Grid Modernization Initiative:
Grid Modernization Lab Call Update

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Why Grid Modernization?

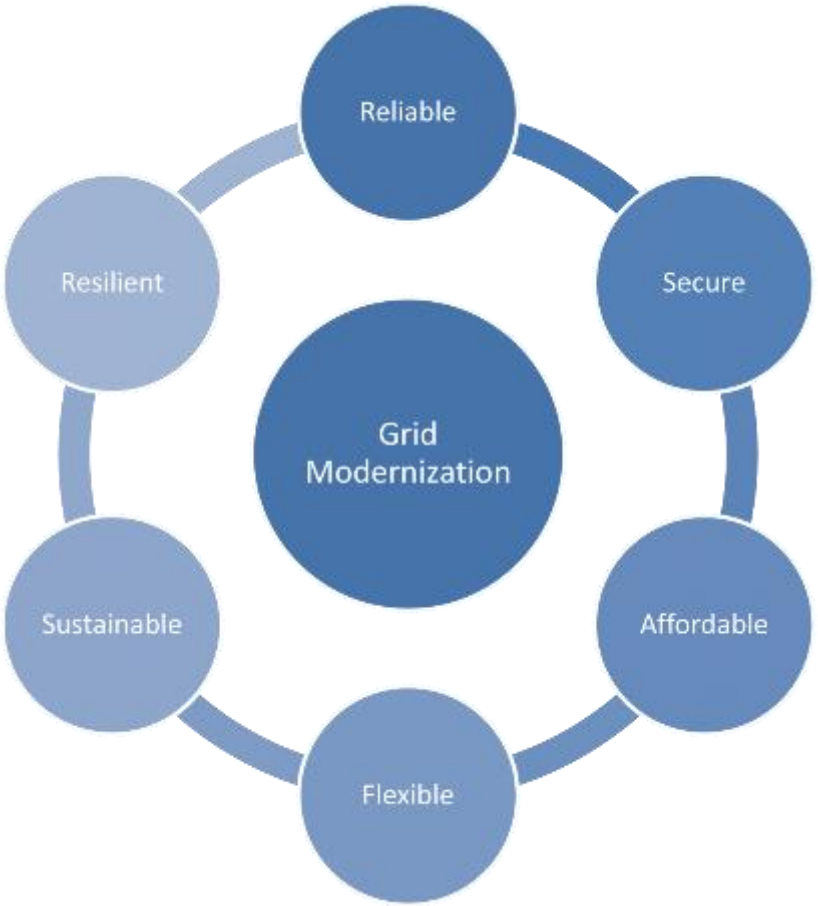
The existing U.S. power system has served us well…

but our 21st Century economy needs a 21st Century grid.

Grid Modernization Initiative

The vision of DOE's Grid Modernization Initiative (GMI) is:

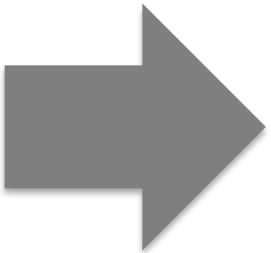
- A future grid that will solve the challenges of seamlessly integrating conventional and renewable sources, storage, and central and distributed generation.
- The future grid as a critical platform for U.S. prosperity, competitiveness, and innovation in a global clean energy economy.
- A future grid that will deliver **resilient, reliable, flexible, secure, sustainable,** and **affordable** electricity to consumers where they want it, when they want it, how they want it.



The MYPP Advances the QER and QTR findings and state and regional needs

Drivers of change as identified in the QTR

- Changing Electricity Supply Mix
- Growing Threats to Resilience and Reliability
- New Market Opportunities for Consumers
- Information and Control Technologies
- Aging Infrastructure



Grid MYPP is a major deliverable of the QER

- Devices and Integrated System Testing
- Sensing and Measurement
- System Operations, Power Flow, and Control
- Design and Planning Tools
- Security and Resilience
- Institutional Support

GMI Will Have National Impact

Drivers of change

- Changing Electricity Supply Mix
- Threats to Resilience and Reliability
- New Market Opportunities for Consumers
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- Aging Infrastructure

MYPP

- Devices and Integrated Systems
- Sensing and Measurement
- System Operations and Control
- Design and Planning Tools
- Security and Resilience
- Institutional Support

Regional Demonstrations

- Low Reserve Margin Demo
- Clean Distribution Feeder
- Grid Analytics Platform

Modernized Grid

Our path to a modernized grid to power American leadership in the 21st Century

DOE Grid Modernization Lab Call for FY16

- ***Category 1: Foundational Platform Activities: 29 Projects***
  - Fundamental Analysis
  - Core Activities
  - Pioneer Partnerships
  - Technical Areas
  - ***Proposals coordinated across the GMLC-National Laboratory complex***
- ***Category 2: Program Office Specific Activities***: 59 Projects
  - Topics that address their specific requirements for grid modernization
  - ***Proposals solicited under a traditional open lab call competition***.

