



Distribution System Modeling Program Technical Advisory Committee Meeting #2

Join the call: <https://www.uberconference.com/gridworks>

Optional dial in number: 415-429-8160

No PIN

Agenda



Introductions	10:00 - 10:15
<ul style="list-style-type: none">- Distribution Modeling Program Overview	
GLOW Overview + Feedback	10:15 - 11:00
HiPAS/OpenFIDO Overview + Feedback	11:00 - 11:50
Next Steps	11:50 - 12:00

Distribution System Modeling Program



GridLAB-D is an open source distribution simulation and analysis modeling software developed by the U.S. Department of Energy, capable of dynamic analysis, estimation of the grid benefits and impacts of DERs, and support of decision making and planning processes on the distribution system.

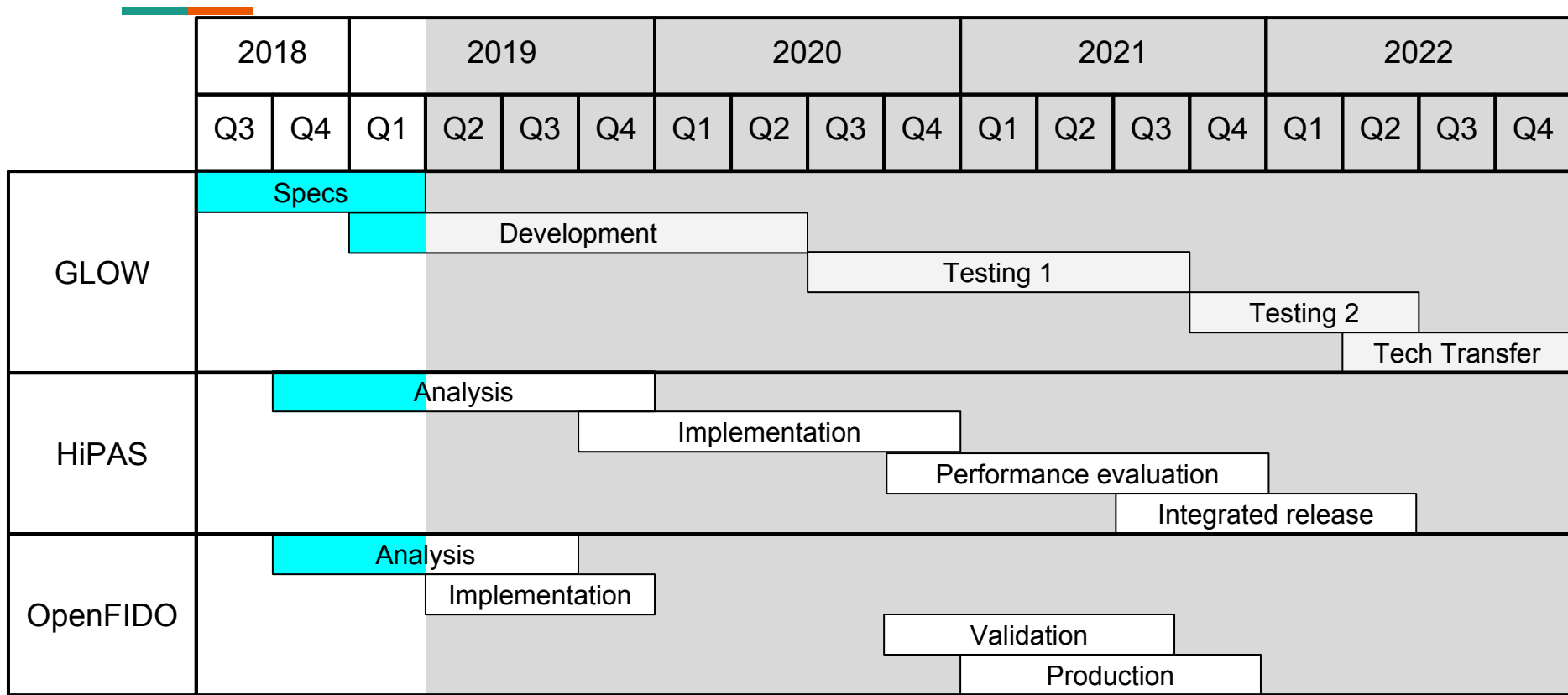
Distribution System Modeling Program



Programmatic objectives:

