Illinois SMART GRID Initiative

Summary of Smart Grid Benefits and Issues

What is a Smart Grid?

The Illinois electric power system, like systems throughout the world, faces major challenges to meet the changing needs of consumers in the 21st century. While modern information technologies have transformed much of the economy, the electric industry -- and in particular the distribution grid -- have not yet embraced and implemented these technologies. "Smart grid" is a term that refers to the modernization of the electric system through the integration of new information-age technologies, new strategic public policies, and allows for new uses of the electric grid, both in operations and through new customer side applications, that extract the benefits of more efficient operation, more efficient use of grid assets, and more cost-effective expansion of the electric grid.

For an excellent 4 minute video overview of the smart grid and its benefits produced by the U.S. Department of Energy, see: http://www.netl.doe.gov/moderngrid/moderngrid_web.html

How Does a Smart Grid Benefit Consumers?

A smart grid can create benefits through i**mprovements in grid reliability** by reducing the frequency and duration of power outages and the number of power quality disturbances, including reducing the probability of regional blackouts. Recent estimates show the annual cost of power interruptions in the United States of $80 billion.[1] With total annual electric industry revenues at roughly $326 billion, these costs represent a significant burden on consumers.[2] Reliability improvements could significantly reduce these costs.

Use of smart grid technologies can help mitigate or **reduce the price of electricity** through the interaction of the demand side of the market (consumers) with the supply side (suppliers). For example, a 2007 study estimates that in the PJM operating area alone[3] a three percent demand reduction in the one-hundred highest prices hours of the year would produce benefits of $145-$301 million annually.[4] This estimated does not include the value of other benefits such as reduction in capacity prices, enhanced competitiveness of the marketplace, avoided investments, and insurance against price volatility and extreme events.

Smart grids can also create a platform on which retailers can create and offer **new products and services** that give consumers greater choice and flexibility in energy consumption and to create

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[1] *See* K. LaCommare and J. Eto, "Costs of Power Interruptions to Electricity Consumers in the United States," LBNL-58164, Lawrence Berkeley National Laboratory, Berkeley, CA, February 2006. This reports reviews several different analyses and reports with some reported estimates of electric outages at well over $100 billion annually.

[2] 2006 data from: http://www.eia.doe.gov/cneaf/electricity/epa/epat7p3.html

[3] PJM operates electricity markets in Northern Illinois as well as states from Ohio to the Mid-Atlantic region.

[4] The Brattle Group, "Quantifying Demand Response Benefits in PJM," January, 29, 2007 Cambridge, MA.

value for end users. Grid operations, and in turn consumers, will benefit from **improved operational efficiency.** Smart grids can also help grid operators optimize the use of the grid assets and avoid new capital expenditures. A study for San Diego shows that a capital investment of $450 million would produce over $1.4 billion in reduced costs and other benefits to the utility system over the life of the investments. [5] Smart grid policies will **improve security and safety** by reducing the vulnerability of the grid to unexpected hazards and promoting a safer system for both workers and the general public.

Finally, the smart grid will promote e**nvironmental quality** by allowing customers to purchase cleaner, lower-carbon-emitting generation, promote a more even deployment of renewable energy sources, and allow access to more environmentally-friendly central station generation. Furthermore, the smart grid will allow for more efficient consumer response to prices, which will reduce the need for additional fossil fuel-fired generation capacity, thereby reducing the emission of CO_2 and other pollutants.

Various stakeholder groups will benefit from the smart grid in different ways:

- **Residential and Small Commercial Customers:** Improved system reliability will create benefits for consumers. However, perhaps the most significant benefits arise from more empowerment and individual control over energy use and monthly bills. Smart grid can provide a new set of tools for consumers to manage their usage and total energy bills. Smart grid technology makes it easier and cheaper for consumers to see their electricity use and to have access to value-enhancing dynamic pricing, if they desire it. Finally, by connecting prices and quantity of usage, customers will be transformed from passive "ratepayers" to active, engaged participants in electricity markets.
- **Low Income Customers, Customers on Fixed Incomes, and the Elderly:** Elderly people are most at risk to extreme heat and cold when power is lost. A more reliable grid will limit the risk of outages. In addition, by helping to reduce the need for costly new generation, transmission, and distribution facilities a smart grid can help relieve upward pressure on prices to the benefit of families on low or fixed incomes.
- **Large Customers:** Large commercial and industrial customers require access to information, including price signals, to make efficient energy decisions. A smart grid will provide additional benefits from more detailed information and better reliability. A smart grid will allow large customers to integrate their production, storage and efficiency investments easily into wholesale market operations. In addition, to the extent that improved reliability attracts or retains businesses and jobs in Illinois, large customers will benefit from avoided relocation costs and growth in the local economy.
- **Local Governments:** Local governments can benefit from higher reliability and lower duration of outages that will reduce the burden on local fire, police and other city resources that must help with such events. Greater information and control over the distribution system will also allow grid operators to assist with emergency situations, such as fires and storms, by turning off power selectively or by restoring power faster and more efficiently. Local governments are also consumers of electricity and can take advantage of the consumer-related benefits of smart grids.
- **Utility/Grid Operators:** Grid operators will benefit from direct cost reductions, enhanced system reliability, and higher customer satisfaction. Direct cost reductions can come in the

[5] "San Diego Smart Grid Study," Prepared for the Energy Policy Initiatives Center, University of San Diego School of Law, October 2006

form of lower meter reading and servicing costs, avoided meter capital costs on existing meters, more efficient deployment of field staff as a result of better information on grid conditions, labor and non-labor operations costs savings, improvement in efficiency of billing, customer connections, and many other utility processes. Other benefits include reductions in working capital needs, reduction in bad debt expense, reduction in theft and energy losses, improved and more efficient customer service, more efficient planning and maintenance of the system, and more efficient use of back office resources.