Our Project Partners

Total Numbers and Representative List of Logos

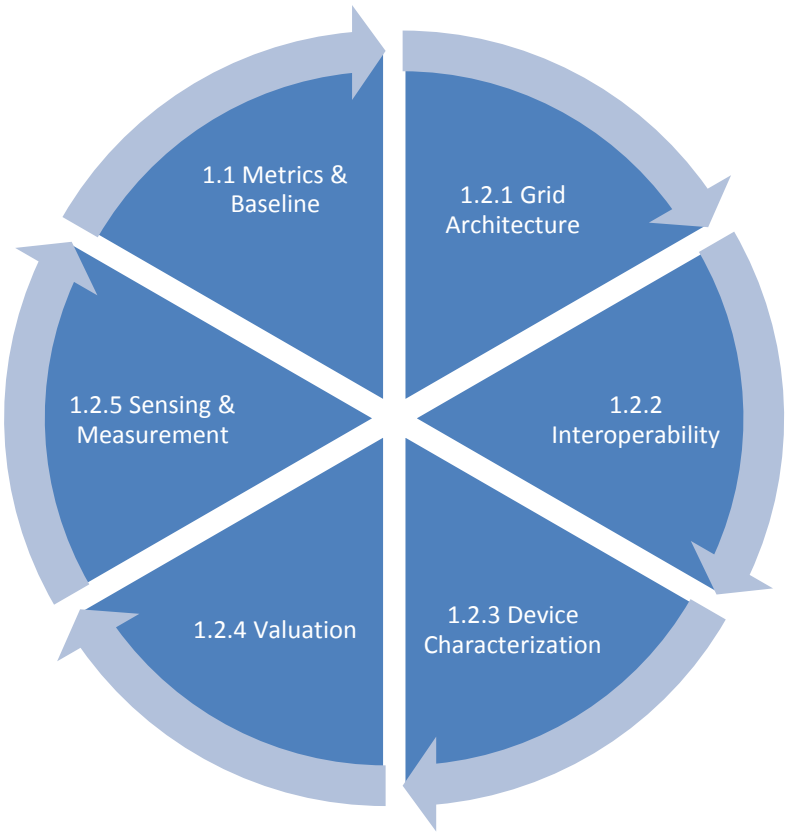
24 Utilities and Power Producers
10 RTO/ISO and Reliability Orgs
25 Tech Developers and Vendors
15 Universities and Research Institutes
9 Federal Agencies

6 State Agencies and PUCs
15 Industry and Professional Associations
5 Policy and Regulatory Associations
14 Standards Bodies and Testing Companies

Core Activities

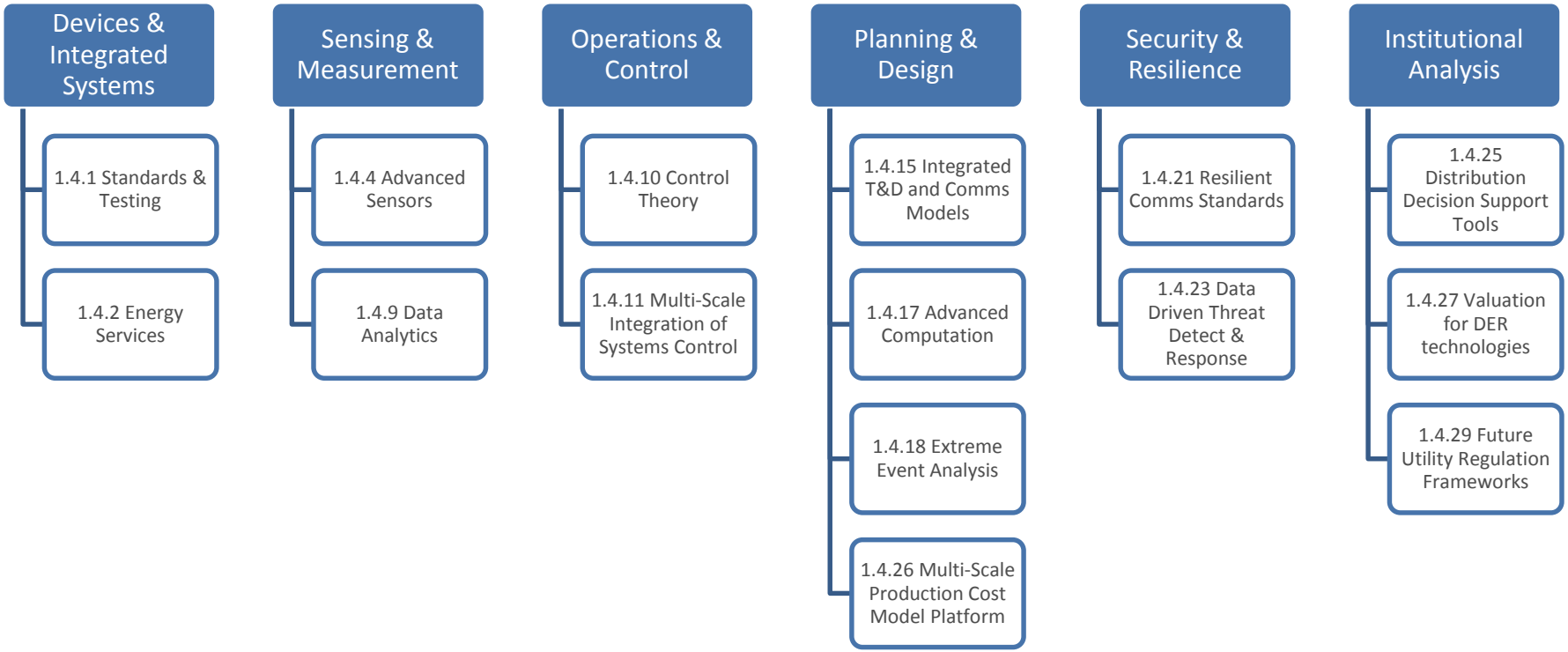
The Foundational Research projects provide the fundamental knowledge, metrics, and tools needed to support all the Cross-Cut R&D and regional partnerships. They provide the framework to enable an integrated DOE grid modernization strategy, including:

