

# Grid Modernization Initiative

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# At a Glance

Developing the tools and technologies to measure, analyze, predict, protect, and control the grid of the future

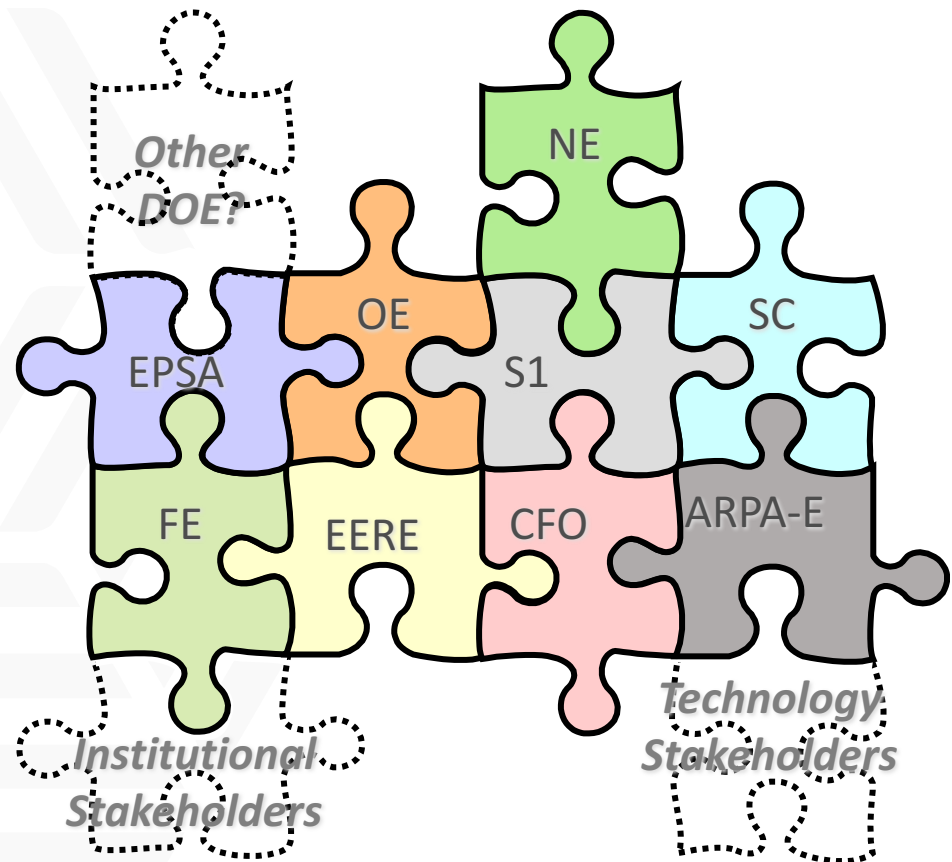


- ▶ Grid Modernization Initiative: Why is it important and how did we get here?
  - Grid Modernization Multi-Year Program Plan (MYPP)
  - Grid Modernization Laboratory Consortium (GMLC)
  - \$220M Grid Modernization Lab Call – Foundational vs Program Specific Projects
- ▶ Success Stories to Date
- ▶ Next Steps: External Peer Review Meeting April 18<sup>th</sup> – 21<sup>st</sup>

