guest editorial

Bruce Hamilton and Mohammad Shahidehpour

working together

international smart grid collaboration

THE STATE OF ILLINOIS HAS received international recognition as an ideal partner for smart grid development and deployment. Global partners are attracted to the wide array of smart grid and renewable energy projects in Illinois and to the state's advanced research capabilities at national labs and universities. They want to develop and deploy emerging technologies in a part of the world that has a lucrative market conducive for smart grid implementation. International collaboration on smart grid solutions in Illinois is expected to stimulate economic development, reduce energy costs, improve electric grid reliability, and enhance environmental quality.

The Republic of Korea has also provided leadership in the area of the smart grid. In 2009, the Major Economies Forum (MEF) on Energy and Climate selected Korea to partner with Italy in spearheading international efforts regarding the advancement of smart grid technology. In consultation with MEF partners, the two countries prepared a technology action plan on smart grids, which stresses the importance of global collaboration to accelerate smart grid development and deployment.

In 2010, Illinois and Korea established a partnership to jointly develop and deploy smart grid and green technologies and business models. This issue of *IEEE Power & Energy Magazine* introduces the growing Illinois Smart Grid Regional Innovation Cluster and highlights how Illinois and Korea are collaborating on market participation strategies for demand response, load control, electric vehicles, and integration of distributed and renewable energy resources.

The first article, "Power of Two," describes how a common desire to provide leadership amid the global push for a clean, reliable, and efficient supply of energy fostered the formation of partnerships and mutually beneficial cooperation between the United States and Korea. The Statement of Intent for smart grid collaboration signed by U.S. Department of Energy (DOE) Secretary Stephen Chu and Korea Ministry of Knowledge Economy (MKE) Minister Choi Kyunghwan, in April 2009, was a catalyst for focusing high-level government attention on the establishment of international public and private sector partnerships for the development, testing, and implementation of smart grid technologies.

In 2010, the MKE and the Illinois Department of Commerce and Economic Opportunity (DCEO) agreed to take actions for deploying smart grid-tested business models and technologies; conducting joint R&D in the development of smart grid and green technologies; and fostering information, technology, and human resource exchanges among government agencies, businesses, and research institutions. Four of the initial collaboration projects, announced in July 2010, are expected to provide more than US$20 million of foreign investment to improve grid cybersecurity, develop technological infrastructure, deploy energy optimization solutions, and create a workforce ready to develop next generation energy solutions.

The second article, "A National Vision," offers an overview of the national vision and development progress for the smart grid in Korea. To achieve a national goal of obtaining 30% reduction in greenhouse-gas emissions by 2020, Korea intends to build a national smart grid infrastructure as a fundamental enabler for expanding the supply of renewable energy and the use of electric vehicles. By 2030, a total of KRW 27.5 trillion (approximately US$25 billion) of investment is expected to support smart grid implementation in Korea, with 90% secured through private investment and 10% through the government. The Korea Smart Grid Roadmap calls for a staged implementation with a smart grid test bed constructed at Jeju Island during 2010–2012, expansion into metropolitan areas from 2012 to 2020, and completion of a nationwide intelligent power grid by 2030.

The third article, "If These Walls Could Talk," discusses how emerging information-based technologies and operational strategies can enable large commercial and residential buildings in Chicago, and other major metropolitan cities, to mitigate rising energy costs through energy-efficiency improvements and participation in demand-response programs. The article explains how new revenue streams, accessed through this system without a noticeable impact on building tenants, can create benefits for consumers and society as a whole.

The fourth article, "Plug into the Future," highlights the important

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role of electric vehicles as a building block for environmental sustainability and describes actions taken by the City of Chicago and Argonne National Laboratory to support the development of an electric vehicle marketplace. The authors note several factors that contribute to the Chicago region providing an excellent marketplace for electric vehicles, including a concentrated population, Chicago climate action plan goals for carbon reduction, a plentiful supply of inexpensive electricity from nuclear power, and support of the local utility as well as from the federal, state, and city government. The article goes on to discuss efforts led by the Chicago Department of Environment to work with key stakeholders in developing a strategy for vehicle electrification and implementing a first-phase infrastructure project to construct electric vehicle charging stations. The article also comments on the accomplishments that place Argonne National Laboratory at the forefront of applied research in hybrid and electric vehicles and led the DOE's Office of Vehicle Technologies to designate Argonne as the lead national laboratory for the simulation, validation, and laboratory evaluation of plug-in hybrid electric vehicles.

The fifth article, "Local Green Teams," provides an explanation of how smart grids offer new opportunities for local communities to support sustainability and economic development initiatives. The authors suggest that local microgrids can be used to create a new model for the generation, use, and delivery of electric power that is more efficient, sustainable, robust, flexible, and environmentally sound and that encourages a much higher level of consumer participation and control. The article points out that local communities in Illinois are seeking sustainable economic development approaches that offer real, lasting benefits to the local environment and improve the quality of life in the community. Together, Korea and Illinois are exploring shared opportunities for smart grid development and deployment that can support local community sustainability initiatives and bring the desired benefits to citizens of both countries.

The sixth article, "A Model of Stability," summarizes the long-term plan and current status to establish a smart infrastructure that enables stable operation of disperse renewable generation sources. The Korea Smart Renewable Technology Roadmap is presented, including the envisioned timing for different stages of technology R&D, renewable device and system commercialization, and needed modifications to power system legislation. The current status of smart renewable development in Korea is articulated through a description of several projects completed by a consortium led by the Korea Electric Power Corporation at the Jeju Island Smart Grid Test Bed.

The final article, "The Green Defenders," gives additional detail on potential cyberthreats to the electricity system, further vulnerabilities for new smart grid infrastructure, and efforts in Korea to introduce cybersecurity measures to identify and remove these threats. The authors introduce a smart grid security model that helps protect the smart grid from cyberattack by means of a multilevel architecture that implements different lines of defence for control system security, operation system security, and field device security.