- Developing a **Graphical User Interface** to lower the barrier to entry for new users (GLOW)
- Deploying a software update to **enable multithreading to accelerate simulations** (HiPAS)
- Integrating diverse data sources into a **single cohesive and adaptable open-source framework to enable widespread data sharing** (OpenFIDO)

Program Timelines & Status



GLOW Project Teams



Hitachi

Bo Yang

Yanzhu Ye

Panitarn Chonguangprinya

Sadanori Horiguchi

Anastasia Osling

Sumito Tobe

Yasushi Tomita

Anthony Hoang

Natsuhiko Futamura

Gridworks

Matthew Tisdale

Andrew Spreen

Territory

Brian OKelley

David Le

Matt Adams

Annie Pomeranz

PNNL

Tom McDermott

Jason Fuller

National Grid

Pedram Jahangiri

SLAC (see next slides)

HiPAS/OpenFIDO Project Teams



SLAC/Stanford University

David P. Chassin (PI)

Brian Flori (Finance)

Velvet Gaston (Research)

Jonathan Goncalves (Computing)

Alyona Ivanova (Engineer)

Siobhan Powell (Research)

Berk Serbetcioglu (Computing)

Nani Sarosa (Finance)

Karen Schooler (Admin)

Gridworks

Matthew Tisdale

Andrew Spreen

PNNL

Tom McDermott

Jason Fuller

Frank Tuffner

National Grid

Pedram Jahangiri

Technical Advisory Committee



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.

Kristen Brown (ComEd)	Pedram Jahangiri (National Grid)	Jamie Patterson (CEC)
Aram Shumavon (Kevala)	Jim Baak (STEM)	Rachel Huang (SMUD)
Justin Regnier (CPUC)	Laura Fedoruk (Sunrun)	Jose Aliago-Caro (CPUC)
Audrey Lee (Sunrun)	Andy Bilich (EDF)	
Raul Perez-Guerrero (SCE)	Tim Heidel (Breakthrough Energy Ventures)	
Jameson Thornton (PG&E)	Fernando Pina (CEC)	

September 2018 TAC Meeting Takeaways:



- 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.
- 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.
- Prioritization of use and business cases was emphasized.

Full TAC Meeting Summary available at:

<https://gridworks.org/wp-content/uploads/2018/09/GridLAB-D-TAC-Meeting-Summary-9.7.18.pdf>

An aerial night view of a city skyline, likely New York City, with numerous skyscrapers and city lights. Overlaid on the image are several glowing white arcs and dots, suggesting a network or data flow. Two white rectangular frames are positioned on the left and right sides of the image, partially enclosing the central text.

GLOW

USER RESEARCH

HITACHI AMERICA

.....

OVERVIEW

GridLAB-D Open Workspace (GLOW) is a project to deliver a web-based graphical user interface for GridLAB-D. The open-source user interface aims to augment Gridlab-D in a more intuitive, user friendly manner, contributing to wider use of the simulation technology.

Hitachi aims to achieve the intuitiveness of the tool by employing human-centered design approach. The process includes defining requirements for the interface through researching the potential users, and designing the interfaces according to the discovered requirements.



USER RESEARCH

.....
FINDINGS &
IMPLICATIONS



.....

OVERVIEW

The team visited the following organizations, and conducted in-person interviews with stakeholders. The following organizations kindly contributed insights to the project:

- CEC
- CPUC
- PG&E
- SCE
- Sunrun



1 Mission and Goals

.....

