

SMART GRIDS

Why We Need a New Grid

The American Recovery and Reinvestment Act set aside \$4.5 billion of mostly grants to industry for the development of a smart grid in the hopes of achieving President Obama's goal of installing 40 million smart meters in homes and modernizing 3,000 miles of transmission lines.

That's a testament to the desperate need for a smart grid and states can help the cause.

That need is illustrated by the blackouts many parts of the country have experienced, including an unprecedented power blackout in parts of the Midwest and Northeast on Aug. 14, 2003. Some 55 million people were affected by the outage in myriad ways: Cleveland lacked water for a day because pumps could not run; fires spread in New York as residents resorted to candles for lighting during the evening; and nearly 100 miners in Sudbury, Canada, were trapped underground.¹

The 2003 blackout, which resulted in \$6 billion in economic losses, highlighted the aged condition of the electricity transmission and distribution system, which is running near capacity and is expensive to maintain, meaning higher rates for consumers. Seventy percent of transmission lines in the U.S. are more than 25 years old. As such, the lines are prone to being damaged and costly to repair. They are also carrying much more electricity than they were meant to handle. Demand for electricity has increased—and continues to increase—but the number of lines has not grown, meaning more electricity is traveling along the same old lines, increasing the potential for blackouts like the one in 2003. In addition to the economic losses that can result from such blackouts, sending crews to repair the grid when it malfunctions can be costly, dangerous and time-consuming.²

Due to the NIMBY syndrome as well as a lack of interconnection standards, it is also difficult to connect new sources of generation, especially renewable energy sources, to the grid; and a growing number of state renewable portfolio standards require more power generation come from sources such as wind and solar power. Finally, the inefficiency of the grid results in the need to run older, dirtier sources of generation that emit copious amounts of greenhouse gases that are not aligned with many states' climate change goals and policies. Thus, there's a need among all stakeholders to move to a smart grid that



Smart Grid City, Boulder, Colo.: Potential Benefits

- ▶ Cheaper power for the utility and customer by being able to connect and disconnect power remotely, reducing the need for a call center and reading meters more accurately
- ▶ Ability for customer to choose power source—coal, wind or solar, for example--based on preference (e.g. cost, environmental benefits of power source)
- ▶ Self-correcting, meaning fewer and shorter power outages
- ▶ Opportunity for plug-in hybrid electric vehicles
- ▶ Potential to reduce CO2 output by 1.5 million tons per year by managing distribution losses and increasing efficiency
- ▶ Reduced need for added transmission lines by reducing peak load

Source: <http://smartgridcity.xcelenergy.com/learn/downloads.asp>

reduces reliance on such sources and that minimizes the risks associated with age and congestion.

The Smart Grid Solution

A smart grid would automate and digitize the electricity transmission and distribution system to allow two-way communications between utilities and devices connected to the grid. This two-way system would allow power generators and consumers to monitor and effectively manage electricity and power generation. When this happens, officials and consumers alike are equipped with the kind of information they need to maximize generation efficiency and minimize cost.

Smart grid technology has many advantages that just don't exist in the old grid. For one, a smart grid will employ advanced meters that allow customers to see the real-time rates of electricity. A customer using the smart grid technology can see, for example, that turning up the air conditioner a few degrees during the summer or delaying their washing until the evening—when prices are historically lower—will save them money.

Today, the smart grid is beginning to advance piecemeal past the conceptual stages and into actual practice, with some utilities beginning to roll out limited testing of applications and devices. In a pilot program, Baltimore Gas and Electric Company found with smart meters, customers cut their electricity usage nearly in half and saved approximately \$100 on their utility bills over the course of the year.³ Customers will also have the option to permit utilities to minimally control their electricity usage by briefly turning off appliances, especially during peak hours. This will allow utilities to minimize disruptions to the system that occur when the demand for electricity exceeds the supply and help prevent the need to intentionally cut service to areas, known as rolling blackouts.

Additionally, smart grid technology will offset the need for new generation and transmission as greater efficiency will result from the system. Southern California Edison, a subsidiary of Edison International based in Rosemead, Calif., for example, plans to deploy 5.3 million smart meters to its customers between September 2009 and 2012. The California Public Utilities Commission allowed Southern California Edison to secure \$1.63 billion in ratepayer funding for this project, which it hopes will improve the performance of the grid.⁴ And Oncor—Texas' largest electricity transmission and distribution service—will deploy 3 million advanced meters to its customers, which will result in a \$2.21 monthly surcharge on customer utility bills to cover the cost of deployment.⁵

The smart grid will also more easily integrate renewable energy sources and will help in managing the generation variability problems they present. It even has the potential to allow customers to choose the source of their electricity and will provide an opportunity for the development and advancement of plug-in hybrid vehicles, thereby reducing the country's dependence on fossil fuels.

