RECHARGING A NATION

Building a smart grid will help the U.S. get networked for the Digital Age.

IN PARTNERSHIP WITH:
platts

A REVOLUTION IN ENERGY IS UPON US. IT IS SO MONUMENTAL THAT IT WILL TRANSFORM SOCIETY AND CHANGE THE WAY ALL OF US IN AMERICA LIVE AND WORK.

It has been triggered by large-scale efforts to modernize the U.S. electric grid, adding high-speed communications and morphing the infrastructure into a "networked grid," or an "Internet for energy." This so-called smart grid will not only bring new communication capabilities to mission-critical grid devices and end-user appliances to optimize energy efficiency, reliability, and security. It will also serve as the enabling platform to plug in the next generation of clean energy technologies, such as rooftop solar systems, wind farms, and electric vehicles.

Surprisingly, the Digital Age has yet to reinvent the $350 billion electric power business, arguably one of the farthest-reaching and most extensive networks in existence. It's no wonder. The amount of capital it will take to upgrade an industry that has lagged in both R&D and IT investment is substantial.

Despite a general lack of public awareness of the grid's central role in enabling our nation's economy, the Obama administration has been increasingly advocating and funding investments in this area to drive GDP and give the U.S. a competitive advantage. These epic infrastructure investments are analogous to the ones made under the direction of President Eisenhower in creating the interstate highway system—the economic benefits of which are still realized to this day. However, the U.S. is hardly alone in promoting the smart grid as an economic growth engine; virtually every major economy is now either piloting or deploying smart grid technologies. It's understood that you cannot run a digital 21st-century economy on a 20th-century grid.

While today's grid remains largely based on the architecture invented by its forefathers—Edison, Tesla, and Westinghouse—and the majority of power is generated at large, centralized fossil-burning power plants, tomorrow's grid will allow for greater amounts of distributed generation and storage, giving consumers the opportunity to produce their own clean energy and sell any excess back to the grid. While today's distribution grids, lacking real-time visibility and control, are largely running blind and costing the nation approximately $100 billion to $150 billion each year in power outages, tomorrow's grid, much like the human body's own nervous system, will have sensory intelligence embedded throughout, giving the grid the ability to anticipate disruptions and even self-heal.

Last, and perhaps most welcomed, is the manner in which the smart grid will completely reengineer end users' relationship to their energy use, empowering consumers with real-time data and analytics through in-home energy management systems and web portals, taking us closer to the age of *The Jetsons*. Over the next five years, consumers will interact with the first wave of smart appliances, lighting systems, and management systems, using "set it and forget it" technologies to automate their homes and businesses for energy savings and other preferences, such as increased levels of green energy.

In phase two, over the upcoming 10 to 20 years, the next wave of home energy apps will be introduced, such as community microgrids able to generate 100% of their own power over certain periods, while trading energy for profit at other periods. In other apps, electric vehicles will be able to determine the most affordable hour of the day to charge their batteries. In this new automated world, we will finally have control over our energy usage and will gain independence.

—David J. Leeds, GTM Research

IEEE Advancing Technology for Humanity

IEEE SMARTGRID

LEADING A REVOLUTION

The IEEE is mobilizing technology changes around the world to help communities adopt the smart grid.

THERE ARE MANY WORDS to describe the smart grid: innovative, revolutionary, empowering. It will change the way we use and deliver energy profoundly. Once we build it, that is.

Realizing the promise of electricity's next-generation networked future requires teamwork and leadership. We need to develop standards so any device from any manufacturer can plug into the grid—smart meters, hybrid or electric vehicles, smart appliances, etc. Creating these new technologies calls for individuals and organizations to collaborate.

"Converting the grid to a digital system—integrating power, electronics, batteries, sensors, communications—requires people with different professional backgrounds to work together," says Wanda Reder, chair of smart grid efforts at IEEE, the world's largest professional association dedicated to advancing technological innovation. "Often, it's like everyone is speaking a different language."

That's where the IEEE comes in. For more than 125 years IEEE has built an unmatched reputation as a trusted, unbiased, and proven force for inspiring technical collaboration, strategy, and consensus. It includes 395,000 members from a range of disciplines in industry, government, academia, research, and small business.

Three decades ago, it was IEEE that brought together engineers and researchers with a vision for connecting computers in a network. Their work resulted in the IEEE 802 standards, a series of technical specifications for the world's most important wired and wireless networks: Ethernet, Wi-Fi, and Bluetooth, to name a few. With these standards, manufacturers know exactly how to design their equipment to work seamlessly with these networks. It's the reason we can check e-mail on a phone or laptop any place that offers wireless.