Sustainable Growth for California



Reduction of Greenhouse Gas emissions



Increased integration of renewable energy sources and storage

**OUR MISSIONS ARE
ALIGNED**

2 Tasks for Achieving the Goals

.....

Create and execute plans and projects that contribute to the goals in the most *effective* and *sustainable* manner.



OUR TASK

Using simulation to ensure the plans are feasible, effective, and economically sound.

3 Challenges and Needs

.....

Moving Targets

- Technology
- Market
- Legislation
- Ongoing projects

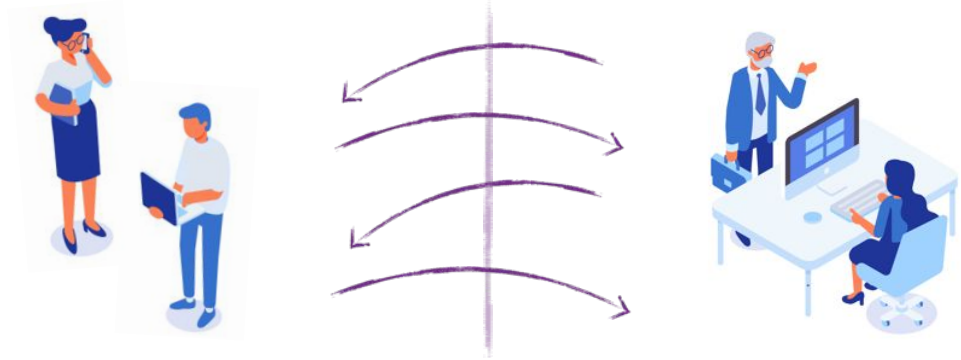
Transparency

- Access to common data
- Explainable results
- Process visibility

Cost

- Tools
- Learning cost
- Human resources cost

Differing parameters and capabilities leading to difficulties of communication.



NEEDS

Need for a common ground for effective and constructive discussions.

4 Requirements for GLOW

.....

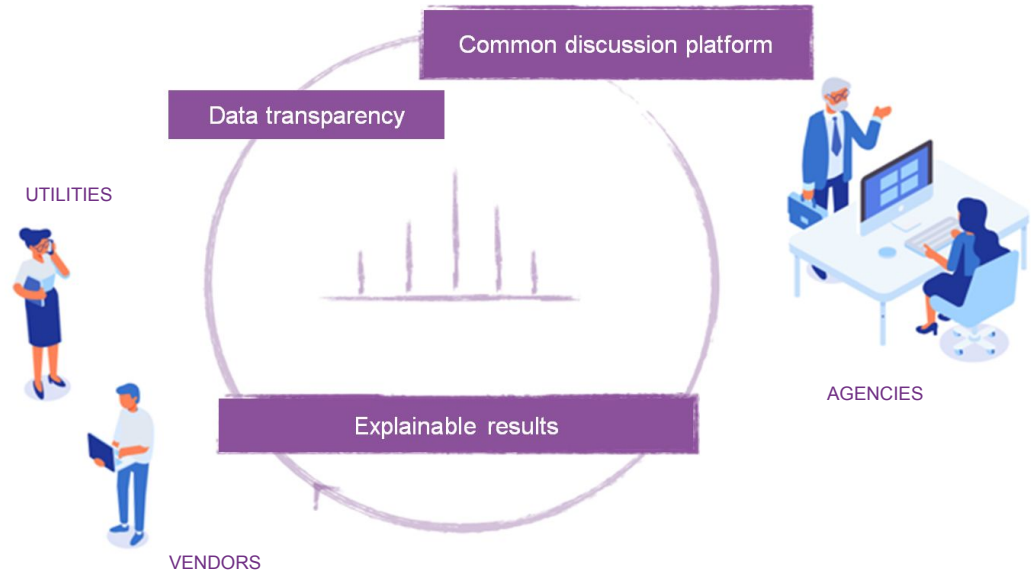
GLOW aims to be the common basis for evidence based constructive discussions.

