GRIDWORKS

# ENHANCING GRIDLAB-D: LAUNCH WORKSHOP

## IN-PERSON WORKSHOP

### SEPTEMBER 7TH, 2018

### 1111 BROADWAY, OAKLAND CA

# Agenda

**9:00** Welcome/Introductions

**9:15** Project Overview (David Chassin, SLAC), including;
- Goals for the TAC
- TAC Schedule

**9:45** Facilitated Discussion of Use Cases and Related Modeling Tools, including:
- How GridLAB-D is used now and may be tailored to best achieve future CPUC goals;
  - *Goal: Identify Probable Near-, Medium-, and Long-term GridLAB-D Use Cases*
- How TAC members engage with grid modeling tools now;
  - *Goal: Identify what about existing tools works and what could work better with help form GridLAB-D*

**10:45** Deep-dive on how Hitachi will engage TAC members to help design a new GridLAB-D user interface (Bo Yang, Hitachi)

**11:45** Next Steps

**12:00** Adjourn

# Introduction and Purpose

Roll call

TAC Commitment Letter

# GridLAB-D TAC Meeting 1

7 September 2018

EPC 17-043          EPC 17-046          EPC 17-047
**GLOW**              **HiPAS**

**OpenFIDO**

# Presentation Overview

**1.**      **Program Overview**

- TAC mission/schedule/members
- Project teams
- Motivation, benefits, & objectives

**2.**      **Technical Approach**

- Perspective/architecture/GridLAB-D
- GLOW
- HiPAS
- OpenFIDO

**3.**      **Budget and Timeline**

- Timeline/coordination
- Budget overview

**4.**      **Consortium Planning**

- Motivation
- Challenges
- Success stories

# Project Teams & Key Staff

## Hitachi America Labs

- Dr. Bo Yang (GLOW PM)
- Sadanori Horiguchi
- Dr. Yanzhu Ye
- Sumito Tobe

## Stanford/SLAC

- Dr. David Chassin (HiPAS/OpenFIDO PM)
- Dr. Chin-Woo Tan (HiPAS/OpenFIDO DPM)
- Alyona Ivanova (modeling and validation)
- Berk Serbetcioglu (performance tools)
- Supriya Premkumar (user interface APIs)

## Gridworks

- Matthew Tisdale
- Alex Smith

## Battelle/PNNL

- Dr. Tom McDermott (OpenFIDO)
- Jason Fuller (HiPAS/GLOW)

## National Grid

- Dr. Pedram Jahangiri

# TAC Mission

## One Coordinated TAC for All Three Projects

| Participant | What they bring |
|---|---|
| CPUC | Expert in policy context which will define current and future needs |
| DOE | Expert in GridLAB-D applications and ongoing-R&D |
| Utilities | Expert in GridLAB-D's role in grid analytics, past, present and future |
| DER Vendors | Expert in current and future use-cases for GridLAB-D; future users |
| Environmental NGOs | Independent outside perspective, anticipating future needs |

# TAC Members

## Government

- Justin Regnier (CPUC)
- Eric Lightner (US DOE)

## Industry/Vendors

- Audrey Lee (Sunrun)
- Jim Baak (STEM)

## Public Interest

- Merrian Borgeson (NRDC)
- Davianna Olert (EDF)

## Industry/Users

- Kristen Brown (ComEd)
- Tom Russell (PG&E)
- Aram Shumavon (Kevala)
- Pedram Jahangiri (National Grid)
- Raul Perez-Guerrero (SCE)
- Rachel Huang (SMUD)

# TAC Schedule

| Date | Milestone |
| --- | --- |
| September 6 + 7 , 2018 | Workshop and TAC Meeting |
| September - October | One-on-one Interviews with Project Leads and TAC Members |
| Annual September Meetings | TAC Convened Annually for Project Update and Input |
| Ad hoc | Additional TAC engagement as project needs arise |

# Program Overview

**Programmatic effort to support decision of Commissioner Picker of 2/25/18**

## GridLAB-D Open-source Workspace (GLOW - EPC 17-043)

- General user interface for GridLAB-D
- Focus on use-cases in Grid Modernization investments

## High-Performance Agent-based Simulation (HiPAS - EPC 17-046)

- High-performance simulation in GridLAB-D
- Focus on supporting DRP Tracks 1 (Tools) proceeding use-cases

## Open Framework for Integrated Data Operations (OpenFIDO - EPC 17-047)

- Energy data interoperability for California (CPUC, utilities, consultants, etc.)
- Focus on support of DRP Track 2 (Data Access Portal) use case