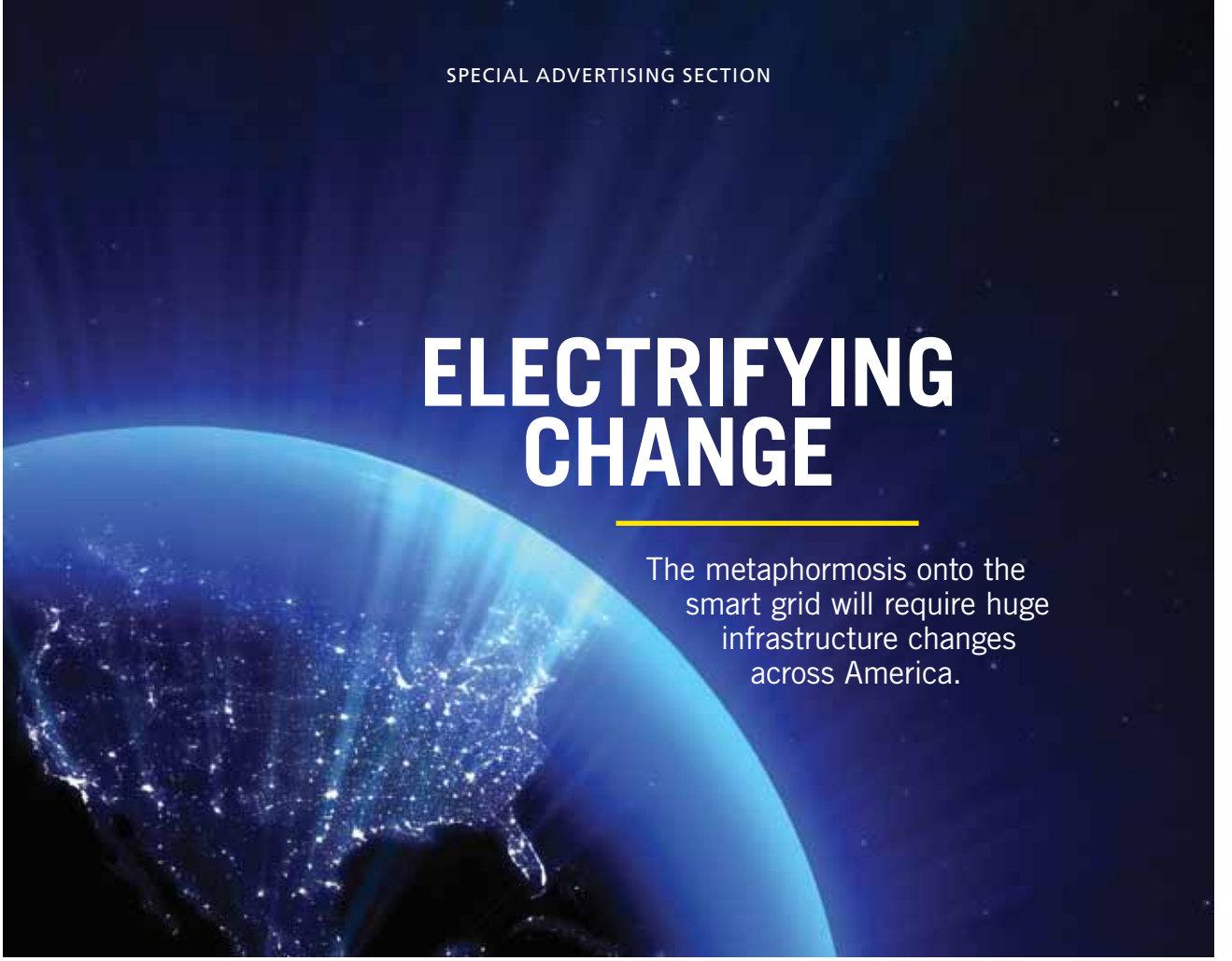
IEEE is providing this same thought leadership in creating standards for smart grid. To foster interoperability on the grid, IEEE working groups are developing or updating nearly 100 global standards, including specifications for integrating renewable energy. "Future grids will expand their transition to renewable energy sources," says Charlton Adams Jr., president of the IEEE Standards Association. "Reducing dependence upon carbon fuels requires technologies to integrate, manage, and store renewable energy. The IEEE is at the forefront of addressing these technologies, to ensure that wherever you are, renewable energy will be a part of your daily life."

IEEE fosters cross-industry collaboration and knowledge sharing. Around the world, IEEE is helping government officials organize working groups to determine national energy priorities and employ new technologies. To disseminate ideas about the grid, IEEE has published 2,500 journal papers—and continues to publish new research. To keep its members and the public up to date on the latest news and IEEE events related to the grid, it has created a web portal, ieeesmartgrid.org.