High Level Requirements

- Low learning cost
- Low cost of implementation
- Explainable results
- Encourage Collaboration

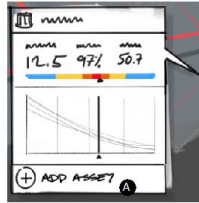
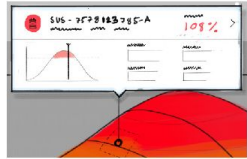
Desired Topics of Discussions

- Cost Benefit
- Load Impact
- Source Introduction/Change
- Tariff Design
- Device Level Behavior
- What-if Scenario on Simulation Results
- Overlay of Data Sources such as weather, location development parameters, etc.

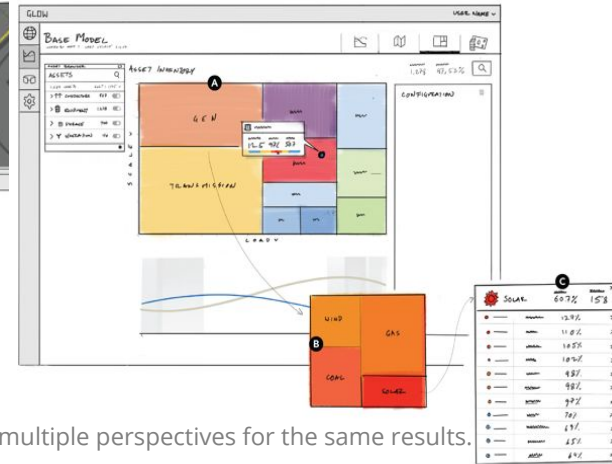
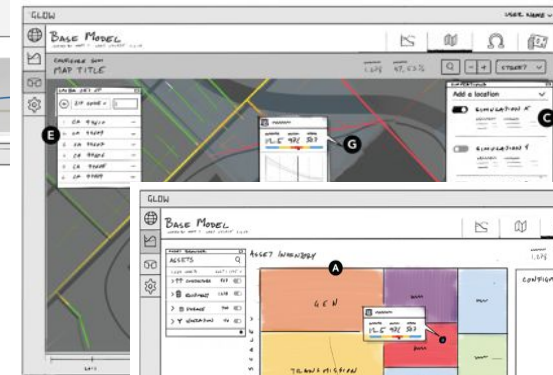
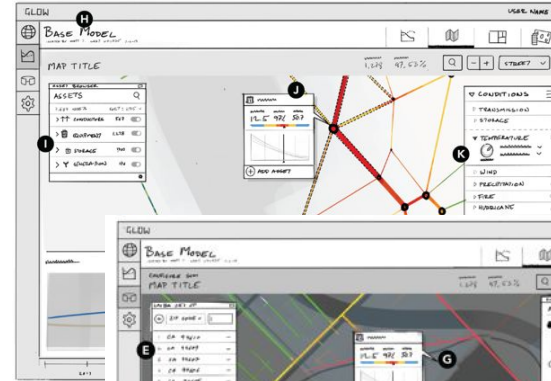


5 UI Considerations

.....



A UI window titled 'ADD AN ASSET?' with a 'LOOKUP' tab and a table of assets. The table has columns for 'TYPE', 'MANUFACTURER', 'MODEL', and 'QTY'. It includes a search bar and an 'ADD' button.



Actionable tool-tip for maintaining contexts.

A screenshot of the GLOW software interface showing a list of validated base models. It includes a 'CREATE NEW BASE MODEL' button and a 'VALIDATE SELECTED' button.

A screenshot of the GLOW software interface showing a list of validated base models. It includes a 'CREATE NEW BASE MODEL' button and a 'VALIDATE SELECTED' button.

A screenshot of the GLOW software interface showing a list of validated base models. It includes a 'CREATE NEW BASE MODEL' button and a 'VALIDATE SELECTED' button.