- ***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;
- ***Device Characterization***: an integrated testing network that spans the National Labs as well as industry and academia;
- ***Valuation***: a consensus framework for valuing emergent grid technologies and services; and
- ***Sensing 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: Proposed Pioneer Partnerships

Grid Modernization Lab Call: Crosscutting R&D



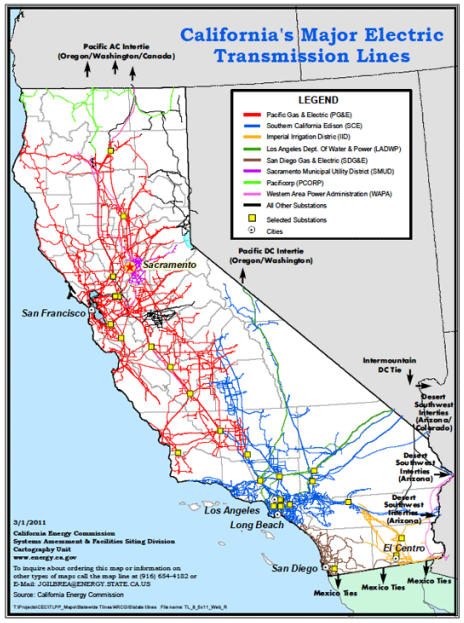
Design and Planning Tools

Expected Outcomes

- Deliver open software platform for adding advanced computation approaches to grid planning & design tools (50x speedup)
- Add capacity to model uncertainty in grid planning for new renewable generation
- Incorporate system dynamics into planning tools to enhance resilience in face of increased system variability

Key Lab Call Activities

- DER Siting and Optimization tool to enable large scale deployment of DER in California
- The Midwest Regional Partnership and Interconnection Seams Study
- North American Renewable Integration Study
- The Alaska Microgrid Partnership: Developing affordable, clean, reliable, and scalable islanded-power systems for rural Alaska
- Development and Deployment of Multi-Scale Production Cost Models
- Computational Science for Grid Management
- Extreme Event Modeling



Decreasing PUC RPS assessments from days to hours

Nearer Term Aid to States
California Distributed Resource Planning

Drivers of change

- ★ Changing Electricity Supply Mix
- Growing Threats to Resilience and Reliability
- ★ New Market Opportunities for Consumers
- ★ Information and Control Technologies
- Aging Infrastructure

- **Challenge:**
  AB 327 requires the electric utilities in California to file Distribution Resources Plans (DRPs) to identify optimal locations for the deployment of distributed resources
- **Solution from MYPP:**
  Deliver an online open-access integrated distributed resource planning and optimization platform
- **Partners:**
  CA Public Utiliy Commission
  Pacific Gas & Electric
  Southern California Edison
  NYSERDA
  Metropolitan Washington Council of Governments
- **Expected impact:**
  Identify meaningful behind-the-meter DER adoption patterns, potential microgrid sites and demand-side resources, and evaluate the impacts of high renewable penetration feeders on the distribution and transmission grid

Areas of MYPP

- Design and Planning Tools
- Devices and Integrated Systems
- System Operations and Control
- Institutional Support