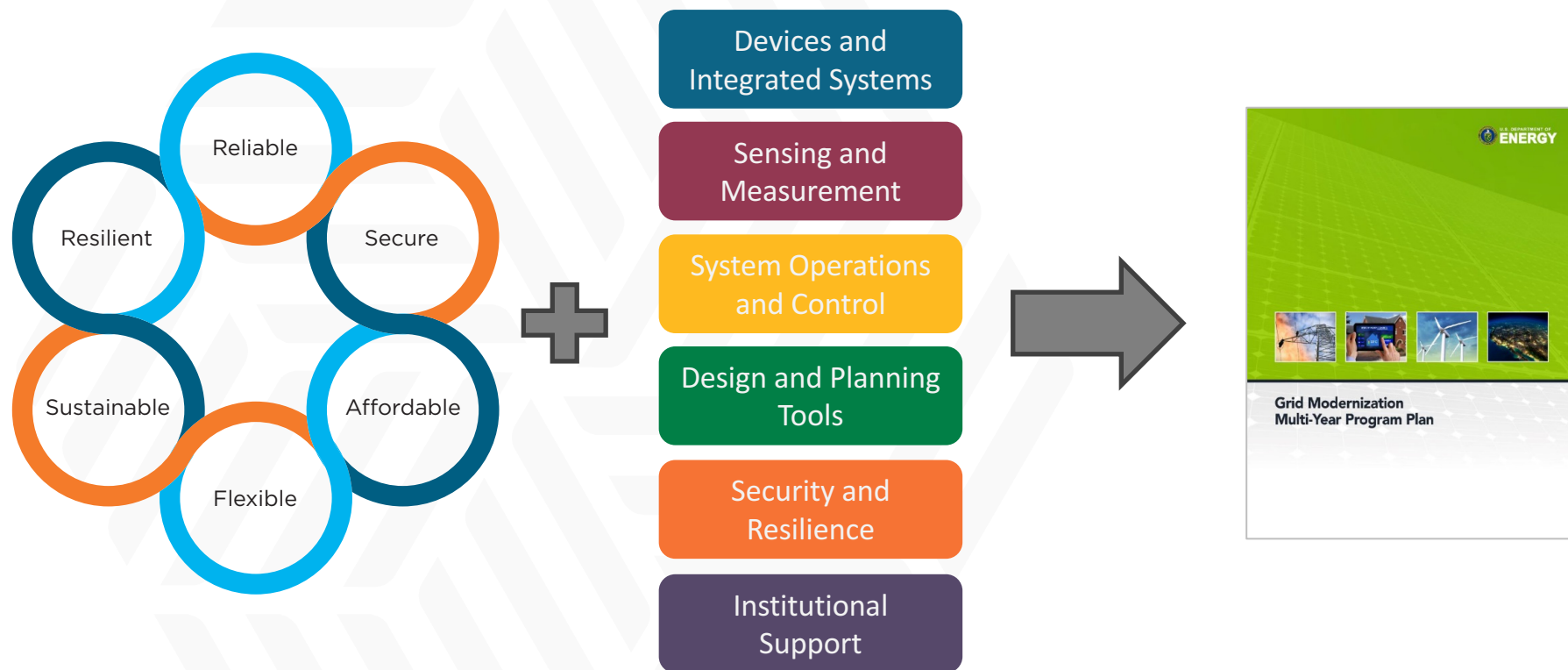
# Grid Modernization Initiative

An aggressive and urgent five-year grid modernization strategy for the Department of Energy that includes

- Alignment of the existing base activities among the Offices
- An integrated Multi-Year Program Plan (MYPP)
- New activities to fill major gaps in existing base
- Development of a laboratory consortium with core scientific abilities and regional outreach



# Grid Modernization Initiative Approach



# Grid Modernization Laboratory Consortium



*Move from a collection of DOE and lab projects to a DOE-Lab Consortium Model that integrates and coordinates laboratory expertise and facilities to best advance DOE Grid Modernization goals.*