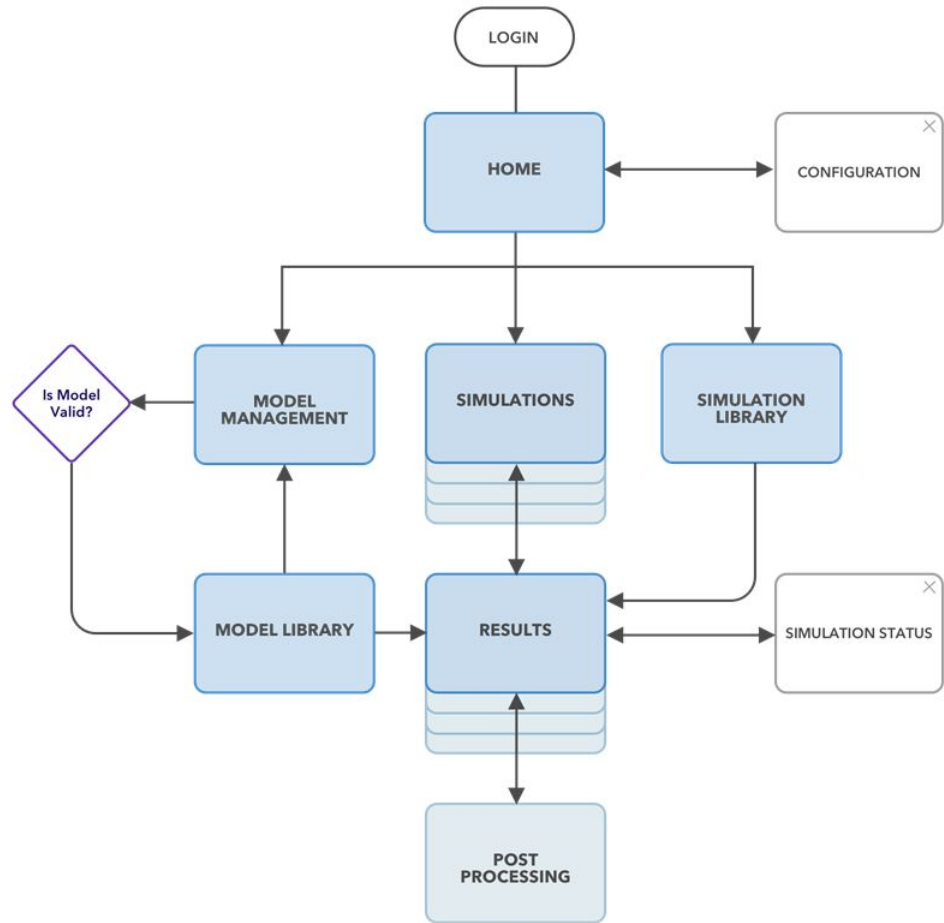
Accessible and manipulatable past activities.

Modifiable multiple perspectives for the same results.

6 Next step

.....

- Finalize information architecture
- Develop UI conceptual designs
- Iterative prototype and validation development
- Welcome TAC review and feedback