In January, IEEE held the first IEEE Innovative Smart Grid Technologies conference near Washington, D.C., bringing together participants from 32 countries representing the electric utility, regulatory, research, and manufacturing industries to discuss the key grid issues of cybersecurity, advanced metering, renewable integration, and home automation. A second conference was held in Sweden in October and many more are planned, including the December kickoff in Brussels of the IEEE Smart Grid World Forum, an ongoing series of conferences enabling those working on grid technologies to exchange best practices.

Indeed, with IEEE's leadership, soon there will be another way to describe smart grid: a reality.

For more information on smart grid developments, public policy, or how to get involved, go to ieeesmartgrid.org.



ELECTRIFYING CHANGE

The metaphormosis onto the smart grid will require huge infrastructure changes across America.

It's funny how the most transformative innovations go by the simplest of names: the wheel, the PC, and the web. Now add the grid. Sweeping changes are coming to the way electricity is delivered and used. Imagine a world where your electric car knows the cheapest time of day to charge its battery and goes ahead and juices up. Picture being able to take the excess energy your rooftop solar cells produce and sell it back to the electric grid. And forget about waiting hours for a utility worker to turn on power at your new home. With the smart grid, power companies can do that remotely instead of sending out crews.

The smart grid will enable unprecedented reliability in the way electricity is transmitted, by evolving from a largely electromechanical system into a digital network. Sensors will alert utilities of immediate trouble; automated switches will reroute power. Renewable energy sources such as solar and wind power will be integrated into the grid. Smart meters will provide a wealth of data about energy use, so we can use it more wisely.

Features such as these will cut pollution, lower consumers' bills, and spare utilities costly headaches. Indeed, the Electric Power Research Institute (EPRI) estimates that smart grid technologies could reduce electricity use by more than 4% by 2030, saving consumers and businesses $20.4 billion a year. That efficiency—along with all the renewable sources the new grid will bring online—will also cut the carbon emissions produced by electricity generation by as much as 9% from 2006 levels, according to the EPRI.

But the grid is a long-term project. It should take at least five years to get the necessary communications networks built and decades more to add a stream of innovative devices and applications. Expect the tab for this initiative to be high. EPRI estimates development will cost a whopping $165 billion over the next 20 years. And there are going to be significant challenges beyond the funding. Top-of-mind issues: How do we foster partnerships among all the vital industrial sectors (i.e., consumer electronics, IT, and telecommunications) that have not historically worked together? How do we create standards to make sure all different appliances can work on the smart grid? How do we install millions of smart meters efficiently across the country? And how do we give consumers incentives to take advantage of all the benefits the smart grid will offer?

KICK-STARTING A REVOLUTION

Traditionally, the biggest obstacle to big change has been financing. The good news is that the money for this mammoth undertaking has started to stream in from both the private and public sector. The dazzling opportunities have captured the imagination of America's entrepreneurs. Over the last five years, $1.3 billion in venture capital has been doled out to smart grid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If you innovate,
they will come.
In a recent Accenture survey, 89% of executives agreed that innovation is as important as cost management for high performance. But while many companies are investing more in innovation, only a few have a rigorous approach for managing the process. As a result, even innovative companies often fail to realize the benefits that their new ideas could produce. To see how our vast experience and research can help you maximize your return on investment as you embark upon your smart grid journey, visit accenture.com
• Consulting • Technology • Outsourcing
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High performance. Delivered.

startups. And that is just the beginning. Between 2008 and 2015, smart grid investment in the U.S. is expected to total $53 billion, according to Pike Research, a market research and consulting firm specializing in global clean technology markets.

At the same time, the federal government is trying to catalyze infrastructure development and new technologies for the smart grid. The American Recovery and Reinvestment Act has allocated $3.4 billion in smart grid investment grants, which will be matched by private investment. Already, 100 utilities, technology companies, manufacturers, and other organizations have received grants (up to $200 million apiece) to cover up to 50% of their project costs for a variety of ventures—from smart meter deployments to advanced transmission sensors to smart appliances for the home.

Falling technology costs, particularly for wireless communications systems, are also spurring investment. "Ten years ago we wouldn't have even tried this," says David Leeds, an analyst for the smart grid sector at GTM Research, a market research firm covering the energy and emerging technology sectors. "But we're now at the point where the price of building a networked grid is affordable."

