

benefits of the smart grid

part of a long-term economic strategy

THE SMART GRID IS NOT JUST A new form of infrastructure; it can be part of our long-term economic strategy. In addition to stimulating economic activity directly through significant new capital investment for its design, development, and construction, follow-on innovations using this powerful enabling technology are expected to multiply its short-term economic impacts.

It will take time, both public and private resources, and coordinated economic policies to achieve the anticipated benefits of smart grid development and deployment. But the emergence of this transformational technology at a moment calling for a dramatic restructuring of America's energy economy and environmental policies provides a once-in-a-generation opportunity to grow our economy, foster business opportunities, and generate jobs while advancing societal imperatives. Illinois has seized this opportunity. Among other efforts, we in Illinois formed a public-private partnership to help position our communities, corporations, universities, and laboratories to leverage the opportunities of this infrastructure transformation.

This public-private partnership has laid the foundation for a growing Illinois Smart Grid Regional Innovation Cluster that brings together the talent, resources, and ambition required to define, develop, and advance smart grid-enabling strategies. In this approach, research and development conducted across multiple disciplines by Illinois's renowned laboratories and universities

are clustered and focused on market-changing solutions, entrepreneurs and businesses are encouraged and supported to commercialize these innovative technologies, and programs are implemented to match a well-trained and highly skilled workforce with the installation and management needs of a smarter grid and of the innovative businesses built using that platform.

This effort is facilitated by the convergence of diverse economic and political forces that recognize the smart grid as a viable path to achieving environmental benefits, creating new business opportunities, and growing the Illinois and national economies. Realizing the promise of the smart grid will, however, require additional preparation to identify investment tools needed to spur new enterprises utilizing smart grid capabilities, implement economic and regulatory policies to accommodate new smart grid business models, and encourage informed customer participation.

Market Potential

A smart grid and the new services it can enable will require (and attract) substantial capital, especially for early adopters and innovators. Industry reports project the market for smart grid enabling technologies in the United States to increase to US\$17 billion per year by 2014, up from an estimated US\$6 billion currently. Globally, the market for smart grid technologies is expected to grow to US\$171 billion by 2014, up from US\$70 billion today.

Direct investment in the smart grid and related new businesses can grow

our economy. Based on an industry jobs report, each US\$1 billion invested in smart grid technology is projected to propel US\$100 billion in gross domestic product growth. Greater consumer control over power consumption could add US\$5–7 billion annually to the United States by 2015 and US\$15–20 billion per year by 2020. The Galvin Electricity Initiative notes that distributed generation technologies (electricity produced at or near the site where it will be used) and smart, interactive storage for residential and small commercial applications could potentially add another US\$10 billion per year if 10% penetration is achieved by 2020.

Technology investments of this magnitude can reasonably be expected to result in increased job creation globally, nationally, and locally. To the extent that Illinois' technology firms are early entrants in manufacturing and construction/installation, that economic activity can be localized. Analysts note that the value creation associated with the smart grid's "green" capabilities can outpace more traditional energy investments. For example, clean-energy investments are estimated to result in 16.7 jobs for every US\$1 million in spending, while spending on fossil fuels is estimated to generate 5.3 jobs per US\$1 million in spending.

Environmental Benefits of the Smart Grid

Aside from the economic gains from added investment and customer benefits, the integration of smart grid

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capabilities into the grid and consumer management of energy consumption is expected to produce environmental benefits. Environmental advocates, therefore, can be key elements of support for the emerging Illinois Smart Grid Regional Innovation Cluster.

Coupled with plentiful renewable energy resources in Illinois, the smart grid can dramatically advance our efforts to combat climate change. A recent U.S. Department of Energy report suggests that 100% penetration of smart grid technology in the United States could lead to an 18% reduction in carbon dioxide emissions by 2030. It has been estimated that if the electrical grid were simply 5% more efficient, the efficiency gain could displace the equivalent of 42 coal-fired power plants, and that would equate to permanently eliminating the fuel and green house gas emissions of 53 million cars.

In the United States, buildings account for an estimated 72% of U.S. electricity consumption and 38% of all U.S. carbon dioxide emissions. LEED certification is awarded by the U.S. Green Building Council for new buildings constructed to have less impact on the environment. Chicago is home to more LEED-certified buildings than any other city and is leading the efforts to reduce building energy usage. The smart grid can bring the energy management sophistication of Chicago's leading-edge buildings to small businesses and residences. The potential environmental benefits also could be accompanied by direct economic value if/when a price for carbon is established. The smart grid would enable timely, accurate measurement of usage reductions (carbon output requirements), which (once monetized as credits) can be bought, sold, or traded creating new revenue streams for consumers, building owners, and local governments. If small business and residential consumers are effectively engaged in managing their energy using smart grid capabilities, the eco-

nomics opportunities provided by its real-time communications and usage/pricing data could further realization of environmental benefits.

Illinois and Korea: Working Together to be Market Leaders

Smart grid interest and potential is global. Just as in the domestic market, those who act first and meet the standards and needs of multiple markets will be positioned to capture market share. With this in mind, the State of Illinois and the Republic of Korea have entered a partnership to foster the development of strategies and projects that can be deployed in both environments. To date, this work has been managed through four channels:

- ✓ policy and business model development
- ✓ research and development
- ✓ technology deployment
- ✓ workforce development.

Each area is briefly described below.

Policy and Business Model Development

The ongoing collaboration between Illinois and Korea has helped to refine policy makers' understanding of the smart grid and what is required to advance its potential. Senior leaders in both governments have begun the process of considering how best to accommodate this paradigm-changing technology. The experiences and results of already initiated demonstration and pilot programs in Illinois and Korea will guide future policy decisions.

