GRID MODERNIZATION INITIATIVE PEER REVIEW

GMLC 1.3.5 – DER Siting and Optimization tool for California

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Sheraton Pentagon City – Arlington, VA

U.S. DEPARTMENT OF
ENERGY

DER Siting and Optimization tool for California
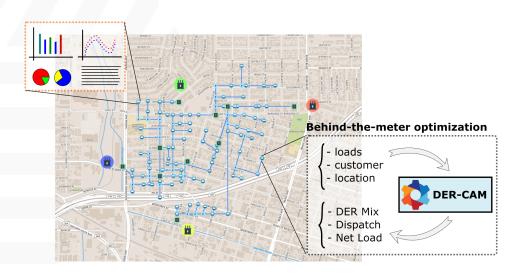## High Level Summary

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.

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)

Value Proposition

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

Behind-the-meter optimization
- loads
- customer
- location

DER-CAM
- DER Mix
- Dispatch
- Net Load

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

PROJECT FUNDING			
Lab	**FY16 $**	**FY17$**	**FY18 $**
LBNL	114,107	315,893	-
SLAC	45,000	215,000	-
LLNL	65,000	170,000	-
NREL	73,333	56,667	-
BNL	53,333	76,667	-
ANL	24,333	90,667	-

Total funding: $1.3M
Duration: 18 (16) months
Due: End of Sep 2017

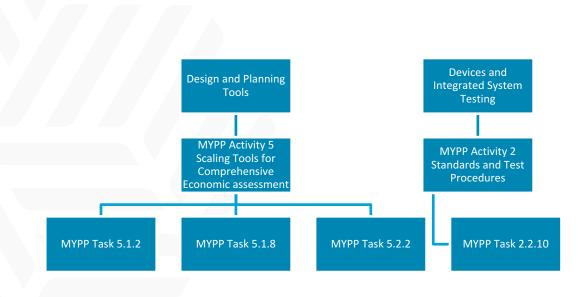# DER Siting and Optimization tool for California
Relationship to Grid Modernization MYPP

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

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)

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***

Design and Planning Tools

Devices and Integrated System Testing

MYPP Activity 5 Scaling Tools for Comprehensive Economic assessment

MYPP Activity 2 Standards and Test Procedures

MYPP Task 5.1.2

MYPP Task 5.1.8

MYPP Task 5.2.2

MYPP Task 2.2.10

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Approach

Task	Task Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		-	-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Milestones			MS				MS		GNG									
1	**Integrated T&D Modeling**																		
2	**Mapping Platform**																		
3	**Model Automation for DER Adoption Paterns**																		
4	**Characterization of Feeder Loads**																		
5	**Demonstration and DER Market Concepts**																		
6	**Dissemination and Training**																		
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
					FY 16									FY 17					

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.
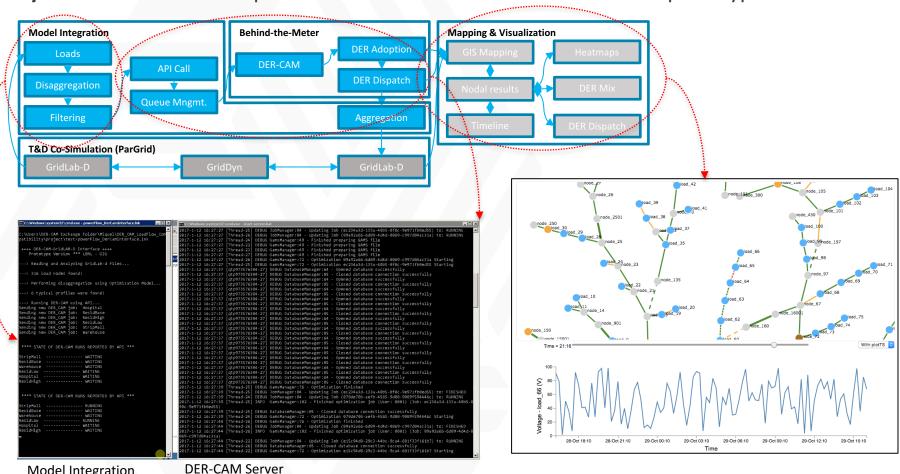
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Key Project Milestones

Milestone (FY16-FY18)	Status	Due Date
Milestone #1 – Quarterly Progress Measure: Completed initial testing of PG&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);	Completed	6/30/2016
Milestone #2 – Quarterly Progress Measure: Completed PG&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.	Completed	9/30/2016
Annual Milestone #1 : Completed SCE distribution data collection, conversion and validation (1.2); Completed T&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.	Completed	12/31/2016
Annual Milestone #2: 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.	On Time	9/30/2017

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Accomplishments to Date

Key achievement: Development of end-to-end software framework prototype

Model Integration

DER-CAM Server

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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

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Response to December 2016 Program Review

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

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Project Integration and Collaboration

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

<u>CyDER</u>: interconnection and short-term operations using real-time data (PGE)

<u>1.3.5</u>: 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

<u>Communications</u>:
Active participation in ICA and LNBA WG meetings (14 total)
Presentation to CPUC / DRP WG

Diagram:
- (SUNSHOT) CyDER
- 1.2.4 Valuation Framework
- 1.3.5 DER Planning in CA
- 1.3.22 NY REV
- 1.4.15 TD&C Models

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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