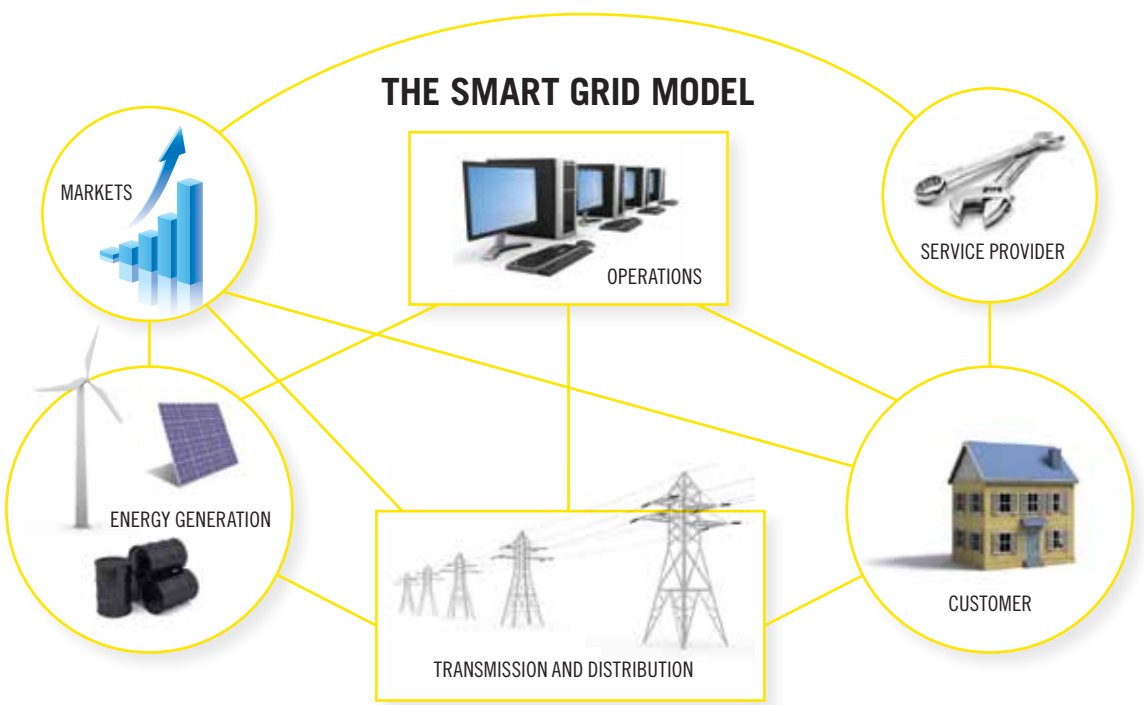
That has changed the cost-benefit analysis. "Even utilities that didn't get stimulus funds are mapping plans because the business case is so compelling," says Mark Munday, president and CEO of Elster Solutions, a global leader in smart grid and metering technology for gas, water and electric utilities.

One of Elster's customers, Salt River Project Agricultural Improvement and Power District (SRP), the third-largest public power utility in the nation, is making that case. Since deploying smart grid technology—namely, the Elster EnergyAxis smart grid system—it estimates that it has remotely addressed nearly 750,000 customer orders instead of sending out trucks. That has saved SRP more than 249,000 hours of labor, 1.3 million driving miles, and 135,000 gallons of gas.

LAYING THE INFRASTRUCTURE

There are a host of devices and technologies that will revolutionize the grid. Some, such as smart meters, are already hitting the market. Others—such as storage devices that will let us save any excess power from renewables so that it can be used it later on—are yet to be commercialized. And then there is the innovative hardware we haven't even thought up yet. They'll all have one thing in common: the need to communicate, both with the utility running the grid and all the other devices on it.

That makes two-way communications key. No wonder, then, that building the telecom networks that will link everything together on the grid is the crucial first step. But a utility has to be very careful when deploying its network, because it will be the backbone for every application to come. The network has to be flexible and powerful enough that new devices and services—



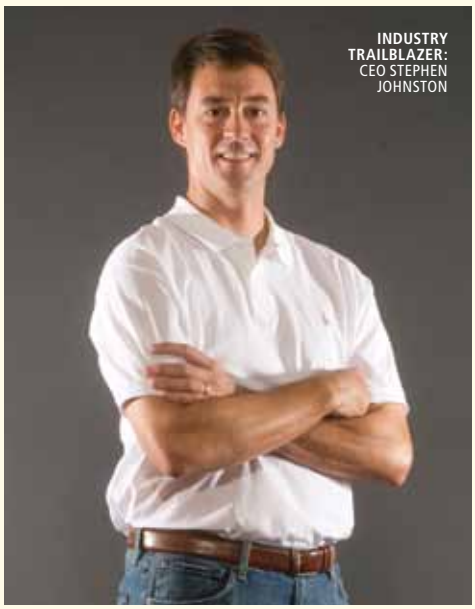
Source: National Institute of Standards and Technology

SmartSynch® we create smart grids™

PLUGGING INTO THE NETWORK

By connecting to the existing public cellular infrastructure, utilities can leapfrog onto the smart grid.

