Grid Modernization and the Smart Grid

Office of Electricity

America's economy, national security and even the health and safety of our citizens depend on the reliable delivery of electricity. The U.S. electric grid is an engineering

marvel with more than 9,200 electric generating units having more than 1 million megawatts of generating capacity connected to more than 600,000 miles of transmission lines.

The electric grid is more than just generation and transmission infrastructure. It is an ecosystem of asset owners, manufacturers, service providers, and government officials at Federal, state, and local levels, all working together to run one of the most reliable electrical grids in the world. The Office of Electricity (OE) is working with its public and private partners to strengthen, transform, and improve energy infrastructure to ensure access to reliable, secure, and clean sources of energy.

Our electric infrastructure is aging and it is being pushed to do more than it was originally designed to do. Modernizing the grid to make it "smarter" and more resilient through the use of cutting-edge technologies, equipment, and controls that communicate and work together to deliver electricity more reliably and efficiently can greatly reduce the frequency and duration of power outages, reduce storm impacts, and restore service faster when outages occur. Consumers can better manage their own energy consumption and costs because they have easier access to their own data. Utilities also benefit from a modernized grid, including improved security, reduced peak loads, increased integration of renewables, and lower operational costs.

"Smart grid" technologies are made possible by two-way communication technologies, control systems, and computer processing. These advanced technologies include advanced sensors known as Phasor Measurement Units (PMUs) that allow operators to assess grid stability, advanced digital meters that give consumers better information and automatically report outages, relays that sense and recover from faults in the substation automatically, automated feeder switches that re-route power around problems, and batteries that store excess energy and make it available later to the grid to meet customer demand.

This exciting transformation of the nation's electric grid creates both challenges and opportunities to advance the capabilities of today's electricity delivery system. A critical component of grid modernization is a coordinated, strategic research, development and demonstration (RD&D) effort that involves both the public and private sectors.

OE's Role in Grid Modernization

Since its inception, OE has catalyzed investment in electric and energy infrastructure. Over the years, OE has continued investing in the research, development, and demonstration of advanced technologies while also developing new modeling and analytics capabilities that can evolve as technology and policy needs mature.

OE leads national efforts to develop the next generation of technologies, tools, and techniques for the efficient, resilient, reliable, and affordable delivery of electricity in the U.S. OE manages programs related to modernizing the nation's power grid, including, but not limited to, grid scale energy storage; smart grid research and development; advanced technologies such as solid-state transformers and power flow controllers that can optimize power delivery and enhance resilience (power electronics); complex interactive capabilities that can allow the system to respond to change (adaptive networks); intelligent communications and control systems; and new measurements, data analytics, and models that leverage the latest scientific advancements in mathematics and computation.

Legislative Mandates

In December 2007, Congress passed, and the President approved, Title XIII of the Energy Independence and Security Act of 2007 (EISA). EISA provided the legislative support for DOE's smart grid activities and reinforced its role in leading and coordinating national grid modernization efforts. EISA Section 1303 established at DOE the **Smart Grid Advisory Committee** and **Federal Smart Grid Task Force.**

RELATED LINKS

OE R&D Fact Sheet

Grid Modernization Initiative

Grid Modernization Laboratory Consortium

Interactive Grid

Power Grid Podcast