GRID MODERNIZATION INITIATIVE
PEER REVIEW

GMLC 1.3.5 – DER Siting and Optimization tool for California

JOHN GROSH & GONÇALO CARDOSO

April 18-20, 2017
Sheraton Pentagon City – Arlington, VA
**Project Description**
Prototype framework for integrated distributed resource planning and optimization tool able to identify DER adoption patterns, microgrid sites, and evaluate DER impacts on the distribution and transmission grid.

**Value Proposition**
- Integrate private DER investment and dispatch decisions in grid planning
- Capture distribution and transmission grid interactions
- Unique methodology enables holistic view on grid impacts of DER

**Project Objectives**
- DER penetration patterns and operational strategies
- Identify sites with economic potential for microgrid and DER
- Address policy incentives and value of DER as grid assets
- Consider network constraints in the DER location problem
- Evaluate impacts of DER on the bulk electric grid system
- California as starting point for wider application (e.g. NY)
**Project Participants and Roles**

**John Grosh, Liang Min - LLNL (Current lead)** – T&D power flow co-simulation Lead, feeder data conversion, Demonstration, Dissemination

**Michael Stadler**, **Gonçalo Cardoso - LBNL (Original lead, Plus One)** – Behind-the-meter DER modeling, Model Integration, Model Automation, Demonstration, Dissemination, Coordination

**Sila Kiliccote - SLAC (Plus One)** – Mapping and Results Visualization Lead, Demonstration, Dissemination

**Anthony Florita - NREL** – Load disaggregation Lead, feeder data conversion, Demonstration

**Robert Lofaro - BNL** – Support on T&D power flow, Data collection, Load disaggregation, Demonstration

**Jianhui Wang - ANL** – Support on T&D power flow, Mapping, Demonstration

**CPUC, PGE, SCE + External Advisory Committee**

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**PROJECT FUNDING**

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<thead>
<tr>
<th>Lab</th>
<th>FY16 $</th>
<th>FY17 $</th>
<th>FY18 $</th>
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<td>LBNL</td>
<td>114,107</td>
<td>315,893</td>
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<tr>
<td>SLAC</td>
<td>45,000</td>
<td>215,000</td>
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<td>ANL</td>
<td>24,333</td>
<td>90,667</td>
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*Total funding: $1.3M
Duration: 18 (16) months
Due: End of Sep 2017*
**DER Siting and Optimization tool for California**

**Relationship to Grid Modernization MYPP**

**MYPP Vision:** The future grid will solve the challenges of seamlessly integrating conventional and renewable sources, storage, and central and distributed generation (…)

**Direct relationship** to MPYY vision by delivering a tool to **estimate DER impacts on the electric grid**

(Behind-the-meter modeling + T&D co-simulation + Visualization)

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5.1.2 – **Develop methods for integrating distribution into system-wide planning,** (…) including distributed generation, demand response, electric vehicles, and energy storage

5.1.8 – **Develop methodologies and tools to produce simple-to-use desktop computer models from HPC-generated simulations and economic analysis**

5.2.2 – **Scale modeling framework to the regional level.**

**Develop associated models for load, distributed generation, energy storage, and controls to enable the design and evaluation of future EMS/DMS/BMS architectures and novel wide-area sensor-control networks**

2.2.10 – **Establish and test methodologies for enabling optimal dispatch of energy storage to serve multiple grid services**
## DER Siting and Optimization tool for California Approach

<table>
<thead>
<tr>
<th>Task</th>
<th>Task Description</th>
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<td>Model Automation for DER Adoption Patterns</td>
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<td>Characterization of Feeder Loads</td>
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<td>Demonstration and DER Market Concepts</td>
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<td>6</td>
<td>Dissemination and Training</td>
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**Task 1 – Integrated T&D Modeling**
- Develop CA-representative integrated T&D power-flow model
- Collect, convert, test, and validate datasets required to enable T&D co-simulation

**Task 2 – Mapping Platform**
- Develop mapping and visualization capabilities
- Integrate all three main model components: behind-the-meter models, T&D model, visualization

**Task 3 – Model Automation for DER Adoption Patterns**
- Collect new DER-CAM datasets / update existing ones
- Enable automated DER-CAM model creation, parallel optimizations, automated data exchange

**Task 4 – Characterization of Feeder Loads**
- Identify and collect distribution datasets required to build representative CA T&D model
- Develop and apply load disaggregation methods

**Task 5 – Demonstration and DER Market Concepts**
- Select and conduct a demonstration case focusing on how this project complements and/or exceeds current DRP process
- Develop high-level DER market concepts focusing on revenue streams of DER-based solutions and DER potential as grid asset

**Task 6 – Dissemination and Training**
- Prepare project specific documentation and scientific publications
- Develop interactive training material, tutorial videos, and organize training sessions

**Uniqueness**: Integrated modeling tool brings together customer-oriented *behind-the-meter modeling* with *T&D co-simulation* and custom *visualization* capabilities.
## Key Project Milestones