# Motivation

**Vision for all three projects**

- Enable DRP user-cases (see Com. Picker Decision, R.14-08-013) analysis using GridLAB-D

- Support and leverage California leadership in renewable integration and adoption

- Focus GridLAB-D R&D community on California's electricity system needs

- Establish basis for long-term support of GridLAB-D in California

**Address critical modeling tool needs in California**

- A user-interface for GridLAB-D (GLOW)

- High-performance modeling and simulation in GridLAB-D (HiPAS)

- Data interoperability for system planning and operation studies (OpenFIDO)

# Project Benefits/Impacts

## Anticipated benefits

- Shorten time/cost, while increasing transparency, of DRP analysis activities

- Get ahead of future grid modeling issues in California

- Create lasting impact through more usable versions of GridLAB-D

- Enable high levels of DER, DR and EV technology in distribution systems

## Highlights of Kick-off Benefits Questionnaire

- Enable stakeholder insight into dynamic optimization of grid operations and resources

- Feeds 14+ CPUC rulemakings; impact on CEC policy-making, utility planning, DER integration

- Bridge to other grid modeling tools (OpenFIDO) and increase computational power (HiPAS)

# Technical Perspective

**GridLAB-D basis for modeling and simulation work**

- GLOW focus on use-cases for user interface for modeling and simulation

- HiPAS focus on latest high-performance and scalable solver technology

**Platform for data integration with other tools (OpenFIDO)**

- Compatibility with tools used widely in California

- Emphasis on standards-based formats (e.g., CIM)

- Support for modern high-performance storage technology (cloud, triple-store)

- Support for entire data pipeline including models, weather, AMI, SCADA, etc.
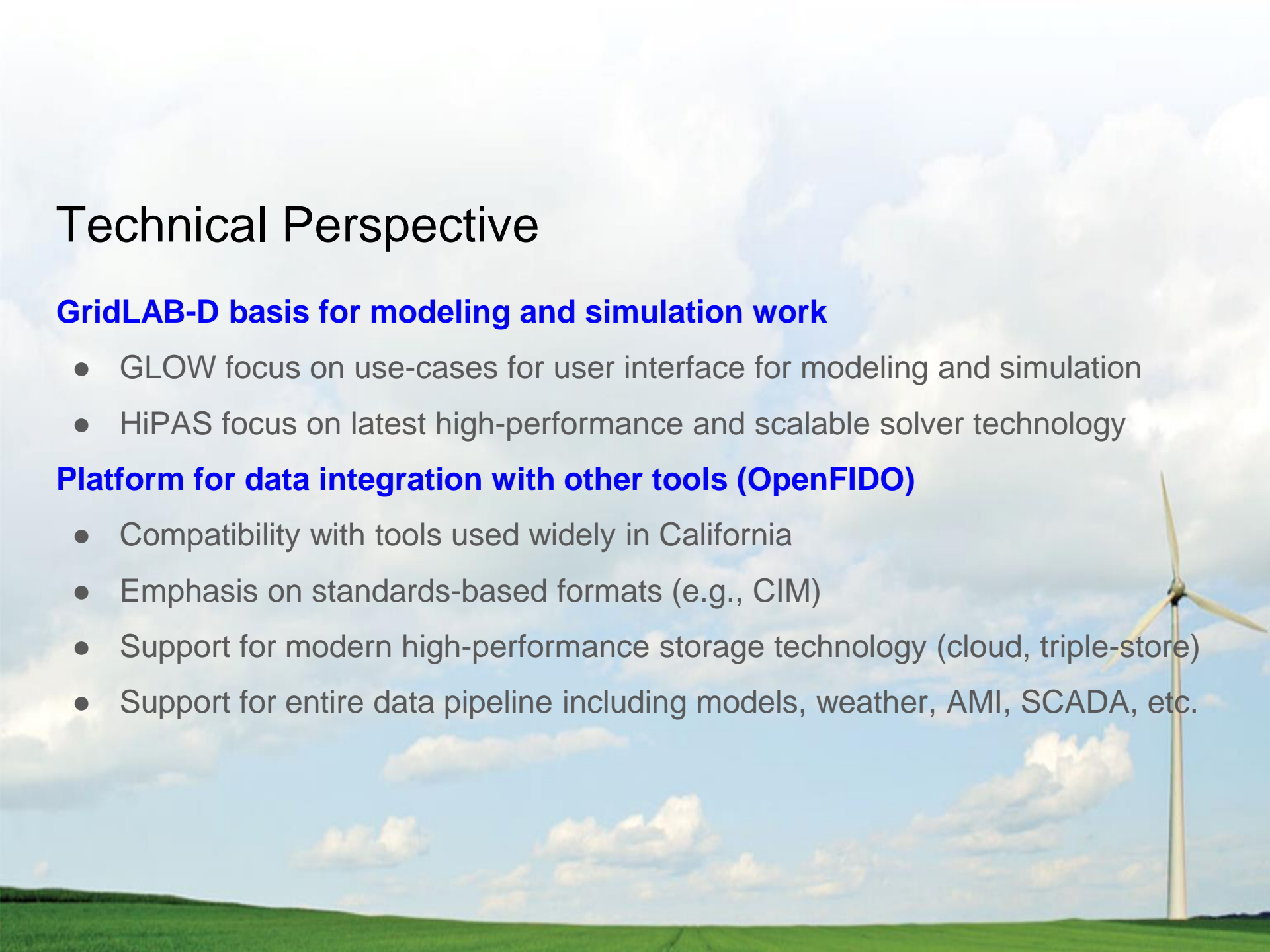
# GridLAB-D