HiPAS and OpenFIDO

2019 Q1 Progress Update

Technical Advisory Committee Meeting, 3 April 2019

EPC 17-046
HiPAS

EPC 17-047
OpenFIDO

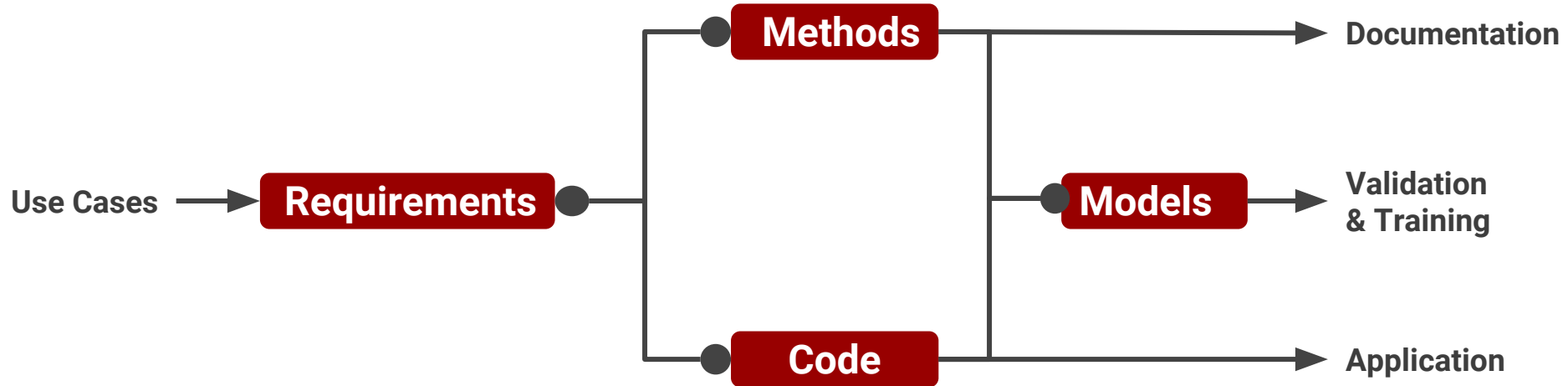
HiPAS and OpenFIDO status update

- 1. Technology transfer plan**
- 2. Joint use case development**
- 3. GridLAB-D code review**
- 4. Requirements analysis**

Key outreach messages about GridLAB-D:

- **Lower entry barrier by improved data access**
- **Enables validated grid dev and IRP processes**
- **Stimulate discussion on democratization of data**
- **Future-proof tools based on GridLAB-D**

Joint use cases: Development process



- **Publications of the DRP Working Group**
 - Required inputs, analysis & outputs
 - Applications of ICA & LNBA
 - Recommended and approved methodologies
- **Review demonstration projects & progress**
 - Limitations and benefits of various approaches
 - Capability of existing modeling & simulation tools (E3, EPRI, etc)

- **Resilience planning tools**
 - Weather/emergency resilience and response (see DOE GRIP)
- **Tariff design tools**
 - Emerging tariff design needs (e.g., feed-in, real-time, transactive)
- **Smart inverter standards**
 - Standards validation and DMS impacts (see Smart Inverters WG)
- **Composite load model validation**
 - WECC/NERC datasets for interconnection planning (see DOE ALM)