TWO-WAY COMMUNICATIONS networks are revolutionizing the power grid. They give utilities a wealth of data on how electricity is being used so that it can be delivered more efficiently. They let the utilities send signals back to homes and businesses so that power can be turned on remotely and appliances can be turned down when demand is strong. But these communications have to be ultrareliable and supersecure. Building private networks is one strategy, but SmartSynch, a company in Jackson, Miss., thinks there's a better way: using the public cellular networks that already exist. Its technology enables smart meters to connect to these networks, from providers such as AT&T and T-Mobile, and get the data flowing. We spoke to SmartSynch's CEO, Stephen Johnston, to find out why this strategy makes sense.



INDUSTRY TRAILBLAZER: CEO STEPHEN JOHNSTON

Utilities have traditionally built, managed and owned every last part of their infrastructure. Doesn't a public cellular network go against that?

Yes, and that's a good thing, because for the overwhelming majority of U.S. utilities, building and managing their own communications networks makes absolutely no sense. There are some 3,500 utilities in America, yet maybe 30 have the IT staff to run their own network. The others, frankly, have no idea what a hassle it is. When a storm knocks everything offline, they're going to want to focus on getting power restored, not their communications links. Keep in mind, too, that the cellular carriers spent $80 billion last year on upgrades. No one runs a network better than these guys.

What about coverage? Cellphone calls get dropped and you can't get a signal everywhere. Wouldn't utilities have the same problem?

This is probably the biggest misconception about using cellular networks for the smart grid. For one thing, the transceiver in the average smart meter is four times more powerful than the one in a cellphone. Second, utilities will be sending quick bursts of data, much more akin to a text message than a phone call. Finally, and this is a big point, we can integrate multiple carriers for a utility. So if AT&T has better coverage in one area and Sprint is better in another, you get the best of both.

Wouldn't utilities have to share the network with everyone's calls, video, and photos?

Most cellular carriers will let a utility set up its own network within the network. A lot of utilities don't know that. The carriers have realized that utilities can be a huge source of revenue, and they're lowering prices dramatically. In fact, over the life span of a smart grid, it will be less expensive to utilize an existing network than to build and run your own—in some cases, 50% cheaper.

Finally, there's the one word that raises everyone's blood pressure: security. Wouldn't a private network secure data better?

Let me put it like this: Commercial network providers spend billions of dollars annually to maintain secure networks. These are the same measures that secure millions of daily financial transactions, military data transmissions, even the e-mail on the President's BlackBerry. When you consider this, and add to it the coverage, bandwidth, and increasingly attractive cost a public network offers, the question isn't "Should I go cellular?" but "Why aren't I doing it now?"

whether automated meter reading, video surveillance of substations, washing machines that automatically turn on when electricity rates fall during the night, or any of a hundred features yet to be invented—can be added fairly painlessly. Few of these applications will be running on a utility's smart grid on day one. But the network has to be able to integrate them into the grid and have the capacity to run them without bogging down all the other applications sharing the bandwidth. Think about your Internet connection 10 years ago. It was fine when all you needed to do was send e-mails. But when you tried to download a video, you suddenly ran into trouble. Utilities want to avoid the smart grid equivalent.

"That makes planning your network architecture very important," says Denise Barton, director of marketing at Tropos Networks Inc., a Sunnyvale, Calif., company that develops reliable, high-performance wireless networks for smart grids. Tropos' GridCom architecture enables utilities to build a distribution area network that meets requirements for today and easily scales as needs expand—new applications, expanded coverage area, and capacity.

Helping utilities make the right long-term business and technology choices are companies like Accenture, a global management consulting, technology services, and outsourcing firm. Accenture's 8,000-plus utility industry professionals have already assisted on more than 100 smart grid projects, helping power companies take a hard look at their goals and build road maps for achieving them.

"Operationalizing the smart grid goes far beyond selecting the most appropriate technology," says Sharon Allan, senior executive, Accenture Smart Grid Services. Just as important, she adds, is the ability to align that technology with the utility's business objectives, processes, and skills. That can mean broad-reaching changes, but those changes are essential if utilities and consumers will truly realize the potential of the new grid. "The sensing and communications capabilities of the smart grid give utilities a great deal of intelligence about their operations, but the challenge is turning that data into insight," says Allan. "That comes when you have integration, connectivity, and collaboration throughout the enterprise."