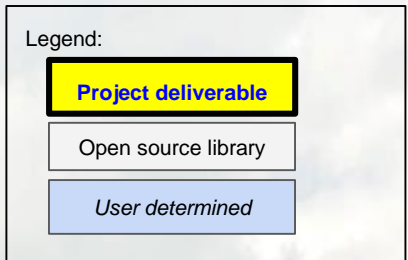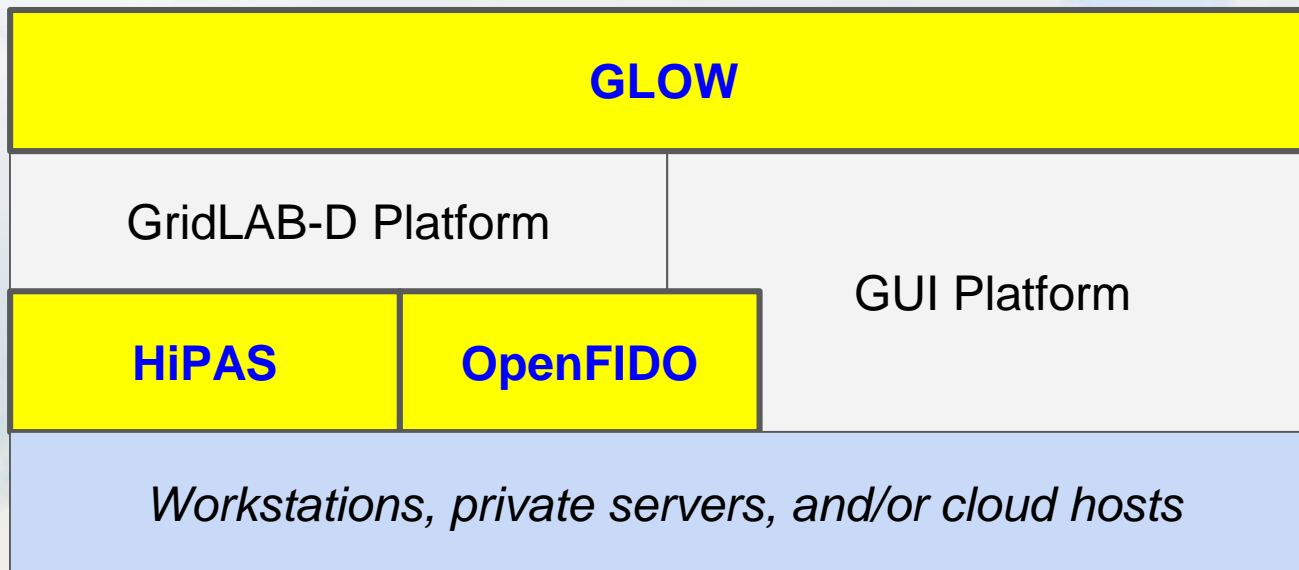**DOE-funded development since 2003**

- Open source since 2007
- 100,000 downloads
- International user-base

**Multi-domain support (power, buildings, markets, DERs, dynamics)**

- Solves resource integration problems (e.g., DR, EVs, FIDVR)
- Unique agent-based approach to solving grid integration problems
- Test use-cases by simulation before going into the field