Another advantage of the smart grid will be its ability to enable utilities to pinpoint disruptions in the system more quickly for rapid repair and to detect deficiencies ahead of time in order to prevent service outages. In many cases, repairs will take place automatically through the grid's computerized programs, negating the need to send out crews, saving on both time and cost. Baltimore Gas and Electric Company estimates it will save nearly \$600 million per year on its 2 million customers with the smart grid technology that enables rapid notification of power outages and reduces the need for meter readers.⁶

Finally, the smart grid is expected to create jobs. Industries that contribute to the development of smart grid technologies—engineering, software design and management—will need employees on both the utility and commercial sides, as appliances that communicate with the grid will need to be outfitted with communications technology. There will also be jobs for those who will install and maintain such products. The American Recovery and Reinvestment Act of 2009 provided roughly \$100 million for the training of smart grid workers. IBM Corp. estimated 500,000 jobs will result from investing \$10 billion in the development and deployment of the smart grid.⁷

Issues Facing the Development and Deployment of the Grid

While the smart grid appears to have much to offer, developing it will not come without challenges. At the forefront are concerns over utility control and cost. Consumer advocates fear the ability to more easily control service shutoffs (remotely rather than onsite) will result in an increase in the number of elderly and poor people who cannot pay their bills and could be stranded without power during adverse weather. Another concern is whether costs associated with the grid will outweigh benefits. Smart meters and other smart grid features that will be developed once funding starts to flow will cost utilities money to design and install (Baltimore Gas and Electric Company anticipates \$500 million for the deployment of smart meters to its customers⁸). The costs will then be passed on to the consumer in the form of monthly surcharges, as Oncor in Texas did with its monthly \$2.21 surcharge to customers. The success of smart grid technology still largely depends on how the customers use it, and if it inspires any electricity-saving action. If, for instance, customers do not heed pricing signals and alter their behavior, and utility bills continue to rise (or benefits of the grid are miscalculated and savings do not accrue), a backlash could occur that could potentially halt development of the grid, though companies such as Xcel Energy are working to educate consumers through community events and demonstrations.

Utilities will also naturally be reluctant to design smart grid devices and applications unless the state public utilities commission permits it to recover the cost through rate increases



because of the high initial cost of development. Without a guarantee from states, utilities will put forth very little effort on the research and development side of smart grid applications.

Finally, security of the system and the development of common standards that allow communication between all devices connected to the grid are considered vital to the success of the smart grid. When the smart grid becomes operational it will be fully digitized and run by computers, making it vulnerable to cyber attacks. The system, in order to be secure, must ensure every aspect meets certain standards, which are being coordinated by the National Institute of Standards and Technology in consultation with industry and other stakeholders. And to maximize the capabilities of the grid and spur competition, common software standards are needed that allow all parties an opportunity to develop applications.⁹

States' Roles in Advancing the Smart Grid

The federal government has been the primary driver of the smart grid. The Federal Smart Grid Task Force was created under the Energy Independence and Security Act of 2007. The American Recovery and Reinvestment Act also sets aside

\$4.5 billion to develop the grid and also align it with President Obama's goal of installing 40 million smart meters in homes and modernizing 3,000 miles of transmission lines.

But state engagement is also vital to the success of smart grid implementation. The Federal Energy Regulatory Commission is responsible for regulating the interstate transmission and commerce of power, but states regulate distribution and rates. States are therefore responsible for approving and designing utility rates that help promote the smart grid through cost recovery. States will need to carefully consider whether rate increases are prudent and just. Thus, small-scale demonstrations and gradual rollouts of smart meters by utilities will serve to demonstrate the feasibility of the smart grid.

Also, since a handful of states are moving ahead with smart grid deployment on a limited basis, it is important they coordinate with Federal Energy Regulatory Commission on the development of interoperability standards to ensure that when different segments of the grid come online they all function seamlessly together. For example, Boulder, Colo., was designated as a Smart Grid City by Xcel Energy, the utility overseeing the grid's development there. Xcel plans to deploy smart grid technology to 100,000 residents in the hopes of capturing the benefits of the smart grid and determining its

wider applicability. Xcel will soon take its rate case to Colorado's Public Utilities Commission to see if it can adjust prices. Xcel's successes and missteps in implementing its program will therefore be helpful to other utilities and states in determining how to proceed.

Thus, state regulators are vital to the success of the grid and in determining whether it reaches full functionality.

The Smart Grid Summed Up

As the U.S. economy continues to become digitized, increasing the number and scope of transactions moving over the grid, the need to move to a more reliable, secure and compatible electricity delivery system becomes ever more pressing. By working with Federal Energy Regulatory Commission, industry and other stakeholders to ensure rate recovery and harmonization of interoperability standards, states can help ensure the implementation of a smarter grid that will modernize our electricity system, promote cleaner sources of energy, minimize disruptions, and lower customer utility bills, while at the same time enhancing the nation's work force.

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TODAY'S GRID. AND TOMORROW'S.		
Characteristic	Today's Grid	Smart Grid
Enables active participation by consumers	Consumers are uninformed and non-participative with power system	Informed, involved, and active consumers - demand response and distributed energy resources
Accommodates all generation and storage options	Dominated by central generation- many obstacles exist for distributed energy resources interconnection	Many distributed energy resources with plug-and-play convenience focus on renewables
Enables new products, services and markets	Limited wholesale markets; not well integrated - limited opportunities for consumers	Mature, well-integrated wholesale markets, growth of new electricity markets for consumers
Provides power quality for the digital economy	Focus on outages - slow response to power quality issues	Power quality is a priority with a variety of quality/price options - rapid resolution of issues
Optimizes assets & operates efficiently	Little integration of operational data with asset management - business process silos	Greatly expanded data acquisition of grid parameters - focus on prevention, minimizing impact to consumers
Anticipates and responds to system disturbances (self-heals)	Responds to prevent further damage- focus is on protecting assets following fault	Automatically detects and responds to problems - focus on prevention, minimizing impact to consumer
Operates resiliently against attack and natural disaster	Vulnerable to malicious acts of terror and natural disasters	Resilient to attack and natural disasters with rapid restoration capabilities

Courtesy: U.S. Department of Energy "The Smart Grid: An Introduction." Page 38, prepared for the U.S. Department of Energy by Litos Strategic Communication Accessed from [http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages\(1\).pdf](http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf) on August 31, 2009.