oncor installs 3,500 new meters. By year-end, Oncor expects to have installed nearly 700,000 advanced meters, one of the largest and most comprehensive meter upgrades in the nation. Oncor's interactive meters are state-of-the-art, latest-generation sensing devices that allow consumers to see their electricity use instantaneously through home monitors and review their historical energy use online through a Web portal.

Last year, Oncor launched an extensive consumer education campaign to show 7 million Texans how Oncor's advanced meters can change lives. The Smart Texas Mobile Experience Center, a 1,000 square foot trailer with interactive teaching zones, travels around the state visiting festivals and events where consumers can learn the benefits of technology and advanced meters through interactive displays and kiosks. In 2008, the Smart Texas "mobile classroom" educated more than 14,000 visitors.

One of the most popular stops in the Mobile Experience Center is a kitchen island where an electronic monitor, an energy use "speedometer," communicates wirelessly with an advanced meter system. The monitor illustrates dramatically just how much energy appliances are using, what the electricity costs, and how the power is priced.

Smart Texas also comprises one of the most expansive high-voltage line construction projects in the nation. Oncor expects to

The Smart Texas Mobile Experience Center tours Texas educating consumers about Oncor's plan to install more than 3 million advanced meters by 2012.

Courtesy: Oncor

build more than 850 miles of transmission lines, a Renewable Energy Super Highway, to move wind power from West Texas to the state's major population centers. Oncor's planned lines are part of a statewide master blueprint to double wind generation in Texas through Competitive Renewable Energy Zones. Already, Texas is the nation's leading wind producer with more than 8,000 megawatts of clean energy capacity in production today. Constructing a fast lane for renewable energy delivery to the rest of the state creates a vast new source of clean, affordable electricity.

Automation, using technology to automatically detect outages and restore power to consumers, is another Smart Texas innovation. Oncor pioneered the development of automation and technology to improve service and reliability. Today, Oncor has more than 700 smart switches that talk, collaborate and react to outage threats, reducing the number of outages and improving reliability. In June, Oncor began operating a Static VAR Compensator, a fast-acting, voltage booster that keeps power flowing to the Dallas/Fort Worth area. Eventually, consumers won't have to pick up the phone to call in power outages. Advanced meters and switches will know, within a few blocks, where to send repair crews.

Oncor's Smart Texas initiative is opening the door to immense possibilities for consumers. Studies conducted around the world have consistently shown that consumers reduce overall energy use by 5 to 15% when they know exactly how much power they are using. Simply giving consumers the information they need to make better decisions results in more effective personal energy management.

With transformed electric grids, Oncor foresees a day when consumers, like businesses, opt for rates that adjust with the time of day. For example, winds blow at night in West Texas, making cheap, renewable energy from wind farms readily available. Consumers could choose to help the environment and get a break on their electricity prices by doing some chores at night, rather than during the day. By shifting electricity use to the evening or off-peak hours, new power plant construction could be delayed or shelved, protecting the environment and reducing emissions.

A proactive, interactive electric grid is starting to take shape in Texas. Within a few years, an expanded transmission system will remove bottlenecks to delivering renewable energy to major cities. By the end of 2012, Oncor's advanced metering system will be in place, setting the stage for a new era in personal energy management and grid diagnostics. Sophisticated switching systems with the ability to sense potential faults and automatically switch from one power source to another are already improving service and reliability.

In coming years, smart grids will encourage development of fleets of plug-in hybrids and electric vehicles. When charging at night, electric vehicles have the potential to store lower-priced electricity generated off-peak. As more wind power is produced in Texas, consumers with electric vehicles will increasingly fuel their cars with clean wind energy. Smart grids, with the capability of understanding the peaks and valleys of power demand, enable this type of innovation.

On May 13, the plug-in hybrid (PHEV) and battery-powered electric vehicle (BEV) concepts came closer to reality with Oncor's participation in Ford Motor Company's application for Department of Energy stimulus funds earmarked for plug-in hybrid and electric vehicle utility fleets. In the next three years, Oncor and 14 other utilities could be part of a grand national experiment designed to speed commercial development of electric vehicles. Utilities included in the application have committed more than $170 million to develop, integrate and deploy smart charging infrastructure in their local communities.

The smart grid revolution is underway, but the future promises even more changes and innovations. Already, appliances are being designed with digital chips able to talk to advanced meter systems. These smart appliances will help consumers decide when to wash dishes, dry clothes, or cook food at the lowest possible electric rate. Energy management systems, common in businesses, could move into the home, turning lights and fans on and off, adjusting the temperature, around the clock. With smart grid technology as a launching pad, new products and services will move from the design to production phase at warp speed. ■

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Developing Your Industry Smarts — A Guide to Optimizing Smart Grid Opportunities

John Ferrare, Co-Owner, Enerdynamics

BY SOME ESTIMATES, NEARLY $500 BILLION will be spent upgrading meters, appliances and the electric grid itself in the next two decades. The opportunities are enormous and once-in-a-lifetime. But for many companies with products to sell, the electric utility business is an enigma. And that presents a problem that can make selling even the most innovative product a tremendous challenge.

