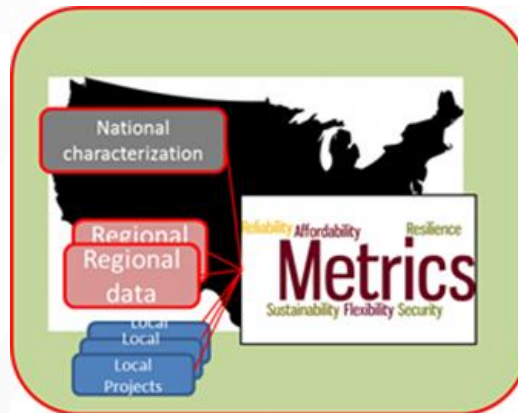


Foundational Metrics Analysis

CHALLENGE

The nation's power grid is becoming increasingly challenged because of growing consumer energy use and the penetration of resources such as wind and solar power. The grid must be modernized to ensure reliability in electricity delivery. However, electricity industry stakeholders have no consistent, standardized way to capture the current state of the grid or measure the progress of modernization efforts. A set of metrics—which measure change as the grid evolves—must be developed and defined for six critical grid functions: reliability, resilience, flexibility, sustainability, affordability, and security.



Metrics are being developed to provide the national and regional electricity industry with insights into historic trends of the evolving grid and how investments may affect future performance outcomes.

APPROACH

This challenge is being addressed by several national laboratories partnering with electricity industry experts. They are developing and applying metrics that will allow stakeholders to assess the evolving state of the grid as well as monitor progress for grid modernization. As part of this effort, the national laboratories and industry partners are

- defining new metrics and developing methods to measure progress
- testing the metrics and methods to demonstrate value to stakeholders
- working with stakeholders to integrate the metrics and methods into existing data collecting products.

EXPECTED OUTCOMES

New metrics will be used by utilities, system operators, regulators, state governments, aggregators, security agencies, research organizations, and consumer protection organizations. These stakeholders will be better able to make decisions in a complex environment when they understand

At-A-Glance

PROJECT LEADS

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PARTNERS

- North American Electric Reliability Corporation
- National Association of Regulatory Utility Commissioners
- Energy Information Administration
- American Public Power Association
- Department of Homeland Security
- Environmental Protection Agency
- Electric Power Research Institute
- Federal Energy Regulatory Commission
- National Rural Electric Cooperative Association
- Electric Reliability Council of Texas

BUDGET

\$4.75 million

DURATION

April 2016 – September 2018







TECHNICAL AREA

Institutional Support

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the tradeoffs between multiple sets of metrics. For instance, moving lines underground can improve the resilience to hurricane wind forces, but may also increase electricity rates for customers. Metrics that

clarify the tradeoff between resilience improvement and affordability will be very informative for decision makers.

Category	Definition	Goals
Reliability 	The uninterrupted delivery of electricity with acceptable power quality to meet electricity users' needs for—or applications of—energy.	Develop new distribution system metrics to support reliability value-based planning; develop new metrics to support system-level reliability impact of transmission equipment availability and performance; demonstrate value of probabilistic transmission planning metrics.
Resilience 	The ability to prepare for and adapt to changing conditions and to withstand and recover rapidly from disruptions, including deliberate attacks.	Develop metrics that describe the current state of resilience and methods that quantify resilience change of electric services given a particular investment.
Flexibility 	The ability of a power system to respond to changes in supply and demand. Flexibility metrics are critical for integration of renewable generation.	Develop metrics that describe the current state of flexibility and methods to determine future flexibility requirement for short- and long-term planning
Sustainability 	Defined as having three pillars—environmental, social, and economic—this project focuses on sustainability factors associated with greenhouse gas emissions.	Develop an objective, comprehensive, and critical review of the landscape of federal greenhouse gas (GHG) emission estimation products, and assess their ability to discern changes in GHG emission performance as the grid modernizes; discern the major linkages between voluntary reporting metrics and those reported to federal agencies.
Affordability 	The customer's cost of electric service as a proportion of their income or business revenue.	Augment existing cost-effectiveness metrics and methods to represent the cost burden on residential, commercial, and industrial customers.
Security 	The ability to reduce risk to critical infrastructure by reducing vulnerability to physical and cyber-attacks or natural disasters.	Apply publicly available data to develop security metrics.

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