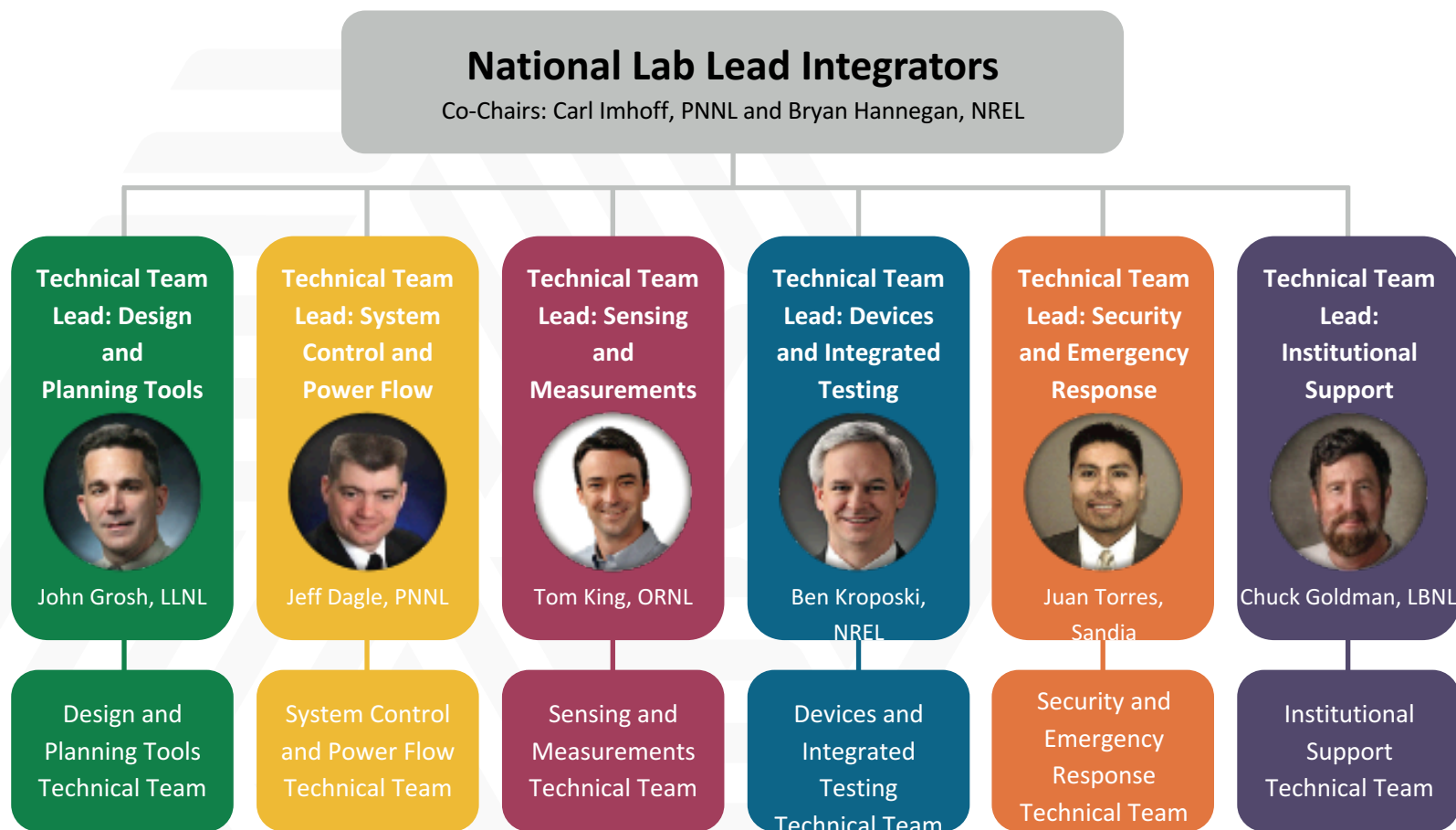
Efficiency, Synergy, Collaboration, Acceleration



**GRID**  
MODERNIZATION  
LABORATORY  
CONSORTIUM  
U.S. Department of Energy



# GMLC Structure Supporting the MYPP



*Lab leads coordinate teams and projects across the GMLC to ensure DOE and the national laboratories are meeting the goals in the multiyear plan.*