# System Architecture

**GLOW**

GridLAB-D Platform

GUI Platform

**HiPAS**

**OpenFIDO**

*Workstations, private servers, and/or cloud hosts*

Legend:

**Project deliverable**

Open source library

*User determined*

# GLOW (Hitachi)

1. **Software specification**
- Human-machine interaction, information architecture, visual design; Representative use cases (workflow), I/O requirements, **UI support for OpenFIDO/HiPAS**

1. **Software development**
- Fast prototype, agile development, early integration with GridLAB-D, automatic testing environment

1. **Software testing**
   a. Alpha - Functionality, interface with GridLAB-D/OpenFIDO/HiPAS, comply to standard testing process
   b. Beta - Quality, robustness and performance
   c. Usability testing - Ease of use, UI flexibility, overall system performance

2. **Software release**
- Coordinated release with OpenFIDO/HiPAS/GridLAB-D

1. **Maintenance**
- In project + 5 yr post project

# HiPAS (SLAC)

**1. Multithreaded iterators**

- Deploy highly granular parallelization within the structure of GridLAB-D models.

**2. Job control**

- Enable large-scale batch runs of parametric models for distribution planning studies.

**3. Multithreaded solvers**

- Enable fast simulations by running independent agent solutions in parallel.

**4. Stochastic properties**

- Allow representation of correlated properties to reduce the number of batch runs needed to complete planning studies.

**5. Large data access**

- Enable high-performance simulations when using large amount of data (e.g., SCADA, AMI).

**6. Fast powerflow solvers**

- Implement a machine learning-based solvers to reduce overall simulation runtime.
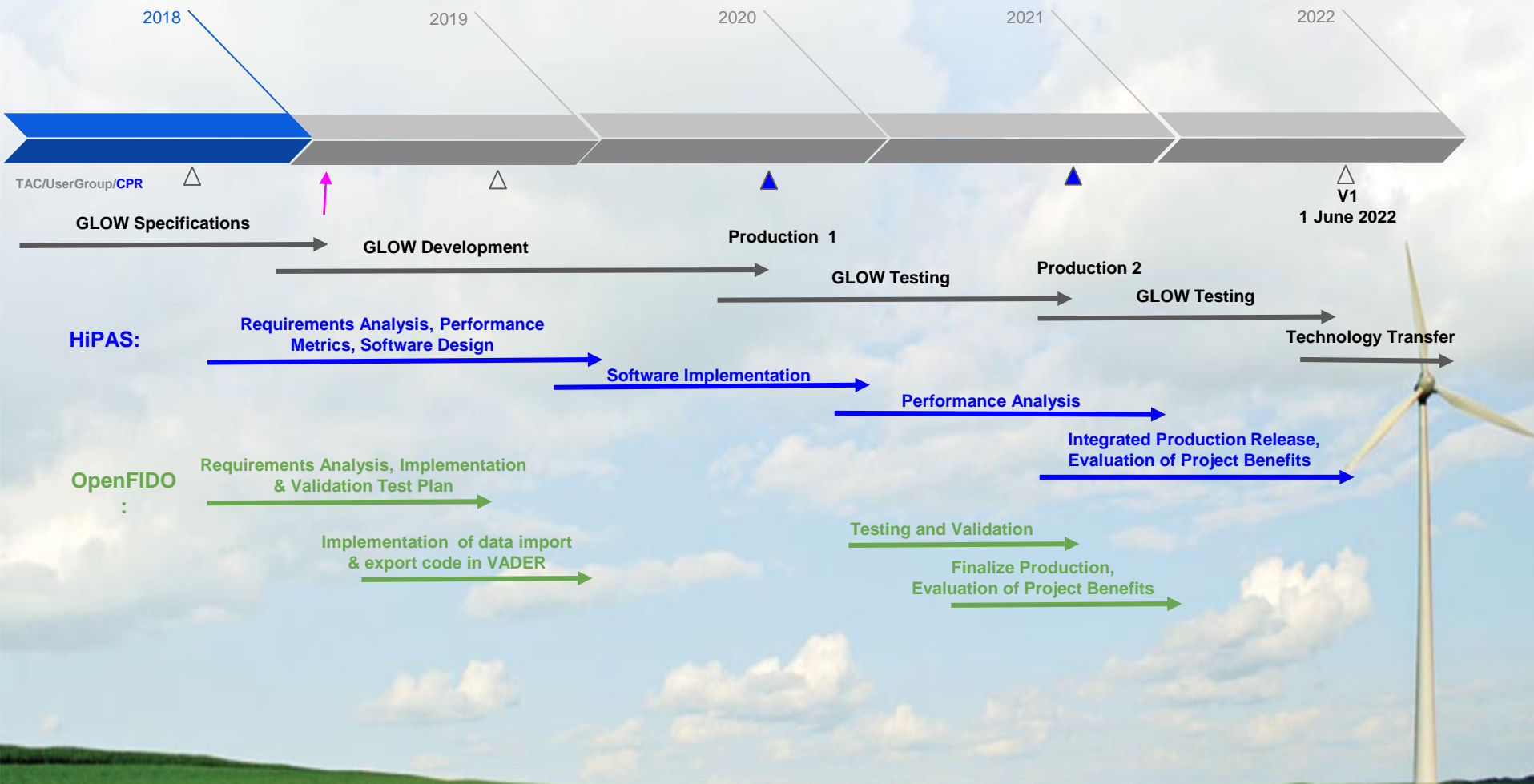
# OpenFIDO (SLAC)