- **State and Local Economies:** Benefits can arise from increasing the reliability of the power system, creating a modern infrastructure for 21st century commerce and attracting or retaining new and innovative businesses providing new jobs and income. Most importantly, a modern electricity infrastructure can protect the economic and environmental viability of communities that are essential to creating a truly sustainable economy. In addition, the environmental benefits of a smart grid can reduce health-care-related costs.

Creating the Smart Grid

Creating the smart grid requires new thinking about policies shaping the use of the electric grid, including a new approach to utility investment. [6]

Fundamental barriers to change. The process for creating a smart grid that produces consumer benefits will require addressing several hurdles inherent in the utility-regulatory system. First, there can be a significant gap in knowledge and understanding among stakeholders. To address these issues many jurisdictions have engaged in extended public discourse, generally outside the confines of a litigated proceeding, to provide a common understanding and foundation for discussion of smart grid issues. Second, the traditional regulatory system tends to discourage investment in innovative technologies. Other jurisdictions have recognized that traditional utility regulation may need to be modified to encourage utilities to invest in the smart grid concept. For example, states such as California, Oregon, Texas and New York have entertained targeted mechanisms that address smart grid investments. And third, especially in those jurisdictions with distribution-only utilities like Illinois, a serious discussion of the function of a modern electric distribution company has been undertaken. One fundamental question that must be addressed is: what is the role of the modern electric distribution company in supporting customer choice in electric commodity and other energy services?

General policy considerations. In addition to these foundational issues there are many implementation issues, including:

- Why should Illinois pursue a smart grid? If it should, what functions should the smart grid proposals address?
- Are customers interested in receiving advanced energy and other informational services through the electricity grid?
- What are the costs and benefits of investing in AMI/smart grid technologies?
- How should the smart grid be planned and implemented?

[6] Many jurisdictions have either already approved policies to move toward a smart grid (e.g., OR, TX, CA, NY) or are in the process of evaluating such policies (e.g., OH, IN, CO, DE, DC, NJ, and PA). In addition, the US Congress made it the policy of the US to "support the modernization" of the electric grid through smart grids.

- How will the costs and benefits be passed through to consumers?
- Who is involved in the information system? Who will be the users of the information? Where are the data sources for the required functions?
- How are all the organizational and technology components integrated into a logical architecture? Which systems, subsystems and components do we need in order to meet the utility's requirements? What standards, technologies, and vendor solutions are necessary to accomplish the project goals?

Analyzing specific consumer benefits. There are also specific questions associated with various benefits of a smart grid:

The modern grid is designed to become **more reliable, safe and secure**.

- How can more localized generation (e.g., CHP, renewable, etc.) be incorporated into the smart grid and what investments are necessary to facilitate these generation technologies?
- How can other rules and regulations, such as building codes and standards, be addressed to help support reliable service?
- Do reliability standards need to change, and if so, should, and how would, utilities be rewarded for meeting or exceeding those standards?
- What investment projects or system design changes should utilities undertake to improve distribution operations (e.g., automation projects, feeder looping, etc.)?
- What policy changes might be appropriate for areas of the grid that need higher than average investment to maintain or improve service quality?

The modern grid is also a way to promote **efficient delivery and investment in the electric system**.

- What methods can be used to help consumers finance energy efficiency and lower carbon generation (e.g., on-bill financing, capacity payments, etc.)?
- What portions of the current utility system could be paid for through non-utility investment (e.g., customer hook-up, metering, on-site distribution, etc.)? How can competition operate in this market (e.g., what rules are necessary)?
- How does utility planning for future grid operations need to change to address these new concepts?

A smart grid can also enhance **customer choice.**

- How can the state promote voluntary real-time pricing or time of use pricing to allow consumers to choose to reduce consumption in response to prices?
- What aspects of the regional electric system bear on consumers' choices, and how can the state promote active participation by those consumers who choose to do so in wholesale markets? For example, how can we promote transparent pricing signals for capacity, energy and other electricity related products and services so that all customers have the choice to respond to these prices?

- What utility-sponsored tariffs and services could be used to promote customer choice in both generation technologies and choice of competing suppliers?

Finally, a smart grid offers the opportunity for enhanced **environmental quality**

- What rules, regulations or other legal requirements need to change in order to support more renewable and low carbon generation?
- How do low carbon generation sources get valued in the utility planning process?
- Can the state use carbon markets to increase the value of low carbon alternatives?

Many of these policy questions raise other more detailed issues concerning the operations of markets, the legal environment surrounding the electric system, and the feasibility of technologies. Through the discussion of these and other topics the range of policies actions best suited to and the welfare of consumers can be evaluated.