Section 1: Smart Grid Opportunities

Remarkable things happen when economic forces and new technology converge. Consider how the the Internet -- combined with new, affordable consumer electronics like laptops, cell phones, HDTV, MP3s, etc. -- has fundamentally changed the way in which people live, work and communicate. A broad range of industries have embraced technology in their quest to improve productivity, reduce costs and improve customer service. Today, the energy sector has a unique opportunity to leverage similar transformational possibilities as a as a range of forces converge:

- Volatile energy costs
- Rising costs of capital, raw materials and labor
- Aging infrastructure and workforce
- Continuing national security concerns
- Increasing environment awareness
- Regulatory and societal pressures

- Calls for energy efficiency
- Growing energy demand
- Rising consumer expectations

At the dawn of this "convergence era," the electric industry is poised to remake itself – both the body of its infrastructure and spirit of its processes and products – through the evolution of a Smart Grid that will create a new paradigm of the "intelligent, virtual utility." Smart Grids will bring opportunities to:

- Achieve cost savings for consumers and utilities through reduced energy usage
- Enhance customer convenience and safety
- Reduce environment impact of the generation and use of electricity
- Improve the reliability of the electric grid, which is a critical infrastructure for national security and productivity

Energy efficiency and cost savings

High energy prices and environmental concerns are driving a demand for increased energy efficiency and reduced consumption. Today, consumers generally don't know how much electricity they are using until they receive their monthly bill, and many are shocked to see these bills continuing to rise dramatically. With today's new smart metering and communications technology, consumers are becoming more aware

of their energy use as they are able to monitor consumption – and cost – at 15-minute intervals. Such improved awareness gives consumers incentives to reduce energy use by switching to more efficient appliances and light bulbs, adjusting thermostat temperatures and turning off lights and other energy-consuming devices when not in use.

Consumers will become more active participants in the energy market as they can more easily compare monthly bills applying different electric retailers' rates to their actual usage. Improved market transparency will allow customers to easily seek the best retail prices and services. For retail electric providers, Smart Grid technology creates the opportunity to provide innovative products such as pre-paid service, time-of-use rates and online energy analysis. Pre-paid service reduces credit risk for providers and eliminates deposits for low-income consumers. Time-of-use rates promote energy efficiency and cost savings by charging consumers higher rates for usage during peak periods and lower rates during off-peak periods, which, in turn, enables improved load forecasting and balancing for utilities and less need for generation of electricity from more expensive, less efficient power plants called into service only during periods of peak demand.

Reduced load and/or shifting to off-peak cycles may lower overall supply costs and reduce market price volatility. Based on nationwide pilots, customers could reduce their consumption by 25 percent during peak periods. For example, a customer with a typical 2,000 square-foot house, a four-ton air conditioning unit and maximum power consumption of about 4 kilowatts per month could save 1 kilowatt during summer peak conditions. A quarter million customers saving one 1 kilowatt results in a 250 megawatt reduction in demand, the equivalent of avoiding power generation for 50,000 homes during a hot summer or 125,000 to 175,000 homes during normal conditions. When combined with other price-responsive behavior, annual market savings could reach between $90 and $120 million, of which an estimated $80 million would come from reduction in capacity needs and lower market clearing prices.

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Customer convenience and safety

In addition to energy and cost savings, Smart Grids offer customers greater convenience and safety. With two-way communications between the customer's meter and the utility, automated meter reading is much easier for consumers and utilities alike. Not only are digital smart meters more accurate, but they also will greatly reduce the number of estimated readings due to inaccessible meters. Smart Grid technology will

also allow utilities to connect and disconnect electric service remotely, making it easier and faster for customers to start, stop or transfer service as well as change retail electric providers.

Furthermore, the Smart Grid enables the Smart Home. Seeking to bring convenience and efficiency to hectic modern life, consumers can create Home Area Networks (HANs) of smart appliances, thermostats, security systems and electronics able to communicate with the grid. In response to energy demands and market pricing, consumers can remotely manage their home appliances and thermostats. Two-way communications can even allow appliances and security systems to initiate the conversation, notifying homeowners of problems or safety alerts when they are away from home.

Environmental opportunities

While the demand for electricity for industrial, commercial and residential consumers continues to grow, concerns about the environment – especially the impact of carbon and other emissions – are also growing. Merely ramping up generation of electricity from traditional sources will not relieve the social, political and regulatory pressures to protect the environment, nor will it take advantage of the business, economic and technological opportunities created by alternative energy sources. Distributed generation and renewable energy sources, along with reduced demand through energy efficiency measures, will help protect the environment while meeting ever-rising energy needs.

