

U.S. Department of Energy  
Office of Electric Transmission and Distribution



GridWise™ Program

Rethinking Energy From Generation To Consumption

# Overview

GridWise™ is a vision for the future electric system built upon the fundamental premise that information technology will profoundly transform the planning and operation of the power grid, just as it has changed business, education, and entertainment. With business-as-usual solutions, the U.S. will invest around \$450 billion in conventional electric infrastructure — generation, transmission, and distribution — over the next 20 years just to meet demand for a growing population and economy.<sup>1</sup> Since the mortgage on infrastructure is a major component of electric rates, economic prosperity and our way of life depend upon minimizing the need for new infrastructure by increasing the utilization of these assets. Deploying GridWise virtual infrastructure will maximize the use of existing assets. Wherever information technology can be used to displace or defer new infrastructure, it is likely to be overwhelmingly cost-effective. Infusing the system with information technology will allow for the integration of traditional and distributed assets — from generation, transmission, and distribution to end-use — into a collaborative “society” of devices that share responsibility for operating the power grid.<sup>2</sup>

## Program Areas

### The GridWise Program

The GridWise Program is working to build consensus, broaden the vision, and seed the research and demonstration required to make the transformation happen in a cohesive, well-planned manner. The program has a strong commitment to working with industry through the GridWise Alliance, an industry group which is committed to working to make the GridWise vision a reality. Specifically, the GridWise Program will invest in the following areas:

- **Communications architecture and standards** will make it possible for generators, transmission and distribution utilities, energy service companies and consumers to share information and form an integrated network.



Continues on page 2

### Our Mission

The mission of the GridWise Program is to inspire an explosion of technological innovation, as market participants from utilities to new third parties to consumers create value by developing and deploying information solutions that cross enterprise and regulatory boundaries in lieu of infrastructure. When fully realized, GridWise will:

- Provide the incentive for customer and third-party assets to collaborate with existing grid assets to control costs and improve reliability by revealing the true time- and location-dependent value of electricity.
- Provide the basis for collaboration by allowing the revealed values to be shared in real-time by leveraging broadband communications that are rapidly becoming ubiquitous.
- Provide the means to take advantage of the opportunities for collaboration so revealed, and capture value in return, through rapid advances in distributed controls and e-business applications.

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## *The GridWise Program (continued)*

- **Simulation and analysis tools<sup>3</sup>** are needed to simulate energy markets and energy systems and validate the vision. While promising, many of these concepts have not been fully explored or tested. These tools will combine operations and economics in a single model to analyze and monitor the system as changes are implemented to determine the impacts and ensure fairness.
- **Smart technologies from the government** and industry, are needed to help jump-start the transformation. While industry will invest in those seen as potential profit-makers, the federal program will help seed the early development of technologies that individual commercial companies otherwise might not risk pursuing.
- **Test beds and demonstration projects** will provide experiments of ever increasing scale to prove the worth of these technologies or reveal their faults. They will help build momentum for change and reduce the perception of risk, building acceptance of the concept of a transformed energy grid.
- **New regulatory, institutional and market frameworks** that support a climate of innovation as these technologies are developed and evolve need to be examined.

<sup>1</sup> L. D. Kannberg, D. P. Chassin, J. G. DeSteele, S. G. Hauser, M. C. Kintner-Meyer, R. G. Pratt, L. A. Schienbein, and W. M. Warwick, "GridWise™: The Benefits of a Transformed Energy System," PNNL-14396, Pacific Northwest National Laboratory, Richland, Washington, September 2003.

<sup>2</sup> V. L. Smith and L. Kiesling, "Demand, Not Supply," The Wall Street Journal, Opinion page A10, August 20, 2003.

<sup>3</sup> SE, JM Roop, RT Guttromson, and Z Huang. 2004. "Simulating the Dynamic Coupling of Market and Physical System Operations." In Proceedings of IEEE Power Engineering Society General Meeting, June 2004, Denver, Colorado, vol. 1, pp. 108-113. IEEE, New York, NY.

## *Success Stories*

### *GridFriendly Appliances: An Innovative Near-Term Technology*

In the U.S., air conditioners, space heaters, water heaters, refrigerators, washers and dryers represent about 20% of total electric demand during most of the day and throughout year. DOE's Pacific Northwest National Laboratory is researching how these ordinary household appliances can be turned into Grid Friendly™ appliances, using a simple computer chip that can sense disturbances in the grid's power frequency and can turn an appliance off for a few minutes to allow the grid to stabilize during a crisis. These devices can be installed in appliances that regularly cycle on and off during normal use, so that consumers will not notice when the GridFriendly device is in operation. With Grid Friendly appliances, demand can be rebalanced to match available supply almost instantaneously (within a half-second) when a crisis occurs. This is an improvement over the approximately 30 seconds it currently takes for power plants kept on standby to come up to speed, and it allows customers become an integral part of power grid operations.