

Distribution System Decision Support Tools

CHALLENGE

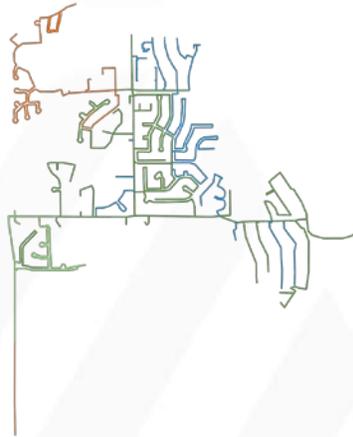
For many people, the utility pole planted along a highway or on a street corner is the iconic symbol of the electric grid. Utility poles are components of distribution systems, which transfer electricity from high-voltage substations out to each individual customer.

To ensure their systems deliver safe and reliable power, at reasonable cost, distribution utilities rely on planning tools and practices to guide the engineering, design, and construction of these sophisticated electric distribution systems. Yet, most decision support tools and practices that utilities use today are intended for one-way electricity flows. New tools and practices are needed to address distributed energy resources (DERs)—such as rooftop solar, energy storage, and demand response—and resulting two-way power flows and voltage fluctuations and incorporate advanced distribution system technologies and systems.

For many U.S. utilities, state regulators oversee their obligation to serve. But, with limited resources and experience, it is challenging for states to keep up with technological capabilities, new planning methods, and business and technology requirements.

APPROACH

As part of DOE's Grid Modernization Initiative, this project informed and advised state regulators and utility organizations on emerging distribution planning methods and tools. These efforts focused on updating distribution planning by incorporating emerging grid modernization technologies and the implications of significant DER deployment.



This map of feeder power lines produced by a commercial distribution-planning tool shows voltage and type of each line, by color.

At-A-Glance

PROJECT LEADS

- **Michael Ingram**
National Renewable Energy Laboratory
Michael.Ingram@nrel.gov
- **Lisa Schwartz**
Lawrence Berkeley National Laboratory
LCSchwartz@lbl.gov

PARTNERS

- National Association of Regulatory Utility Commissioners (NARUC)
- National Association of State Energy Officials (NASEO)
- American Public Power Association
- National Rural Electric Cooperative Association
- Interstate Renewable Energy Council
- Pedernales Electric Cooperative
- National Grid
- Arizona Public Service Company

BUDGET

\$2.5 million

DURATION

April 2016 – December 2019

TECHNICAL AREA

Institutional Support

Lead: Chuck Goldman
Lawrence Berkeley National Laboratory
CAGoldman@lbl.gov

The project:

- Conducted four regional trainings on distribution systems and planning for public utility commissions (PUCs), including two trainings with state energy offices, co-hosted by NARUC, NASEO and regional partners, with participation from 34 states plus District of Columbia and Puerto Rico. The trainings broadly shared results of several GMLC projects — e.g., Metrics, Grid Architecture, Valuation, Data Analytics, and Future Electric Utility Regulation — and DOE's Modern Distribution Grid (DSPx) initiative. Also provided educational webinars and in-person trainings for members of the National Association of State Utility Consumer Advocates.
- Interviewed top distribution system analysis tool vendors (CYME, Synergi and Milsoft) to assess capabilities of current tools, planned developments, and gaps and published a technical report that identified development requirements and lessons learned.
- Published a report on distribution planning activities in 16 states, covering planning and investment strategies, analyzing non-wires alternatives to traditional distribution system solutions, identifying the capacity of distribution systems to integrate DERs, and assessing the benefits of these resources by location.
- Identified distribution system planning tools for DERs and grid modernization – current capabilities, data needs and gaps.
- Produced a report on cost-benefit analysis for utility-facing grid modernization investments.

OUTCOMES

The project plotted a path for the next generation of distribution planning tools and practices. By identifying gaps in current tools and practices and making recommendations to address those gaps, the project helped shape the development of future distribution system decisions. The project established a series of regional training workshops on integrated distribution system planning for states and provided educational materials and technical assistance for state regulators and the electric utility industry.

These activities helped utilities and regulators envision the capabilities they will require from the next generation of distribution planning tools and practices. This knowledge-base of more advanced distribution system decision support tools and practices will help to enable greater penetration of DERs and advanced grid technologies and systems on the electric grid.

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