



The GridWise™ Vision

Bringing the Energy System into the Information Age

Pacific Northwest National Laboratory has created a vision for transforming the nation's energy system—from central generation down to customer appliances and equipment—into a collaborative network filled with information and a myriad of market-based opportunities. Researchers at PNNL have been exploring how to integrate the traditional elements of supply and demand, transmission and distribution with new technologies such as distributed generation, energy storage, and customer load management, using information to make them function as a complex, integrated system.

The GridWise Alliance, a new public-private partnership, is focused on bringing together key stakeholders to support this vision for the future. The Alliance and the Department of Energy will build on PNNL's early work to bring the energy system into the information age, helping keep energy affordable, bringing new and cleaner technologies to market, and enhancing national security.



Transforming the energy system—from central generation down to customer appliances and equipment—into a collaborative network filled with information and a myriad of market-based opportunities will move the current system into the information age, helping provide clean, secure and affordable energy.

Providing Affordable Energy

Affordable energy is critical to the nation's prosperity and depends upon finding a way to minimize the cost of new electric infrastructure. Investments in infrastructure increase overall energy costs because the mortgage on those assets represents a significant portion of energy rates.

Historically, utility regulation has provided energy providers with a guaranteed rate of return on infrastructure investments. With one-rate-fits-all cost recovery, there was little incentive for distribution-level solutions. Furthermore, technologies that permit electrical use tailored to the supplier and the user were not available. As a result, today's electric system is full of massive, expensive capital assets that are underutilized. Utility restructuring reduces this incentive for overbuilding, but falls short of the full potential to optimize the system. Without a major shift in the way the energy system is planned and operated, nearly \$500 billion of electric infrastructure must be added by 2020 to meet load growth projected by the Energy Information Agency.

The GridWise vision weaves new technologies into the system wherever they provide higher value alternatives to traditional infrastructure. The advent of these technologies will rely upon seamless, plug-and-play integration of alternative generation and storage assets into the information and power network. Furthermore, their widespread use will be accelerated when the technology costs can be offset by real-time markets established to reflect the complete value they bring in avoiding or deferring new infrastructure.

These same markets will influence consumer load response so that existing assets can be used more wisely. New technology will make such response automatic, flexible, unobtrusive and profitable. In times of stress, small reductions in demand have a disproportionately large effect in reducing peak prices. Therefore,

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this automatic response will empower consumers to collectively respond as equal partners in the markets for energy services and help stabilize prices in times of limited supply.

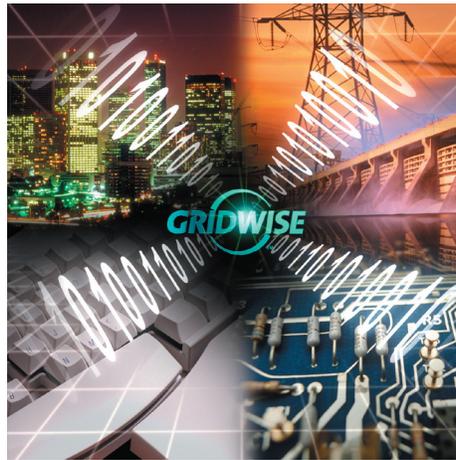
With abundant information from the network, advanced controls can safely operate the system closer to its limits to raise asset utilization even further, providing momentary relief when needed. Tools and techniques that use this information also can detect and prevent market abuses to ensure fairness. The result is a network of energy service transactions glued together with information in such a way that it preserves local decision-making in the interests of consumers and suppliers while providing market-based incentives to operate in the global interests of the system.

Stable energy prices are equally important to affordability and economic prosperity. Stable costs are essential to maintaining consumer and business confidence, and stability reassures the capital markets that set interest rates for financing new infrastructure. A system that incorporates assets that have shorter lead times and add smaller increments of capacity can limit the boom-bust construction cycles that result in price fluctuations and underutilized assets.

Deploying New Technologies

DOE and other organizations have invested billions of dollars in innovative supply and demand energy technologies, yet there is a logjam in the technology deployment pipeline. Complicated market barriers can be characterized by the lack of information to accurately value the impacts on all levels of the system made possible by key attributes of each technology and application.

The GridWise Alliance aims to speed the penetration of alternatives to traditional energy infrastructure by developing information-rich marketplaces and operational environments that provide a complete picture of the value added by these technologies, including values that



DOE and the GridWise Alliance aim to align the energy system with leading-edge industries that use abundant real-time information, e-business systems and market efficiencies to minimize the need for inventory and infrastructure and maximize productivity and efficiency.

currently go unrewarded such as infrastructure deferral, risk reduction, waste heat utilization, reliability enhancement and ancillary services that stabilize grid operation.

For example, clean and renewable technologies will find many new markets where their particular features are advantageous. Energy efficiency and load management technologies are expected to compete effectively as alternatives to otherwise unavoidable infrastructure additions.

Contributing to National Security

The GridWise Alliance is moving toward an energy system that is controlled by a distributed network that will reduce single point vulnerabilities and enhances the ability to dynamically reconfigure the system as needed in response to man-made or natural disasters. Extensive communications, including information about customer loads, allows flexible alternatives to rolling blackouts for managing limited resources in the short term. In a longer-term crisis, the inherent self-organizing and self-adapting properties of free markets would minimize economic disruption.

The Path Forward

Major industrial firms like IBM, Sempra, Alstom and PJM Interconnect form the cornerstone of the GridWise Alliance along with PNNL, DOE and the CEO Coalition. As the alliance proceeds, it will continue to build strong support from and involvement with regional transmission strategies, public agencies, and businesses developing and deploying energy technologies. The GridWise Alliance supports DOE in its efforts to:

- ◆ Identify key regulatory barriers and drive required changes with solid analysis.
- ◆ Catalyze consensus-based, open-protocol architectures and standards for communication.
- ◆ Develop pre-competitive technology in strategic areas where commercial interest is insufficient or unfocused.
- ◆ Conduct demonstration projects to promote early commercial development and reduce perceptions of risk.
- ◆ Support the basic science needed to analyze and advance the transformation.

By following a path blazed by other economic sectors, GridWise will harness and direct information technology and communication systems to bring advantages to the energy system sooner, with more impact and with greater public benefit.

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