



Enhancing GridLAB-D

EPC 18-047, 18-046, GFO 17-3050

September 7, 2018

Technical Advisory Committee

Gridworks, Stanford National Accelerator Laboratory (SLAC), Hitachi, National Grid, and the Pacific Northwest National Lab (PNNL) are leading three California Energy Commission (CEC) EPIC projects to develop distribution system modeling tools to evaluate distributed energy resources. Modeling software for power systems is undergoing significant development to address an increasingly complex electric grid. This initiative looks to address some of these most pressing needs by enhancing GridLAB-D, an open source distribution simulation and analysis modeling software developed by the U.S. Department of Energy. GridLAB-D is capable of distribution grid analysis, estimation of the grid benefits and impacts of DERs, and support of decision making and planning processes on the distribution system.

GridLAB-D TAC has received funding for three projects:

1. Open Workspace (GLOW): looks to develop a high-end user interface for GridLAB-D that is more intuitive and user-friendly for all stakeholders, including non-expert users, to increase access to simulation and modeling results
2. Open Framework for Integrated Data Operations (OpenFIDO): is a data interchange, synthesis and analysis framework allowing interoperability between different power systems tools. This capability allows for a more reliable and efficient data exchange.
3. High Performance Agent-Based Simulations (HiPAS): is an open-source upgrade to GridLAB-D that speeds up the analysis performance and computational efficiency of the tool, using intelligent, adaptive multi-threading to deploy highly granular parallelization in agent-based simulations.

Purpose/vision:

The September 7, 2018, Technical Advisory Committee (TAC) meeting was the first of five annual in-person meetings for the coordination of all three projects (GLOW, OpenFIDO & HiPAS). The TAC process requires industry experts to advise CEC staff on how best technology and tools can meet future state mandated initiatives. TAC members represent government agencies (CPUC, DOE), Industry participants (SCE, PG&E, National Grid), vendors (Sunrun, Kevala, STEM) and public interest groups (NRDC, EDF).

The purpose of the TAC is to create lasting impacts through usable versions of GridLAB-D that enable high levels of DER penetration on the distribution system. Modelling distribution systems needs is paramount to meeting state goals including SB-100¹ and Executive order B-55-18². GridLAB-D's research and development community will focus on California's electricity system and leverage California's leadership in renewable integration and adoption.

The creation of a GridLAB-D Consortium to continue coordination and funding support over time will ensure long-term success. The consortium will look to existing CEC supported developments and industry examples (e.g., Linux Foundation) in the creation of a governance structure that will support collaboration-based outreach and development. By anticipating future grid modelling needs, GridLAB-D can shorten implementation time and cost while increasing transparency of Distributed Resource Plan (DRP) analysis activities.

¹ https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100

² <https://www.gov.ca.gov/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf>



GRIDWORKS

Use Cases:

By focusing on research and planning the tool will complement existing tools (e.g., CYME) to support a variety of state objectives and inform policy decisions. The ability to model multiple use applications (e.g., DR, ramping capacity, energy arbitrage, flexible capacity, system capacity) gives utility planners the opportunity to support targeted deployment of DERs for streamlined interconnections at high-value locations and plan for future distribution system upgrades.

By analyzing large data sets GridLAB-D can provide valuable information to distribution system operators that wish to integrate new grid service devices and predict future grid needs. Example use cases were discussed by industry vendors (SunRun, STEM) for solar plus storage, NWA's, IDER RFPs, DRAM and virtual power plants that can all enhancing overall grid services. The modeling processes supporting the current DRP have been time consuming; this could be improved with HiPAS' ability to handle large volume simulation scenarios more quickly and help streamline the process.

Next steps:

Hitachi will develop a graphical user interface for GridLAB-D using a human-centered design approach. To support GLOW project development Hitachi is looking to better understand how grid modelling tools are currently used in industry by conducting interviews and demonstrations (~90 mins) with TAC members. Hitachi has requested separate interviews with:

- 1 manager responsible for technical leads. Familiarity with high-level requirements for DER integration and coordination responsibilities.
- 1-2 modelling engineers,
- 1-2 technical leads and

Interviews with each of these people may be coordinated, resulting in a one-day visit with participating TAC.