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

Drivers of change

- Changing Electricity Supply Mix
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- **Challenge:**
- Coastal cities in the Southeastern United States face a range of severe weather threats, including hurricanes, floods, and tornadoes. These threats can cause significant damage and disruption to cities, including loss of life, business interruptions and economic losses, and failure of critical infrastructure services. Many of these impacts occur because of failures in the electrical power system, so maintaining effective operations of critical systems and services during a major extended power outage is a growing concern to these cities
- **Solution from MYPP:**

  Conduct technical evaluations to assess energy and critical infrastructure vulnerabilities, and to identify cost effective options to improve the resiliency of both the electrical grid infrastructure and the community.
- **Partners:**

  City of New Orleans, Rockefeller Institute, Entergy, US Army Corps of Engineers

Areas of MYPP

Security and Resilience

Longer Term Research and Development
Multi-Scale Integration of Control Systems (EMS/DMS/BMS)

- Labs: ANL, BNL, LANL, LLNL, NREL, PNNL, SNL
- Project Objectives/Technical Approach: The team will create an integrated grid management framework that is similar to an autopilot system for the grid's interconnected components. An open framework that coordinates building, distribution, energy management systems will be developed and demonstrated. New operations applications will be deployed and demonstrated as well.
- Partners: PJM Interconnection, Duke Energy, PG&E, Alstom Grid, EPRI
- Metrics/Outcomes: Develop an open framework to coordinate EMS, DMS, and BMS operations, and demonstrate the new framework on a use case at GMLC national lab facilities; Deploy and demonstrate new operations applications, probabilistic risk-based operations, forecasting data integration and decision support, and heterogeneous sensor data integration.
- Project Budget(M): $4,500,000/3 years

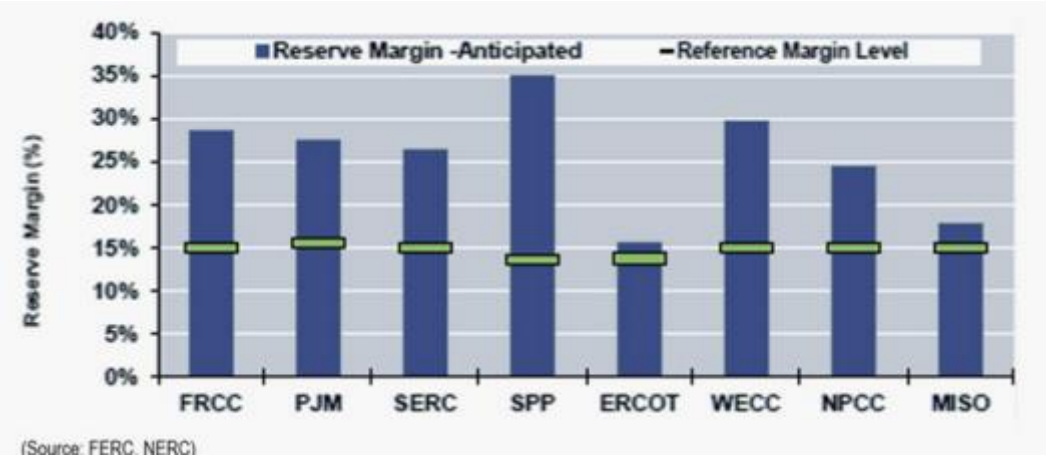
Demonstrations – Lean Bulk Power Systems

Goal:

- Reliable operations with <=10% reserve margin; >33% variable wind, solar
- New capability for grid operators to leverage and manage distribution-level grid services
- Data-driven tools for precise, predictive real time grid operations

Target Partners:

- Transmission Utilities
- System Operators



Demonstrations – Clean Distribution Systems

Goals:

- Demonstrate reliable and affordable feeder operations with >50% DER penetration
- Coordinated microgrid(s) control for resilience (20% fewer outages, 50% shorter recovery time)
- Distributed, hierarchical control for clean energy and new customer-level innovation

Target Partners:

- Distribution utilities
- Cities and municipalities with ambitious energy goals

Demonstrations – Grid Planning and Analytics

Goals:

- Use coupled T&D grid planning models with 1000x speed-up to address specific grid issues
- Develop with stakeholders new data-driven approaches to DER valuation and market design
- Work with States to more rapidly evaluate new business models, impacts of policy decisions

Target Partners:

- States and local regulators
- Distribution utilities
- New market participants

DOE Grid Modernization Initiative – Next Steps

Activities	Dec		Jan		Feb		Mar		Apr		May		Jun	
	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-30	1-15	16-31
Lab Call Selections Comms Plan for Announcement														
Lab Call Negotiation Coordinated across DOE and Labs														
Six Regional Workshops Coordinated with EPSA QER 1.2 Update the Grid MYPP														
DC Grid Summit And Technology Showcase														

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