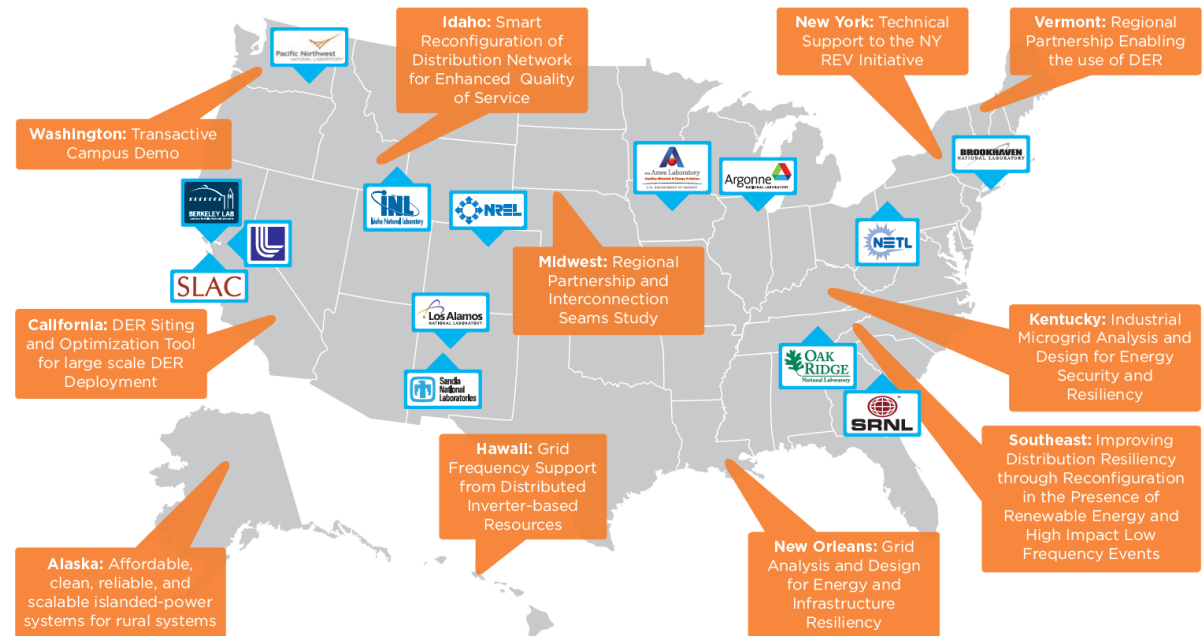
# Grid Modernization Lab Call

## Working across the country



### • Grid Modernization Lab Call

- January 2016
- \$220M over three years
- 13 national laboratories
- 88 projects
- 100+ partners



# A Sample of our Project Partners



- *Category 1: Foundational Activities.* These projects addressed challenges that are faced by multiple offices that need to be addressed in a coordinated fashion. The GMLC developed larger, multi-lab, holistic proposals that address well-defined activity areas in the Grid Modernization Multi-Year Plan. Examples include:
- **Metrics and Baseline:** fundamental metrics to guide and evaluate national progress in grid modernization;
  - **Grid Architecture:** future grid and industry design elements to guide consideration of new industry paradigms;
  - **Interoperability:** standards and protocols for interoperability and testing of all grid devices from high voltage to customer premises;
  - **Valuation:** a consensus framework for valuing emergent grid technologies and services; and
  - **Sensing and Measurement Strategy:** a strategy for observing and monitoring the future grid system in a way that meets expectations for predictive control, real-time operations and security.

# Grid Modernization Lab Call

## Program Specific Activities



- *Category 2: Program Specific Activities.* Using the framework of the Grid Modernization MYPP, the program offices have developed “Program Specific” lab call topics that address their specific requirements for grid modernization, not covered specifically in the Foundational Platform Activity Topics. Examples include:
- **Transactive Campus Demonstration:** Design, implement and test transactive control technologies to coordinate building loads and distributed energy resources (DERs) to demonstrate methods that enable significant energy savings, increased distributed renewable generation, and coordination of loads and DERs at scale.
  - **NARIS:** This *National Renewable Integration Study* will examine the impact of 35% annual renewable penetration (70% instantaneous) challenges in the three continental US interconnections. It will develop tools for integrated stability and production simulation analysis that address Grid Modernization goals of improved planning tools over a broad range of time scales.
  - **Virtual Energy Storage:** Existing residential and commercial building infrastructure, such as water heaters, refrigerated warehouses, and air conditioning units, are possible energy management resources, with potential flexibility in the timing of their power consumption. This project will investigate a software-based solution for existing infrastructure to serve as a lower-cost, smaller-scale virtual storage resource.