Joint use cases: Resilience Anticipation

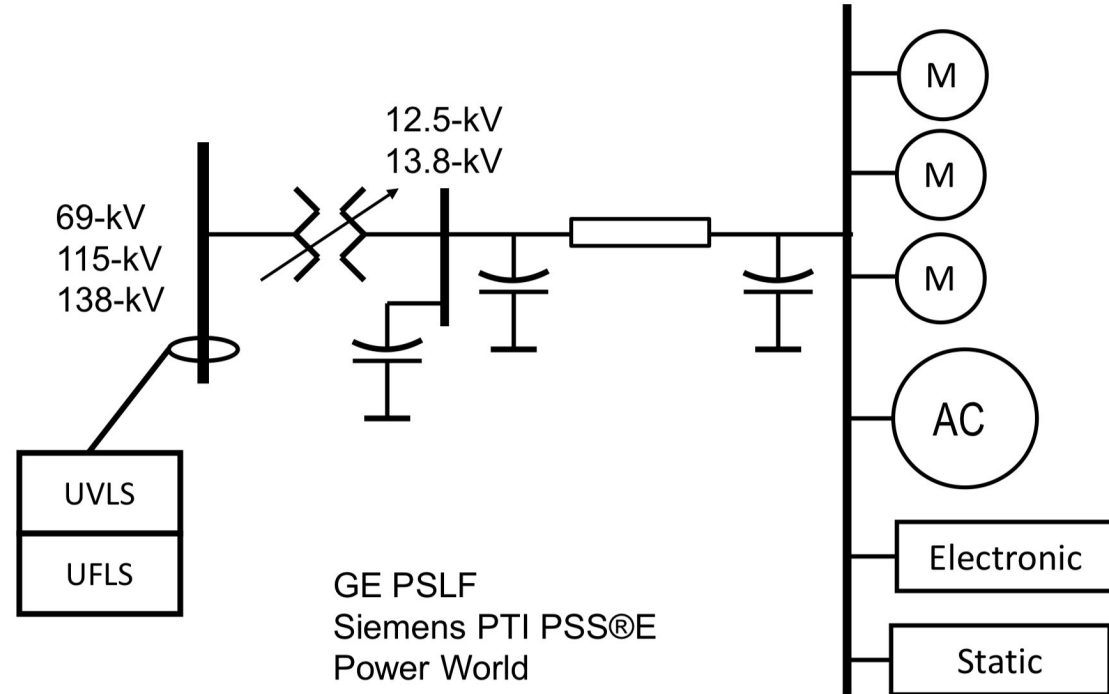
Resilience Planning	Day/week-ahead workforce planning Which poles, cables, etc.need hardening Best locations for assets and protective devices Additional electrical risks 5-days ahead (unexpected impacts / events) Additional physical risks 5-days ahead (unexpected impacts / events)
Situational awareness	Life-safety and property damage risks Fire risk due to pole / cable & pole failure New consequential damage risk (eg. life-safety and property damage) Thermal violations that can cause additional risk or loss of load Best switching settings after predicted pole failure to recover quickly Location of overvoltages to limit ferroresonance during switching Additional physical risks the day of or after Additional electrical risks the day of or after Forecast risks after the event for minimum impact recovery
Pole Inspection	Track/apply data from pole inspections
Vegetation management	Prioritize vegetation management actions related to pole/cable failure

- **Run simulation for tariff evaluation**
 - Compare various tariffs (fixed, TOU, RTP, etc.)
- **Diverse residential models**
 - Housing types (single-family, multi-family, etc.)
 - Appliance/end-use compositions
 - New/emerging end-use loads, programs (DR, DER, EV, etc.)
- **Monte-Carlo runs of cost sensitivity to weather**
 - Range of tariff parameters
 - Normal vs. extreme weather years

- **Smart inverters standards development**
 - Necessary to ensure safe interconnection/operation
- **Needed to ensure system performance**
 - High penetration can impact system performance
- **Simulations needed to validate standards**
 - GridLAB-D can model response up to substation level
- **GridLAB-D simulation support inverters**
 - Needs solar PV, EV charger and battery storage inverter models
 - Simulations verify aggregate response to system events

Joint use cases: Composite Load Model Validation

- Models for bulk system planning studies
- Load data comes from utilities
- Aggregation requires distribution models
- Simulations used to validation models



TAC Question 1: What is your use case prioritization?

SLAC

- 1. Integration Capacity Analysis**
- 2. Locational Net Benefit Analysis**
- 3. Tariff Design**
- 4. Resilience Planning**
- 5. Smart Inverter Standards**
- 6. Load Model Data**

- **Interviews of users (ongoing)**
 - Vendors (data, software, hardware, services)
 - IOUs (California and out-of-state)
 - CCAs
- **Review existing code in GridLAB-D versions extant**
 - Identification of key features needed for California stakeholders
 - Consolidation of issues from current DOE/CEC projects
- **Consolidate DOE and CEC-funded upgrades**
 - DOE started work on V5.0 - next generation of GLD technology
 - CEC V4.2 will be compatible with V5.0 using current GLD technology

- **Input data**

- Availability/sources of required data
- Access controls/credentials
- Portability/standardization of data formats

- **Methodologies**




























- Known/computable methods/models
- Accepted process/validation
- Standardization across utilities

- **Output data**

- Formats of output
- Repositories where data is delivered (if any)
- Access controls/credentials

