

Sensing and Measurement Strategy

CHALLENGE

The nation's electric power system is undergoing a major transformation in many ways, including:

- the increase and integration of new devices, including distributed energy resources (distributed generation, electric vehicles, energy storage),
- a major shift in generation mix (more renewable resources with non-firm power),
- aging infrastructure, and
- greater customer involvement, (demand responsive systems and programs).

To manage the capabilities of the grid's increasing number of assets, this transformation requires greater "visibility" throughout the electric power system. Meeting this goal will require the capability to accurately measure and characterize the state of the power system at much higher fidelity and resolution than ever before—from generation, to transmission and distribution, and finally to end-load use. A cohesive strategy is needed to prioritize DOE's research, development, and deployment activities in this important area.

APPROACH

This project focuses on developing the strategy needed to define measurement parameters, identify devices and R&D for making measurements, determine the communications requirements needed to transfer the sensor data, and identify data analytics needed to manage data and turn them into actionable information. The project includes four key tasks that involve working with external stakeholders to ensure the quality of the work products.

1. **Define the Extended Grid State.** To address the future needs of the modern grid, the concept of grid state must be extended to include all aspects of the electrical power state for distribution systems and elements that address distributed energy resources, including those that are not utility owned, such as energy storage and new electronic loads. The Extended Grid State definition includes both utility and customer assets in the distribution system and connectivity with the transmission system. The project team will work with industry to identify enhancements and new standards needed, and drive definitions for enhancements to existing IEEE and IEC standards.
2. **Develop a Technology Roadmap.** A technology roadmap will be created by 1) assessing the current state-of-the-art in sensors,

At-A-Glance

PROJECT LEADS

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PARTNERS

- Electric Power Research Institute
- Southern Company
- Electric Power Board of Chattanooga
- Entergy
- OSIsoft
- Dominion
- Tennessee Valley Authority
- Commonwealth Edison Company
- North American SyncroPhasor Initiative

BUDGET

\$3 million

DURATION

April 2016 – April 2019

TECHNICAL AREA

Sensing and Measurements

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communications, and data management technologies; and 2) conducting a gap analysis using the Extended Grid State to identify measurement requirements that are not met by currently deployed state-of-the-art technologies and methodologies.

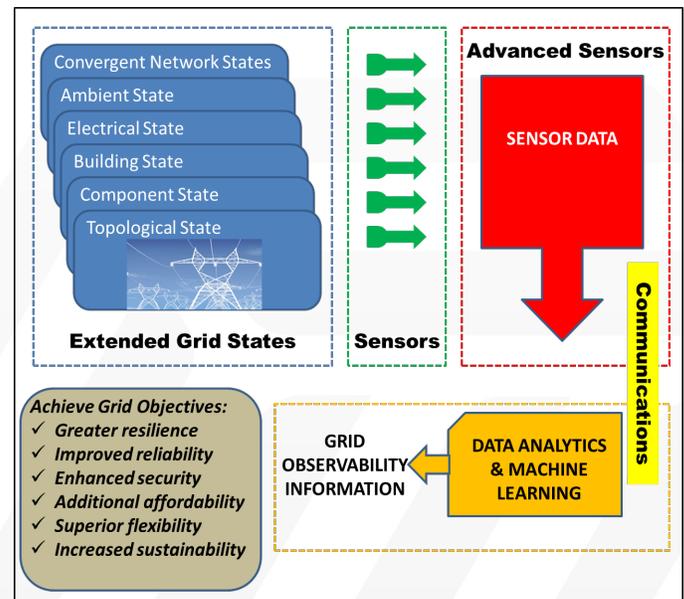
3. **Develop a Sensor Allocation and Placement Optimization Tool.** An optimization tool will be developed to optimize sensor allocation on distribution system feeders based on the extended grid state and roadmap developments to meet the measurement and monitoring requirements of power system operators and planners.

4. **Reach Out to Standards Organizations and Across GMLC Areas.** The project team will reach out to industry partners and stakeholders, technical and standards development organizations, and other power industry organizations dealing with advanced grid technologies, functions, and architecture. The intent of the outreach will be to incorporate the extended grid state definition into appropriate domestic and international standards. Outreach will also involve coordinating with other relevant GMLC efforts related to sensors and measurements.

EXPECTED OUTCOMES

This project supports DOE’s overall Grid Modernization Initiative by

- creating an extended grid state reference model to identify the information needed to understand how to instrument the extended electric grid,
- developing a technology roadmap for the development of technologies to measure electric grid parameters,
- developing a sensor observability optimization tool for developing approaches to placing the technology to measure these parameters, and
- reaching out to technical groups to ensure industry acceptance and to identify standards (new and enhancements).



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LAB TEAM



Launched in November 2014 under the U.S. Department of Energy’s Grid Modernization Initiative, the GMLC is a strategic partnership between DOE Headquarters and the national laboratories, bringing together leading experts and resources to collaborate on national grid modernization goals. The GMLC’s work is focused in **six technical areas** viewed as essential to modernization efforts:

Devices and Testing | Sensing and Measurements | Systems Operations and Control
 Design and Planning | Security and Resilience | Institutional Support