# Examples of State Technical Assistance Activities



- ▶ **Integrated Distribution System Planning**
  - Developed best practices document for the MN Public Utilities Commission
    - Examines analyses required for DER integration (hosting capacity, interconnection, valuation)
  - Establishing a PUC Distribution Planning Advisory Group formed with NARUC to investigate and address distribution system planning needs (includes training)
- ▶ **Working with several commissions to develop requirements for distribution planning, grid operations and market operations to enable the utilization of DERs**
  - Includes considerations for implementing advanced grid functionality, including core components, such as communication networks
  - See: [www.doe-dspx.org](http://www.doe-dspx.org)
- ▶ **Provide performance and benefits information on technologies deployed through Recovery Act, e.g.,**
  - Advanced metering infrastructure (smart meters)
  - Distribution automation technologies (volt/var optimization; automated feeder switching and outage recovery, asset management)
- ▶ **Commissioned the Future Electric Utility Regulation Series**
  - Topical reports written by experts on current issues, such as considerations for planning, markets, fixed-cost recovery and performance-based regulation in a high-DER future
  - See: <https://emp.lbl.gov/future-electric-utility-regulation-series>
- ▶ **Additional pursuits include:**
  - Application of system architecture to determine coordination, communication and control requirements for a distributed grid (See: <http://gridarchitecture.pnnl.gov/> )
  - Cyber security guidelines

# Midwest Interconnection Seams Study

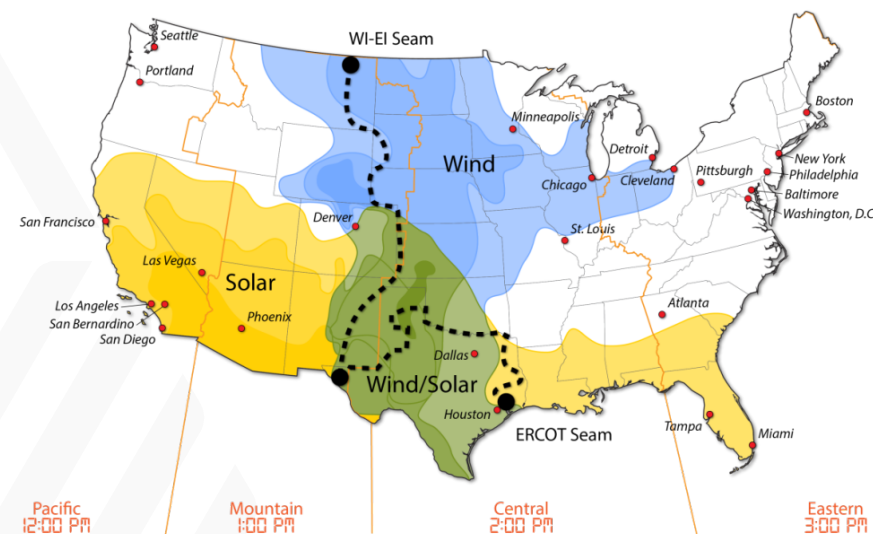
**Research focus:** Determine value of expanding the transfer capacity between the Eastern and Western Interconnections (EI and WI) under various configurations.

## Project Accomplishments

- 2 in-person technical review committee meetings with 40 participants
- 4 scenarios selected for transmission and generation expansion, with assumptions and potential sensitivities identified
- Weather analysis completed; 4 TB of wind and solar data distribution
- Research timeline for modeling activities completed and approved; co-simulation method identified

## Next Steps

- Conduct capacity expansion analysis
- Test production cost models
- Perform AC power flow and N-1 contingency analysis



*Three coordinated modeling tools will be used to calculate the value of expanding the interconnectivity of the interconnections: capacity expansion, production cost, and AC power flow.*

# Grid Analysis and Design for Energy and Infrastructure Resiliency for New Orleans

**Research focus:** Supports NOLA's resilience goals by using advanced grid modeling design tools to develop cost-effective, grid resilience enhancements for NOLA and the surrounding region.