Utilities have a host of goals for the smart grid: bringing more renewable energy online, boosting grid security and reliability, and reducing carbon emissions, to name a few. Achieving them, says Allan, will be possible only through "tight integration among the data, processes, and people that span virtually every business function of the utility."

A PUBLIC OR PRIVATE OPTION

The communications network presents one other issue for utilities: Should they use a private network built from scratch, or leverage existing ones, such as the cellular networks from major wireless providers?

A case can be made for each strategy. Private networks give utilities full control over their communications. There are financial considerations, too, argue proponents. "An advantage of a private network is its operational costs," says Mark Thomson, vice president of strategic development and standards at Aclara, which provides communications technology to more than 500 utilities. "Public carriers aren't going to do this for free, and if you're talking about millions of devices for a utility, even a small charge for each adds up. A utility can also capitalize the investment it makes in a private network."

Proponents for public networks, however, say the cost equation has changed drastically in the last year. "In the past 12 months, the prices the big wireless providers are offering utilities have come down by as much as 95%," says Campbell McCool, chief marketing officer at SmartSynch, whose technology enables utilities to send and receive energy-related data over cellular networks, including those operated by AT&T, T-Mobile, Sprint, and Verizon. "In 2010, we are seeing

QUANTA SERVICES

BUILDING AMERICA'S FUTURE

ACROSS THE GLOBE, energy providers are looking to the smart grid. And little wonder: By leveraging all we know about networks, automation, and communications, it will bring unprecedented reliability and efficiency to the way we deliver power. But choosing the right technology and building the right infrastructure for this project is a formidable task. Mistakes will be costly. Little wonder, then, that companies are partnering with Quanta Services Inc.—a leading provider of specialized contracting services—to develop, and then implement, their vision for the grid.

"You need a fully integrated plan before you can embrace the smart grid," says John Colson, Quanta's chairman and CEO. "That means knowing what your goals are now and trying to anticipate what you might need in the future. We help our customers develop a strategy and then manage all phases of a project—from planning and engineering to construction, installation, and maintenance."

Already, Quanta is helping utilities build the new grid. In Houston, it is working with CenterPoint Energy to install 2.4 million smart meters and related communications equipment. The project will make automated meter reading possible. It will also allow CenterPoint to turn service on and off remotely and see exactly where an outage has occurred, instead of sending out a worker to investigate. Quanta is bringing new sources of renewable energy online, too. For a project in Kings County, Calif., it will design and build two utility-scale solar power plants that will provide Pacific Gas and Electric with enough electricity to power more than 30,000 homes throughout the state.

Quanta isn't just building the smart grid. It's building America's future.

rates that can get as low as 10 cents per meter per month. That's a fraction of what it used to cost."

The reason behind the price drop is simple, says McCool: The wireless carriers see a compelling business case for Grid 2.0, too. "They have recognized that the smart grid represents one of the single greatest sources of incremental revenue they will ever see," he says. "Their networks are already built out; energy data requires relatively little bandwidth. They have no subsidies to deal with since we're selling the meter. There are virtually no additional costs for them, but all this potential revenue."

Add to that, McCool says, the expertise the carriers have in running their networks, not to mention the vast sums they spend improving them, and public networks make a compelling business case, too.

INDUSTRY COLLABORATIONS

Securing the grid is yet another priority and of particular concern since the U.S. Department of Energy (DOE) warned in July that vulnerabilities in some smart grid networks might enable cyber-wrongdoers to disrupt power delivery and steal data. The DOE's study, conducted by Idaho National Laboratory, follows a report by Siemens that hackers had attacked software it designed to control critical infrastructure, including power grids. (Siemens said none of its customers suffered damage, and the company issued a tool to correct the security gap.)

Indeed, one nice thing about an old-fashioned electric grid is that there isn't too much to hack into. The smart grid changes that with connected devices everywhere, each a potential door into the electric system."As utilities deploy more advanced technology in the grid, they must consider how to properly secure the network and ensure reliable, consistent service," says Sharelynn Moore, director of marketing and communications at Itron Inc., a leading provider of smart grid and smart distribution solutions to utilities around the world. "Information privacy is a key consideration, too; preventing unauthorized access to meter data is top-of-mind for utilities."

Itron, for example, uses advanced hardware- and software-level encryption to secure its OpenWay smart grid solution—making it nearly impossible to decode the device's communications. The company—which is supplying 5.3 million smart meters to Southern California Edison and millions more to other utilities across the nation—also voluntarily participates in third-party security testing. And in June, Itron announced a partnership with Idaho National Laboratory to share knowledge and collaborate on security issues associated with critical infrastructure (such as the electricity grid) to identify and further reduce security vulnerabilities.