- **Updates to the GLM format**
 - Reduction of the language used for translation (e.g., MINIMAL spec)
 - Expansion of the language used for modeling (e.g., JSON data)
- **Data pipeline architecture (VADER)**
 - Implements data ingest, clean, storage, and delivery (local or cloud)
- **Cloud data storage (VADER)**
 - Data Lake (e.g., AWS CloudFormation)
- **CIM interface development**
 - Based on PNNL CIM implementation for DOE

User data access: current status

Data Set	Accessible	IOUs	CCAs	Vendors
Distribution Capital Investment	Has been limited; CPUC DRP bringing out new information			
Circuit Capacity (normal)	Available through public filings, but not machine readable			
Circuit Connectivity Models	Several formats with varied conversion to machine readability			
Customer Data (Individual)	Yes, interval varies by meter			
Customer Data (Aggregate)	Yes, to varying degrees			
DER Capacity (existing/queued)	IOUs have some interconnection data, but also lack full insight			
Hosting Capacity	Available, variable granularity			
Distributed Generation Adoption Forecasts	Limited			
Hourly DER Gross Profiles	Varies by technology			

- **GridLAB-D Version 4.2**

- Fork of PNNL Version 4.0 (4.1 is the current DOE dev version)
- Production on 4.2 baseline version is currently underway

- **Performance metrics**

- Development of metrics will be final phase of requirements
- Metrics based on key use-cases, methods, and data I/O

- **Baseline metrics runs on 4.2**

- First performance results expected by late summer
- Measurements taken on multiple platforms

- **Models to test methodologies**

- Standard/public test models (e.g., IEEE-123, IEEE-8500)
- Utility/non-public test models (e.g., SCE, PG&E)
- Known/best-available answers to compare results with

- **Models to test data management**

- Model formats to use (e.g., CIM, Cyme)
- Data sources (e.g., SCADA, AMI, weather)
- Data sinks (e.g., MySQL, GSheets, GSlides, PDF, PNG, S3)
- Test rigs and round robin tests

- **Online documentation**

- Update/refresh of existing feature documentation
- Development of new feature documentation
- “How to” manuals for use cases

- **Online training materials**

- Update online material for general use
- Online courses for main use-cases
- Developer manuals and courses for implemented new use cases

TAC Question 2: What data/models will you share?

- **System models (CIM, Cyme, Synergy, GLM)**
- **SCADA data (any format)**
- **AMI data (any format)**
- **Weather data (any format)**
- **Tariff data/models (any format)**
- **Other data/models**

Let us know what is necessary to share data

Thank you

Contact information:

Matt Tisdale (mtisdale@gridworks.org)

Bo Yang (bo.yang@hal.hitachi.com)

David Chassin (dchassin@slac.stanford.edu)

Backup slides

GridLAB-D Version Timeline

<p>3.2 PNNL (2017)</p>	<p>4.0 PNNL (2018)</p>	<p>4.1 PNNL (2019)</p>	<p>5.0 PNNL (2021)</p>
		<p>4.2 SLAC/Hitachi (2020)</p>	

GridLAB-D development projects: Budget status

	GLOW	HiPAS	OpenFIDO	Total
Hitachi	1,861,881 [1,175,060]	0 [0]	0 [0]	1,861,881 [1,175,060]
SLAC	680,000 [0]	2,740,782 [0]	910,225 [0]	4,331,007 [0]
GridWorks	399,818 [0]	269,999 [0]	39,964 [0]	709,781 [0]
PNNL	58,000 [0]	58,000 [0]	49,811 [0]	165,811 [0]
National Grid	0 [80,000]	0 [300,000]	0 [30,000]	0 [410,000]
Total Budget	2,999,699 [1,255,060]	3,068,781 [300,000]	1,000,000 [30,000]	7,068,480 [1,585,060]
Current spent as of 2/2019	252,000 (8.4%) [103,364] (8.2%)	266,100 (8.7%) [0] (0.0%)	34,500 (3.5%) [0] (0.0%)	552,600 (7.8%) [103,364] (6.5%)

Notes:

1. Quantities in [] brackets indicate cost share and/or matching funds