The challenging nature of this market should come as no surprise, since the utility industry is fundamentally different. Its jargon is unique. Delivery chains are fragmented and products that can be offered are rigidly controlled by regulatory rules. The way in which regulated energy companies make shareholder profits is different (and for many, quite baffling!). Approvals for new initiatives are often subject to an esoteric regulatory process. And let's not forget that each state sets its own rules. So while utility A profits by selling more power, utility B, just across the border, profits by pushing energy efficiency and selling less.

So before you invest millions in developing the next latest, greatest smart grid product, take time first to become conversant with the utility industry. Learn to speak their language and understand their motivations and needs. Quite simply, develop electric industry business acumen.

What is Electric Industry Business Acumen?

Understanding the electricity industry (and subsequently selling products into it), requires not only a highly developed knowledge of the primary customer, the utility, but also an understanding of the utility's customers and suppliers (end-use electric consumers, generators, marketers, transmission companies and fuel providers), the utility's system operators (ISOs), and last but certainly not least, the utility's regulators (FERC, state and environmental). Key areas that are crucial to understand include:

- End-use customers: Who they are, what their needs are, current and future services that your products might enable, how their behaviors impact the design and operation of the physical system and how their use of electricity impacts pricing and revenue opportunities.

- The physical delivery system: What the physical components are from generation through distribution, how the system is designed and operated, how new products can improve system design and operations, how various components contribute to overall system costs and the ways in which system efficiency can be improved.
- The market participants: Who the various players involved in the delivery chain are and how their services help to deliver electricity to consumers. These include investor-owned utilities, municipal utilities, co-ops, merchant generators, power agencies, transmission companies, independent system operators, wholesale marketers, financial service providers, distribution companies, retail marketers and electric services companies.
- The electricity markets: How the various and complex electric markets work. These include ISO markets, open access transmission tariff markets, bilateral wholesale trading, electronic exchanges, financial markets and competitive and regulated retail markets.
- The business of electricity: How the various market participants make money and manage risk. Especially important is the understanding of utility rate cases and return on investment since this determines when a proposed investment is, or is not, profitable for a utility. Also important is risk and risk management, since even the biggest of marketing companies and utilities have experienced bankruptcy in recent years.
- Electric regulation: The key to how utilities make money is how they are regulated. But different parts of their business are regulated by different agencies: the Federal Energy Regulatory Commission (FERC) regulates transmission lines and wholesale power, the state public utilities commissions regulate distribution and retail sales, and various environmental agencies regulate power plant emissions and other environmental issues. Also important to understand is how regulation varies from state to state and region to region. Even in so-called competitive markets, you cannot understand the electric business or identify good opportunities to use technology without an understanding of the regulations that affect all aspects of the business.
- Competition versus regulation: The electric industry began deregulation in the mid-1990s. But deregulation never took hold throughout the US and the industry is now fragmented with some segments highly competitive and others highly regulated. Some regions of the US, such as Texas and parts of the Northeast, are very competitive all the way down to the retail customers. Other regions are still dominated by the vertically-integrated monopoly utility.

Who Needs Electric Business Acumen?

Is it management? Is it your sales team? Is it your product developers? Is it everyone? Many successful companies have found building competency in electric industry knowledge is important not only for the product development and business strategy teams (those that develop the product) and the sales team (those that sell the product), but also for engineers and programmers (those that build the product), all of whom then find it easier to work collaboratively with their utility counterparts and identify additional opportunities and solutions.

The opportunity in this blossoming industry is staggering. But so are the pitfalls. The key is to know your customer: understand their motivations and how they can profit from what you can offer.

The Smart Grid Prize

For those eyeing a piece of the smart grid pie, a warning! Don’t assume that these potential customers will be in any way similar to those you already know. The opportunity in this blossoming industry is staggering. But so are the pitfalls. The key is to know your customer: understand their motivations and how they can profit from what you can offer. And above all, speak their language! Then get to work developing profitable products that satisfy their needs and can win the support of the regulators. ■

The next decade will see unprecedented investment in electricity infrastructure. But having the right products to profit from this once-in-a-lifetime opportunity is not enough.

You also need to understand the enigma that is the utility industry. For nearly 15 years Enerdynamics has been the leader in energy business acumen training. We know the electric utility business inside and out. And we can help you understand it too.

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