This project focuses on enhancing the resilience of the grid as part of the broader energy infrastructure.

## Key Activities

- Infrastructure impact modeling and analysis
- Design and integration study of grid modernization options
- Resilience cost/benefit analysis
- Transactive control feasibility
- Final report to inform resilience prioritization plan which includes microgrid territories (see image)

## Expected Benefits

- Better understanding of infrastructure and community resilience subject to grid performance in NOLA
- Set of risk-informed, cost-effective recommendations for grid enhancements that improve NOLA community resilience
- Conceptual designs utilized by NOLA, Entergy, and other cities to prioritize energy infrastructure improvement options



## Partners

- City of New Orleans
- Sewerage and Water Board of New Orleans
- Entergy New Orleans
- US Army Corps of Engineers
- 100 Resilient Cities

# DER Siting and Optimization tool to enable large scale deployment of DER in California

**Research focus:** To create a 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.

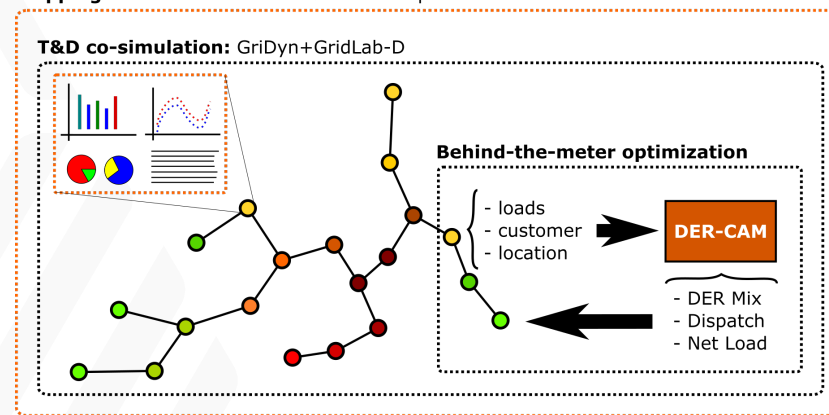
## Key Activities

- Integrated planning tool software prototype
- Completion of a demonstration case
- Application of the tool in different policy scenarios
- Development of market concepts for DER
- Documentation and Outreach

## Expected Outcomes

- 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)

**Mapping and Data Visualization:** Heatmaps + Nodal results



## Partners

California PUC, Pacific Gas and Electric (PG&E), Southern California Edison (SCE), Metropolitan Council of Governments, New York State Energy Research and Development Authority (NYSERDA)

# GMI Annual Peer Review

## April 18<sup>th</sup> – 21<sup>st</sup> (Sheraton Pentagon City)



### ► Day 1 (Tuesday, April 18<sup>th</sup>)

- 9:00 – 9:30 am WELCOME – DOE Leadership (Pat Hoffman, Steve Chalk)
- 9:30 – 10:00 am KEYNOTE (Video from the Hill, High Level Utility/ISO)
- 10:00 – 10:45 am Utility Panel
- 11:00 – 11:45 am Vendor Panel
- 11:45 am – 12:30 pm State/Local Panel
- 12:30 – 1:30 pm Lunch
- 1:30 – 3:00 pm GMLC Tech Leads – Discuss DOE Portfolio
- 3:15 – 5:00 pm Poster Session (all 88 projects)

### ► Confirmed Speakers

- Andy Ott: CEO PJM
- Juan DeBedout: CTO GE Energy Connections
- Bud Vos: CEO Enbala

### ► Reaching out to NRECA, EEI, APPA, NARUC, NASUCA, and others

# GMI Annual Peer Review

April 18<sup>th</sup> – 21<sup>st</sup> (Sheraton Pentagon City)



- ▶ Days 2 and 3 (Wednesday and Thursday, April 19<sup>th</sup> – 20<sup>th</sup>)
  - Focus on External Peer Review
  - Discussion of each of the 30 Foundational Projects organized in six technical areas
  - Lab lead will provide context for the entire portfolio (across the 88 projects) for each of the six technical areas