1. **Technical Approach**

   a. Data import, interchange, storage and export of system data between tool users using VADER

   b. Focus on data exchange for IOUs, CPUC, vendors and DRP use-cases

   c. Implementation activities supporting GridLAB-D (coordination with HiPAS and GLOW)

2. **PNNL Activities**

   a. Webinars on CIM modeling capabilities from DOE

   b. Engage vendors in building data exchange platform

   c. Testing/validation based on feeder models from IOUs

# Project timeline and coordination



2018  2019  2020  2021  2022

TAC/UserGroup/CPR

V1
1 June 2022

**GLOW Specifications**

**GLOW Development**

**Production 1**

**GLOW Testing**

**Production 2**

**GLOW Testing**

**Technology Transfer**

**HiPAS:**

Requirements Analysis, Performance Metrics, Software Design

Software Implementation

Performance Analysis

Integrated Production Release, Evaluation of Project Benefits

**OpenFIDO:**

Requirements Analysis, Implementation & Validation Test Plan

Implementation of data import & export code in VADER

Testing and Validation

Finalize Production, Evaluation of Project Benefits

# Budget Overview

| | GLOW | HiPAS | OpenFIDO | Total |
|---|---|---|---|---|
| **Hitachi** | 1,861,881 [1,175,060] | 0 | 0 | **1,861,881 [1,175,060]** |
| **SLAC** | 680,000 | 2,740,782 | 910,225 | **4,331,007** |
| **Gridworks** | 399,818 | 269,999 | 39,964 | **709,781** |
| **PNNL** | 58,000 | 58,000 | 49,811 | **165,811** |
| **National Grid** | [80,000] | [300,000] | [30,000] | **[410,000]** |
| **Total** | **2,999,699 [1,255,060]** | **3,068,781 [300,000]** | **1,000,000 [30,000]** | **7,068,480 [1,585,060]** |

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

# GridLAB-D Consortium

## Motivations

- Support of collaboration-based development

- Guaranteed code contribution after projects

- Timely support for future users and developers

- Outreach to further expand user groups

## Challenges

- Value propositions to interested entities

- Initial funding and program guidance

- Governance and operating principles

## Success stories

*Linux foundation*

Mission: accelerate open source technology development and adoption

Overview: Founded in 2000 / 1000+ corporate member / 85 projects / 16B USD shared development efforts

Services: Hosting OSS projects / trainings / events / Standards

*Hyperledger Fabric*

Mission: Open source collaborative efforts to advance blockchain technologies

Overview: Launched in 2016 / ~200 corporate and associate members

Services: Create enterprise grade software framework and code basis / community-driven infrastructure support / Build technical use cases / Outreach and education

# Questions and Discussion

# Facilitated Discussion of Use Cases and Related Modeling Tools

How GridLAB-D is used now and may be tailored to best achieve future CPUC goals;

- *Goal: Identify Probable Near-, Medium-, and Long-term GridLAB-D Use Cases*

# Facilitated Discussion of Use Cases and Related Modeling Tools

How TAC members engage with grid modeling tools now;

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# HITACHI
## Inspire the Next

# GLOW
## UI DEVELOPMENT
### A Human-Centered Design Approach

Design Lab

R&D Division, Hitachi America, Ltd.

