THE POWER OF INNOVATION AT PNNL

Pacific Northwest NATIONAL LABORATORY

Sustainable Data Evolution Technology *(SDET)* for Power Grid Optimization

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Partners: National Rural Electric Cooperative Association (NRECA), GE Grid Solutions, PJM Interconnection, AVISTA Utilities, California Independent System Operator (CAISO)

CRITICAL NEED:

CREATING LARGE-SCALE, REALISTIC, SYNTHETIC MODELS & DATASETS FOR POWER GRID ANALYSIS & OPTIMIZATION

The power grid has become increasingly complex. Demand for electricity keeps varying, and the grid now requires more efficient optimization methods for short-term operation, long-term planning and disaster restoration. Power generation must constantly be adjusted to meet these requirements. Optimal power flow is used to make such adjustments. However, the optimization methods used in today's power grid tools are mostly decades old, and there is a lack of realistic, open-access datasets for testing the optimization algorithms. This limits the ability of researchers to develop, benchmark and compare new methods and tools for optimizing the operation and planning of the grid, which leads to slow adoption by end-users.

The open-access datasets that do exist are

- *Either incomplete or too small.*
- *Static and do not keep up with grid needs.*
- *Missing real-world details needed to test for actual applications.*

Specifically, test systems are too small to test optimization algorithms for solving large-scale problems within required timeframes. For example, optimal power flow problems need to be solved every five minutes to be consistent with five-minute resolutions of real-time markets.

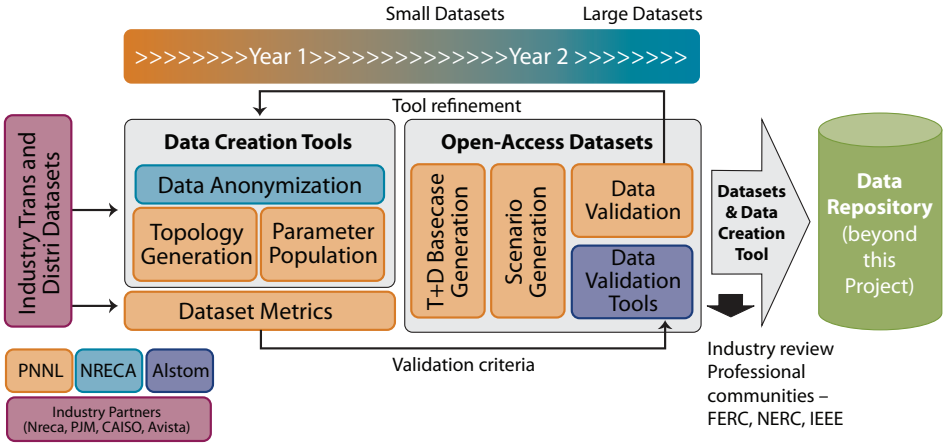
OUR SOLUTION:

OPEN-ACCESS TRANSMISSION & DISTRIBUTION (T&D) DATASETS

PNNL has partnered with NRECA, GE Grid Solutions, PJM Interconnection, Avista Utilities and CAISO to drive innovation and industry adoption for power grid optimization. The six collaborators are working to develop a SDET tool.

The goal of SDET is to create open-access T&D power grid datasets, as well as data-creation tools that the grid community can use to create new datasets based on user requirements and changing grid complexity.

When complete, the SDET technology will deliver large-scale, realistic datasets and data-creation tools capable of generating new datasets. The generated datasets and data-creation tools will be compatible with, and available through, the GRID DATA program's data repository. The objective is for this to be a sustained effort beyond the ARPA-E GRID DATA program so that the datasets can evolve over time and meet the current and future needs for power grid optimization. SDET technology is expected to fundamentally enhance the development, assessment and adoption of new methods and tools for power grid optimization and other applications, which in turn, would significantly improve the reliability, resiliency and efficiency of the power grid.



OUR APPROACH:

CREATING LARGE-SCALE, SYNTHETIC MODELS FROM REAL-WORLD GRID DATA

The SDET approach is deriving features and metrics from many real-world datasets provided by PNNL's industry partners. The project team is using the data to:

1. *Derive features and metrics for T&D systems by analyzing many public and private datasets provided by NRECA, GE GridSolutions, PJM, CAISO and Avista.*
2. *Develop data-creation tools and use these tools to generate large-scale, open-access, realistic datasets that comply with the metrics for T&D systems.*
3. *Validate the created datasets using standard industry tools provided by GE Grid Solutions.*

THE RESULT:

A MORE RESILIENT, ECONOMIC AND RELIABLE POWER GRID

SDET, expected to be completed by October 2018, will dramatically increase the ability to test and validate new technologies and methods using realistic models and scenarios. Specifically, it will

- *Automatically generate desired base cases based on user's needs for both T&D networks.*
- *Generate realistic operating scenarios to mimic real-time grid operation with a five-minute resolution.*

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