As consumers begin to manage their energy use more efficiently by turning off unneeded appliances, changing to more efficient lighting and adjusting thermostats, less electricity will need to be generated and fewer power plants will need to be built. Lower off-peak rates and higher peak rates will further reduce peak demand, which is the most costly energy produced as less efficient power generating plants are pressed into service. The reduction of 250 megawatts of demand described above would result in having to build two to four fewer peaking power plants, thus avoiding both construction costs and environmental concerns (even litigation) raised by building new plants. Reduced demand and fewer new power plants mean lower emissions of carbon dioxide, nitrous oxide and sulfur oxides. Lower emissions mean better air quality and improved compliance with Environmental Protection Agency (EPA) standards.

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The new energy paradigm doesn't just empower utility customers to better manage their consumption, reduce demand and help the environment. Through

distributed generation, it also allows them to become energy producers. Distributed generation includes various alternative forms of energy distributed across the energy system, away from centralized power plants, delivering electricity directly to the consumer, who typically owns the generation assets. Solar panels and wind turbines are familiar examples that have been around for some time. Emerging distributed generation sources include geothermal and biomass, carbon-free hydrogen fuel cells, plug-in hybrid electric vehicles and batteries for energy storage. As the cost of traditional energy sources continues to rise, these new energy sources become more affordable. Not only are these energy sources renewable and environmentally friendly, but they also create opportunities for customers who generate their own power by solar, wind or other means to sell surplus electricity back to the grid. The challenge – and the opportunity – for the utility is to integrate these distributed generation sources with the Smart Grid.

Reliability improvements

The body of America's (and the world's) electric transmission and distribution infrastructure – the towers, poles, and wires – as well as the systems to monitor and control the delivery of electricity have changed little over more than a century. The power grid is rapidly aging, and despite new technology available on the market, control and monitoring is still largely an electromechanical functionthat relies heavily on people to read meters and to diagnose and repair equipment failures. The electricity workforce is also aging. Growing demand is pushing the grid -- and the technicians who support it -- to the limit. Grid reliability is increasingly at risk.

The Department of Energy (DOE) estimates that power outages, interruptions and quality issues drain $188 billion from the U.S. economy each year. The massive blackout which affected 50 million people in the midwest, northeast and Canada in 2003 as well as the severe hurricane seasons of 2004 and 2005 demonstrated an urgent need to "harden" America's critical electric infrastructure. Over the next 20 years, the utility industry must spend an estimated $500 billion on infrastructure just to meet projected demand for electricity in the U.S.

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Moreover, because of their increasing dependence on electricity, industrial, commercial and residential consumers have high expectations for power quality and reliability. They expect their lights, machinery and life support systems to stay on, and when the power does go out, they want it back on quickly. Their business or their lives can depend on it.

The Smart Grid enables significant improvements in power quality and reliability. Interactive meters will allow utilities to more easily ensure that meters are working properly. Two-way communications all across the grid will let utilities remotely identify, locate, isolate and restore power outages more quickly without having to send field crews on trouble calls. In fact, a Smart Grid could eliminate up to 50percent of trouble calls.

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Through proactive grid management and automated response, the frequency and duration of power outages will be reduced, which will also result in fewer calls to utility call centers and improved customer satisfaction. Remote monitoring and control devices throughout the system will create a "self-healing" grid, which can restore and prevent outages and extend the life of substation equipment and distribution assets. Only through such automation can rising customer expectations for power quality and reliability be met in the face of growing demand and an aging infrastructure and workforce. Like the conversion to digital TV, interactive meters and Smart Grid technology are the foundation for converting the electric grid from an electromechanical system with analog controls to an automated grid with digital controls.

Conclusion

The electric utility industry needs to invest in new metering, communication and control technologies to enable us to harden, transform and automate the critical infrastructure of the electric grid. The Smart Grid responds to the convergence of a host of economic and other forces with maturing technologies that open a world of opportunities for utilities and consumers to meet rising energy demands while confronting rising energy costs and protecting the environment.

RECOMMENDATIONS:

Currently, Section 1 overlaps heavily with Section 3. IDC recommends that the current Section 1 be replaced with an Executive Summary and that Sections 1 and 3 be combined into a single section.