Our adoption and integration of new smart grid technologies and capabilities will enable new, innovative business models. For these models to succeed we must support economic policies and industry structures that allow manufacturers of smart grid enabled technologies, providers of new smart grid-enabled services, and electricity consumers themselves to become active participants in expanded markets. Illinois and Korea are collab-

orating in evaluations of market participation strategies for demand response, load control, load shifting, and integration of distributed and renewable resources to expand market participation and markets.

Research and Development

The continual assessment of changing technology and market needs and application of our intellectual capital to meeting those needs is a central strategy in optimizing the economic benefits of smart grid deployment. Illinois is home to a number of outstanding public and private universities, federal laboratories, and corporations. This expertise, particularly in the areas of electric power systems and cybersecurity, must be leveraged. Advanced research and close industry-academia-government collaboration are areas in which Illinois and Korea can be driving forces in the development and deployment of the smart grid. Illinois and Korea are working collaboratively to establish timely and effective technology transition pathways for commercializing validated innovative technologies.

Technology Deployment

To date, this Illinois-Korea collaboration has focused its joint efforts on three areas that promise immediate market impact: smart buildings, smart communities, and smart transportation.

Smart Buildings

Because metropolitan areas like Chicago cannot accommodate significant new local generation, they may see less electricity price stability as peak demand increases over the long term. Driven both by new smart grid capabilities and governmental directives, the need for additional generation resources will likely increasingly be met by integrating intermittent renewable generation resources like wind and solar, resulting in added difficulties for maintaining system balance moment

to moment. Using the smart grid's real-time data and communications, the vulnerability of concentrated metropolitan loads can become an economic opportunity. Smart building technology can be used to reduce one's own consumption when prices spike. That same capability, coupled with smart grid communications, can provide valuable peak-load reduction to balance demand and capacity at times of system stress. These capabilities represent a significant opportunity for buildings to reduce the payback period for energy-efficiency improvements and to capture the market value of real-time load management in the demand- and supply-side markets.

Smart Communities

Illinois communities are interested in sustainable economic development that promises lasting benefits to the local environment and improved quality of life in the community. Tailored community-wide initiatives that focus on resource conservation and energy usage awareness can help local governments and their citizens manage energy costs, strengthening the local economy and creating local jobs, and they can help reduce the production of emissions harmful to the community and to society in general.

Our contemplated smart community efforts seek to identify and test models that deliver technology and knowledge to end users in a way that effectively engages energy consumers in leveraging the technology (to manage energy consumption) and reduce the economic burdens of inefficient usage on communities and the grid. These technologies and knowledge delivery techniques are still developing and emerging. A smart community test will be useful in identifying new business models and financing options for larger scale future initiatives. These community goals suggest that local microgrids can be a model that is more efficient, sustainable, and environmentally sound. Electricity usage and

delivery optimized at the microgrid level can enable greater consumer participation in energy management and result in the more robust and sustainable generation, delivery, and consumption of electricity.

Smart Transportation

As electric vehicles enter the automobile market, Illinois must position itself to be an early adopter and test site for these vehicles. This will require market-making efforts. Utility infrastructure, rate structures, and regulation should facilitate the necessary financial transactions between electricity distributors and these mobile consumers. A major concern of potential electric vehicle users is "range anxiety." To advance the region-wide deployment of needed charging facilities, the State of Illinois and City of Chicago have recently joined together to fund a north-east Illinois regional electric vehicle infrastructure pilot. The objective of that effort is to establish Illinois as a welcoming location for electric vehicle deployment and to improve the region's standing as a target location for manufacturers seeking early market success and consumer adoption.

Workforce Development

Current and future market opportunities will pass us by without the necessary trained workforce to manage and support the smart grid. Producing and maintaining a highly skilled workforce that can keep pace with the evolving demands of the smart grid and related businesses/technologies will be challenging as large numbers of power industry workers are expected to retire in the next five years. Fostering the next generation of entrepreneurs and technicians must be a focus of any comprehensive smart grid plan.

A well-trained and highly skilled smart grid workforce also is vital to maintaining our leading edge position in the research, development, and implementation of a smart grid, the value-added innovations using that

platform, and the integration of renewable energy resources that will feed into it. A successful workforce deployment and development program must engage all stakeholders in Illinois education and career training—from utilities, corporations, and labor unions to educators, community colleges, and universities to the national laboratories, legislators, and policy makers. The objective should be a collaborative initiative to establish the strongest smart grid workforce in the world. This will require enhancing existing science, technology, engineering, and mathematics (STEM) curricula to build a pipeline of students and workers beginning with early childhood education and continuing through elementary, high school, and post-secondary education or trade training. Only with such a combined effort will Illinois be able to meet the global challenges in the smart grid, energy independence, clean environment, and sustainable energy.

The Smart Grid as an Economic Development Tool

The smart grid is a transformative set of technologies and business models. With mutually supportive private and public investment and with governmental policies that accommodate entrepreneurial smart grid innovations, we can grow our economy, create new high-paying jobs, and help protect our environment. The convergence of these diverse benefits represents an unparalleled opportunity for policy makers to advance an agenda based on research and development, on innovation, and on economic development. Through continued advancement of the Illinois Smart Grid Regional Innovation Cluster, the state is positioned to be a leader in the development and deployment of smart grid enabling strategies, services and technologies. Additional information is available at www.adica.com and www.istcoalition.org.

