Report examines limits of national power grid simulations

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America's power grid today resembles the country's canal system of the 19th Century. A marvel of engineering for its time, the canal system eventually could not keep pace with the growing demands of transcontinental transportation.

More than 150 years later, America's infrastructure is again changing in ways that its designers never anticipated. Distributed and intermittent electricity generation, such as wind power, is rapidly expanding, new smart meters are giving consumers more control over their energy usage, and plug-in hybrid electric vehicles may someday radically increase the overall demand for electricity. The evolution of America's energy needs has forced scientists and engineers to re-examine the operations, efficiency and security of the national power grid. The creation of a more secure and efficient national power grid requires significant innovations in the way we transmit electricity and monitor its use.

To better assess the challenges facing the power grid, the U.S. Department of Energy's Argonne National Laboratory hosted a workshop that brought together power system and modeling experts from federal agencies, national laboratories and academia.

"Modeling and simulation have proved to be effective tools for the power industry on many levels," said Mark Petri, Argonne's technology development director and one of the workshop's organizers. "We need to develop a comprehensive and integrated approach that will enable us to better understand the full implications of an evolving power grid as we

plan for future demand and power sources."

The workshop centered on the need for new methods to simulate the national power grid by modeling the creation and flow of electric power as well as the grid's connection to other critical infrastructures, such as transportation, gas, water and communications. Through detailed simulations of how electric power is supplied and transferred around the country, researchers can bolster not only the grid's security but also its reliability, efficiency and resiliency.

"Implementing smart grid technologies on a large scale will not be trivial," Petri added. "The challenges go beyond technical and economic issues. The smart grid technologies could fundamentally change how national power grid systems operate and respond to disruptions."

Because of the great diversity of ways in which electricity is created, distributed and consumed, engineers face a challenge in creating reliable models of large power networks. They have to deal with the intermittent nature of some of the sources (like wind or solar), optimize how power is transmitted and balance economic, security and environmental priorities when finding solutions.

"In the short-term," Petri said, "these simulations could help devise ways to solve the problem of grid congestion, which currently costs consumers many hundreds of millions of dollars each year. Even small improvements in grid efficiency that better models and simulations would produce would make the investment cost-effective."

The workshop, which was sponsored by U.S. Department of Homeland Security Science and Technology Directorate, identified barriers that a national grid simulation capability would need to overcome to be effective. The findings of the workshop appear in the report "National Power Grid Simulation Capability: Needs and Issues." According to

Petri, an operational plan for a national power grid simulation capability that engages industry to better understand their needs, capabilities and concerns would support a more secure and reliable electric power grid system for the future.

Source: Argonne National Laboratory (news : web)

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