Alliances like these highlight a key point: The smart grid will only succeed through collaboration. "No one community, industry, or company supports all the required technology to address this," says Charlton Adams Jr., president of the IEEE Standards Association. "We need relationships that are global and include stakeholders from industry, academia, and government as well as technology standards communities—relationships that enable us to share technology and move it into the marketplace."

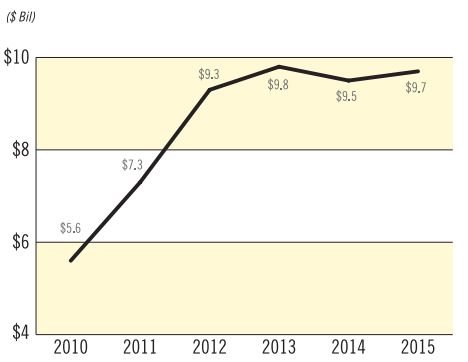
IEEE, the world's largest professional association dedicated to advancing technological innovation, is uniquely positioned to facilitate these partnerships. Its 395,000 members represent every segment—from technological to economic to political—that will play a role in our future grid. With its conferences, journals, working groups and councils, IEEE is the technical world's go-to partner for sharing ideas, pooling intellectual property, and building a vision for the future. "What we offer is a tremendous infrastructure for creating best practices," says Wanda Reder, chair of the IEEE Smart Grid. "We're bringing together all of these people, with multifaceted backgrounds, to foster leadership and consensus for smart grid advancement."

The global nature of the smart grid and the varying needs of different regions make IEEE's worldwide reach invaluable. In the U.S. and in countries around the world, IEEE has brought together leading grid experts and government officials to map out national priorities. Technology advancements, regulatory developments, and findings from actual system installations are often shared to advance smart grid learning and facilitate the realization of related energy efficiency and environmental benefits.

Then there is the work for which IEEE is, perhaps, best known: creating technical standards that ensure interoperability, making sure that any device from any manufacturer can connect and operate on the grid. IEEE committees are now developing

THE FUTURE IS BRIGHTER

A market forecast of investments in the U.S. smart grid spurred by federal stimulus funds.



Source: GMT Research

Trimble

A GUIDING FORCE

Trimble helps utilities build, integrate, and manage their new electrical infrastructure.


TRIMBLE SOLUTIONS HELP UTILITIES WORK SMART, EFFICIENT, AND PAPERLESS.

THE SMART GRID MAY BE the future for utilities, but it's also a jigsaw puzzle. So many pieces have to fit together to make it happen. There's the core technology, of course: smart meters, intelligent transmission and distribution, communications networks, and a variety of innovative applications. But there's also the nuts-and-bolts work: designing transmission lines to connect renewable energy sources to the grid; managing multimillion-dollar projects so they come in on time and on budget; enabling workers in the field to deploy, repair, and inspect equipment safely and efficiently.

Guiding utilities through the life cycle of smart grid projects, from prefeasibility planning through budget and schedule control, project management, surveying, construction, asset management, and all aspects of operations and maintenance, is Trimble—a Sunnyvale, Calif. company best known for its GPS technology. For over 30 years its systems have proved vital for the energy and utilities industries. You need to be very careful, after all, about where you place a transformer or utility pole.

But as the industry has transformed to embrace the smart grid, so, too, has Trimble. Its expanded range of offerings—from design software to outage and mobile workforce management tools—are intended to help utilities build, integrate, and manage their new infrastructure faster and more efficiently than ever before possible.

Trimble's transmission and distribution line design software, for example, will help utilities bring an increasing amount of renewable power online. "You may have consistent wind to support wind farms in the Western plains but the majority of the power may be delivered thousands of miles away," says Doug Merrill, general manager for Trimble's Energy Solutions. "Utilities have to efficiently get that power onto the grid while satisfying a number of stakeholders." The software doesn't just let engineers build optimal structures, factoring in location-specific elements such as wind and geography. It also alerts them when a design violates industry standards. The result: better designs, fewer mistakes, and less-costly projects.

Meanwhile, Trimble's mobile workforce management solutions and rugged field computers enable utilities to roll out smart meters quickly and efficiently. Combining positioning technology with advanced software algorithms, they can determine optimal routing for installation trucks. This maximizes the number of meters installed each day while minimizing fuel, carbon emissions, and the amount of time crews spend on the road. But Trimble's role doesn't end when the new meter is plugged in and activated on the network. Using a Trimble GPS device, an installer can wirelessly send the new meter's bar code, and even installation photos, back to the utility. "You get an absolute record of what was done, when it was done, and where it was done," says Merrill. "That reduces errors, overlap, time, and, once again, costs."