<table>
<thead>
<tr>
<th>Milestone (FY16-FY18)</th>
<th>Status</th>
<th>Due Date</th>
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<tbody>
<tr>
<td><strong>Milestone #1 – Quarterly Progress Measure:</strong></td>
<td>Completed</td>
<td>6/30/2016</td>
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<tr>
<td>Completed initial testing of PG&amp;E distribution data (1.1); Initiated IOU GIS survey (2.1); Collected residential load data for DER-CAM and created residential load database (3.1 and 3.2); Engaged with IOUs to collect feeder data (4.1);</td>
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<tr>
<td><strong>Milestone #2 – Quarterly Progress Measure:</strong></td>
<td>Completed</td>
<td>9/30/2016</td>
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<tr>
<td>Completed PG&amp;E distribution data collection, conversion and validation (1.1); Completed initial testing of SCE distribution data (1.2); Completed IOU GIS survey and identified data exchange needs for the co-simulation platform (2.1); Completed data collection and database upgrades for DER-CAM (3.1 and 3.2); Completed feeder data collection and load data disaggregation (4.1 and 4.2) – End of Task 4.</td>
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<tr>
<td><strong>Annual Milestone #1:</strong></td>
<td>Completed</td>
<td>12/31/2016</td>
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<td>Completed SCE distribution data collection, conversion and validation (1.2); Completed T&amp;D modeling and co-simulation integration (1.3) – End Of Task 1; Completed mapping platform development and model integration (2.1 and 2.2); Completed DER-CAM modifications and model automation (3.3 and 3.4) – End of Task 3.</td>
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<td><strong>Annual Milestone #2:</strong></td>
<td>On Time</td>
<td>9/30/2017</td>
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<td>By the end of September 2017 this project will be completed, delivering a platform to model system-wide impacts of DER penetration and to suggest optimal DER and microgrid locations, as well as a high level framework to establish DER markets.</td>
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DER Siting and Optimization tool for California
Accomplishments to Date

Key achievement: Development of end-to-end software framework prototype
DER Siting and Optimization tool for California

Accomplishments to Date

End-to-end software prototype:
- T&D model for CA
- DER-CAM enhancements & data
- Model integration and APIs
- Visualization

Participation in workshops, meetings, and other stakeholder engagement:
- CPUC and involvement with DRP
  - Attended DRP WG meetings on both ICA & LNBA (8 + 6)
  - Led scoping of validation of ICA methods for long-term refinements, including one-on-one discussions with PG&E, CPUC Office of Ratepayer Advocates, SolarCity, and IREC
- Presented validation approach to the DRP WG
- Briefed DRP WG on the GMLC Project
- Technical advisory committee including CPUC and industry representatives
# Recommendation

<table>
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<tr>
<th>Recommendation</th>
<th>Response</th>
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<tr>
<td>Integrate of results with the Valuation work (1.2.4)</td>
<td>Engaged with the 1.2.4 project; Identified implementation strategy (Demonstration Case)</td>
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<tr>
<td>Determine connections with the Regional Partnership in Vermont</td>
<td>Engaged with the 1.3.10 project; Discussed complementarities and analysis methods for different use cases; strategy for coordination</td>
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<td>Discuss implication of the new DRP</td>
<td>DRP focuses on short-term applications; Integration of 1.3.5 targets “long-term long-term” refinements (CPUC)</td>
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<tr>
<td>Let DOE when Annual Milestone #1 is complete</td>
<td>Annual milestone progress presented via webinar; Submitted supporting documentation</td>
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<tr>
<td>When will this tool be posted online?</td>
<td>July 2017 (aligned with Demonstration Case)</td>
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DER Siting and Optimization tool for California
Project Integration and Collaboration

(SUNSHOT) CyDER – A Cyber Physical Co-Simulation Platform for Distributed Energy Resources in Smart Grids

CyDER: interconnection and short-term operations using real-time data (PGE)
1.3.5: long-term planning for all of California, behind-the-meter DER dispatch, and policy applications

- Data sharing; Complementary in scale (space and time), and granularity

1.3.22 - Technical Support to NY REV
1.3.5 will provide access to DER-CAM and all other project developments
BNL is leading 1.3.22 and also participating in 1.3.5
- Demonstration Case; Technology Transfer

1.4.15 Development of Integrated Transmission, Distribution and Communication Models
LLNL is participating in both 1.3.5 and 1.4.15
- Technology Transfer

1.2.4 Grid Services and Technologies Valuation Framework
LBNL, NREL, ANL are participating in both 1.3.5 and 1.2.4
- Integrate Valuation Framework in Demonstration Case

Communications:
Active participation in ICA and LNBA WG meetings (14 total)
Presentation to CPUC / DRP WG
**Next steps:**

Task 5 - Project demonstration DER Market Concepts [Apr – Sep]
- Demonstration Case (early start)
- Application in Policy scenarios
- Market Concept Development

Task 6 - Dissemination and Training [Jun – Aug]
- Documentation & Training

**Possible additions or expansions:**
- Integration of AMI data
- Integration with grid expansion models (LNBA)
- Application in different territories
DISCUSSION

DER Siting and Optimization tool for California