# HITACHI
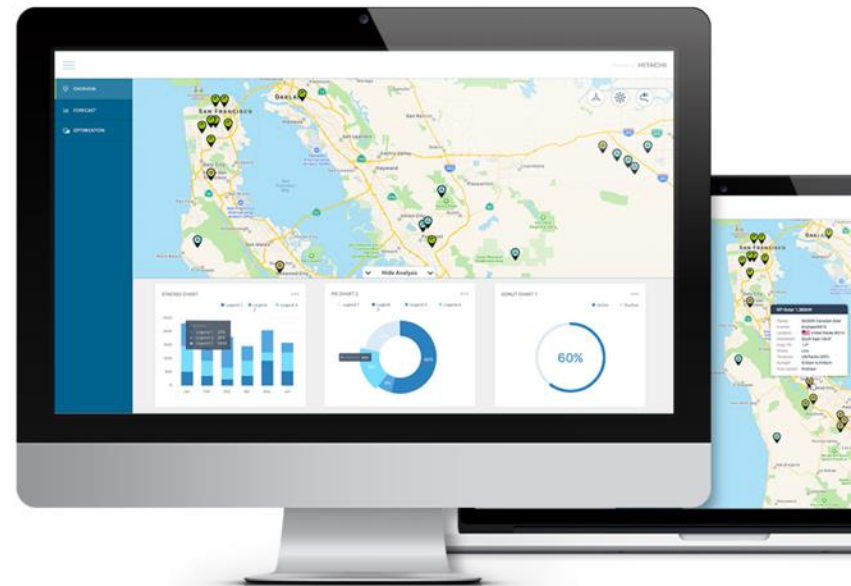## Inspire the Next

## Contents

1. What is going on?

2. Why should we use a Human-Centered Design approach?

3. How does this even work?

4. Does this apply to *us* though?

5. We can do this!

6. So…now what?

# 1. What is going on?

# 1 Introduction

We are developing a **Graphical User Interface** for **GridLAB-D Open Workspace** using a

**Human-Centered Design** approach



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# 2. Why should we use a Human-Centered Design approach?

# 2 Rationale for Human-Centered Design

This is the **standard** approach for design by many successful companies

(not just for graphical interfaces, but also designing solutions):

# 2 Rationale for Human-Centered Design

Facebook has used Human-Centered Design to surpass competitors like MySpace.

**2005**

**2018**

# 3. How does this even work?

# 3 How to do Human-Centered Design

Focus on the **user foremost:**

**Research -**
Study **users** to understand their **context** and build **empathy**



**Evaluate -**
Test solutions with **users**





**Design -**
Create initial ideas for **solutions**



**Improve -**
Use **feedback** and observations to **polish** design

# 4. Does this apply to *us* though?

# 4 Do tools for professionals need Human-Centered Design?



After all, **professionals'** needs are different from normal consumers…

Answer: **YES!**



Who else uses **Human-Centered Design**? NASA Ames set up the Human-Centered Systems Lab group to improve mission safety and efficiency such as designing interfaces combining displays, decision support tools, and automation.



The US Department of Health and Human Services established **www.usability.gov** to promote its use in government and the private sector.

# 5. We can do this!

# 5 Hitachi's Experience



**Case Study:**
**Hitachi Automation Director**

## Method:
**Ethnography** in a data center to find requirements for the **future** of IT management software. Ideation workshops and validation interviews led to design constraints

## Finding:
Automation would be a key requirement in the future, but in order to adopt it, operators needed clear explanations of what was being automated and how.

## Result:
Developed IT management automation software that was acceptable and adoptable by operators

# 6. So…now what?

**Without** Human-Centered Design



**With** Human-Centered Design

## What do we need to be successful?

# YOUR PARTICIPATION!

# 6 Participation Needs

## So what do we need from you?

We would love to have **1 - 2 engineers** and **1 manager per power company** that we can interview and get demonstrations for **90 minutes per person on-site**.

We also would really like to have **1 - 2 technical leads** and **1 manager from CPUC**.

We will have questions around the topics of:

**Current tools & context**

- Process
- Environment
- Interactions
- Technical requirements
    - I/O requirement
    - Data format
    - Computational performance

**Future needs (use cases)**

- Policy outlook
- Impact of environmental changes

**HITACHI**
**Inspire the Next**

## END

## GLOW UI Development

A Human-Centered Design Approach

09/07/2018

Design Lab
R&D Division, Hitachi America, Ltd.

# Discussion

Questions?

# Next Steps

**Recap**

**Upcoming meetings**