Keep in mind, too, that although a smart grid will eliminate manual meter readings, it won't eliminate the need for workers in the field. They will still have to respond to outages and maintain equipment. Solutions such as Trimble Field Inspector and Trimble eRespond software track where and when work needs to be done, allow for improved validation and reporting (using bar codes, photos, and GPS data), and calculate optimal routing for jobs.

"Crews complete their assignments faster and more accurately, enhancing service, improving reliability, and reducing cost," says Merrill. "What you get is a smart grid, and a smarter way to work."

For more information on Trimble, go to trimble.com/smartgrid.

or tweaking scores of specifications for the grid, including those that look at wireline and wireless communications; how power lines themselves can be used for communications; and the interconnection of renewable sources into the grid.

And make no mistake: The smart grid is going to be hugely important for the future of renewable energy. The push for clean sources of power is hard to miss, particularly if you run an electric plant. "States are telling utilities that they need to have 10% renewable energy in their portfolio by 2010, or 15% by 2030, and so on," says John Colson, chairman and CEO of Quanta Services Inc., which provides infrastructure solutions for the electric power, natural gas and pipeline, and telecommunications industries. "An important part of our business is designing and installing solar and wind facilities, and we're seeing increased activity in the U.S. lately." Even more investment will come if these sources can be easily linked to, and managed on, the grid.

After getting industry standards in place, the next task will be moving customers to the new electrical platform. Consider, for example, the logistical demands of swapping the 350 million analog meters in the U.S. with their digital counterparts so that utilities can manage energy usage in real time. It is mind-boggling to imagine.

Fortunately, some innovative companies are helping out here, too. Trimble has integrated its expertise in positioning technologies (particularly GPS) and mobile workforce management into solutions that facilitate smart grid rollouts. "How do you efficiently and cost-effectively replace millions of meters?" asks Doug Merrill, general manager for Trimble's Energy Solutions business. "An efficient process requires a complete end-to-end solution that includes vehicle routing, work order management, and mobile computing capabilities. To minimize costs, it's critical to route the vehicles efficiently, oversee the smart meter inventory, manage the installation and workflow—all while minimizing your carbon footprint. It's the smart way to work."

AN EDUCATED CONSUMER

Finally, there's the consumer's role in all of this. Utilities want to empower their customers, to give them visibility into their consumption patterns so they can take action to modify them," says Peter Mainz, chief executive officer and president of Sensus, a North Carolina–based company that provides communications networks, smart meters, and software to utilities. "If their thermostat changes color when the cost of running their air conditioner increases, they're more likely to turn it down."

Some utilities are already providing visibility through web portals, such as the site created by one of Elster's utility customers, Toronto Hydro. "The portal lets them take the data that is collected by our system and make aspects of it available to consumers," says Elster's Mark Munday. "Customers see how much electricity they have used and at what time, with everything color-coded to reflect the rate structure. Information like that makes it easy to adjust your energy use. This is the wave of the future in North America."

There is, of course, still much to hash out before we get our grid of tomorrow. But there is much reason to be optimistic, too. A lot of the technology we'll need is far up the development curve. For example, EnergyAxis, Elster's comprehensive Smart Grid solution, already allows smart meters on the network to communicate with each other, optimizing efficiency and enhancing outage management capabilities, as well as enabling personalized electric billing—a crucial capability if the grid is to be truly smart. "You can take your electric vehicle to a friend's house, charge it, and the system understands you're the one who should be billed, not your friend," says Munday. Given that an electric car will draw as much power as a home, this will be a key feature for utilities—not to mention many friendships. **—Alan Cohen**

Smart Grid, Smart Meters

When it comes to realizing the potential of the smart grid, there's no substitute for experience. Sensus has over 225 smart grid projects deployed with over eight million smart meter communication devices installed and operating. Our FlexNet communications system, in conjunction with Sensus smart electric, water and gas meters, gives utilities a licensed, dedicated and protected two-way communications spectrum that they can partition to run mission critical applications such as smart metering, distribution automation, and demand response programs. Sensus innovation is making the smart grid a reality today. For more information, please visit sensus.com.

SENSUS

An Empowering Solution

A leader in advanced metering infrastructure and utility networks, Aclara creates solutions that help more than 500 utilities worldwide connect with the grid and with their customers. Its two-way communications technology and advanced software let power companies capture an unprecedented amount of information about how energy is being used, enabling them to deliver it more efficiently. To empower consumers, Aclara solutions deliver information via web portals, connected devices such as smart phones and home area network devices so they can better understand and manage their usage patterns—saving energy, costs, resources, and emissions. For more solutions, visit aclara.com.

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