U.S. DEPARTMENT OF
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Open Modeling Framework

NRECA builds open and powerful modeling tool around GridLAB-D™

The National Rural Electric Cooperative Association (NRECA) Cooperative Research Network (CRN) is developing a state-of-the-art, online platform for analyzing the cost-to-benefits of new smart grid technologies. The open modeling framework (OMF) will allow hundreds of industry cooperatives to access advanced analysis capabilities only available within GridLAB-D, which functions as the core analysis engine. The OMF provides users with an easy-to-use interface and separation from the complexities of the GridLAB-D engine, adding interactive visual interfaces and run management systems. Users can quickly evaluate the technical benefits and cost of implementation of new technologies to determine the effectiveness on their own system via a cloud-based web interface. The interface is designed to screen system components and assess their effectiveness prior to deployment.

GridLAB-D is a time-series, multi-disciplinary simulation tool that simulates the interdependent behavior of thousands of devices at tremendous levels of detail, from the substation to the end-use load. GridLAB-D has been successfully used to evaluate new technologies and control systems including:

- Volt-VAr Optimization and Conservation Voltage Reduction

- Feeder Reconfiguration and Automation

- Distributed Energy Storage and Generation

- Demand Response, Load Management, and Retail Markets

- Distributed and Hierarchical Control Architectures

- Microgrid Operation and Control

The OMF offers a rich set of tools for importing (from Milsoft, GridLAB-D) and editing digital representations of electrical distribution systems. (Image courtesy of NRECA)

The OMF produces detailed visualizations of technology impacts on financial and engineering performance. (Image courtesy of NRECA)

CRN has noted that complexity of GridLAB-D would be a significant barrier to adoption. It has always been of limited use to utility users due the complexity of building a simulation model, validating results against field data, and presenting the information effectively and easily. The OMF addresses many of these issues, providing a more productive workflow for utility users:

- *Development of an automated model extraction and calibration system.* In the cloud-based system, users submit a feeder planning model and available load data. The OMF is capable of automatically converting the planning model to GridLAB-D format, and then through a series of simulations, create a "calibrated" model that approximates the time-series behavior of provided load data with advanced load models.

- *Run management system and collaboration.* Users simulate and store information in a cloud-based system, allowing for easy access and re-use. Users can also share simulation setup or results with other users, creating a collaborative environment.

- *Visual analytics for financial and engineering evaluation.* GridLAB-D produces large quantities of "sensor" data that can be difficult to manage and evaluate, especially across multiple technologies and feeders. The OMF gives users access to easy-to-use tools for visualizing results and comparing across multiple simulations. The OMF effectively separates technical and economic inputs so that users can explore future deployment scenarios and evaluate the potential cost-to-benefit value of new technologies.

The OMF is currently available for evaluation of Volt-VAr Optimization systems to a limited set of cooperatives for evaluation. The end goal is provide open access for all NRECA member utilities.

Future work will continue to refine the model extraction and calibration process, incorporate additional study capabilities (e.g., high penetration photovoltaic, distributed energy storage, and demand response), and continue to improve the performance of the underlying GridLAB-D engine.

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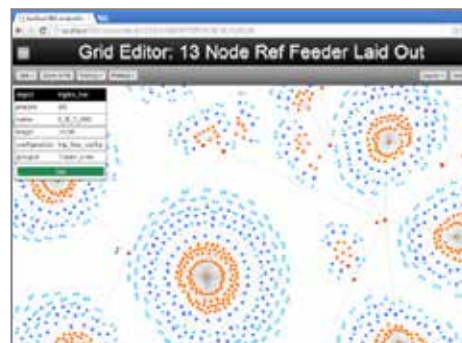
Basic grid model editor, capable of specifying an entire electrical distribution system. (Image courtesy of NRECA)

For more information on using the tool and training schedules, please contact:

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GridLAB-D