

Technology Council Meeting Agenda

February Webinar Meeting - 2/24/2021 @ 3:00 PM EST

I.	Welcome	Steve Hauser, CEO Karen Wayland, Interim CEO
II.	Antitrust Guidelines	Richie O'Neill, Executive Director
III.	Discussion on Current Events	All
IV.	Presentation on National Lab and Department of Energy activities 1. Grid Modernization Lab Consortium (GMLC) a. Key Products to Leverage b. Tools for Extreme Weather Planning 2. Energy Storage Grand Challenge 3. North American Energy System Resiliency Model 4. Priorities for New Administration and Opportunities to Interact	Carl Imhoff, Manager, Electricity Market Sector, Pacific Northwest National Laboratory (PNNL)
V.	Next Meeting	R. O'Neill



GridWise Alliance Antitrust Compliance Program Guidelines

It is the policy of the GridWise Alliance to comply fully with the antitrust laws. The Sherman Act and other applicable antitrust laws are intended to promote vigorous and fair competition and to combat various restraints of trade.

Each person who participates in GridWise Alliance activities has a responsibility to his/her employers and to the GridWise Alliance to avoid any improper conduct from an antitrust standpoint. The following guidelines will assist in meeting this responsibility:

1. GridWise Alliance meetings and discussions generally cover topics related to the generation, transmission and distribution of electricity. Should related discussions ever have any potential for competitive impact, all due care shall be taken to avoid such discussion between competitors.
2. In view of antitrust considerations and to avoid any possible restraints on competition, the following legally sensitive subjects must be avoided during any discussion between competitors:
 - (a) Future marketing plans of individual competitors should not be discussed between competitors;
 - (b) Any complaints or business plans relating to specific customers, specific suppliers, specific geographic markets or specific products, should not be discussed between competitors;
 - (c) Purchasing plans or bidding plans of companies in competition should not be discussed (except privately between two parties with a vertical commercial relationship such as supplier and customer); and
 - (d) Current and future price information and pricing plans, bidding plans, refund or rebate plans, discount plans, credit plans, specific product costs, profit margin information and terms of sale should not be discussed between competitors. All of the above are elements of competition.
3. Any question regarding the legality of a discussion topic or business practice should be brought to the attention of the GridWise Alliance legal counsel or a company's individual legal counsel for advice.

Discussion on Current Events

- GridWise supporting members' grid resilience efforts
 - Collecting case studies
 - Coordinating meetings with Administration and members of Congress
 - Developing content



DOE/National Lab Update on Grid Modernization

Feb. 24, 2021

Carl Imhoff

Manager, Electricity Infrastructure Sector



PNNL is operated by Battelle for the U.S. Department of Energy



Discussion Topics

- Frame top DOE initiatives shaping Grid Modernization
 - Grid Modernization Initiative
 - Energy Storage Grand Challenge
 - North American Energy Resilience Model
- Share key transition themes
- Sample GMI projects from PNNL related to GridWise agenda
- Conversation: opportunities for industry to shape and engage the DOE Grid Modernization journey
 - Shaping strategy
 - Partnering on research agenda
 - Preparing for regional responses related to potential stimulus legislation

DOE Grid Modernization Strategy (2017-2020)

▶ Fully Integrated Vision:

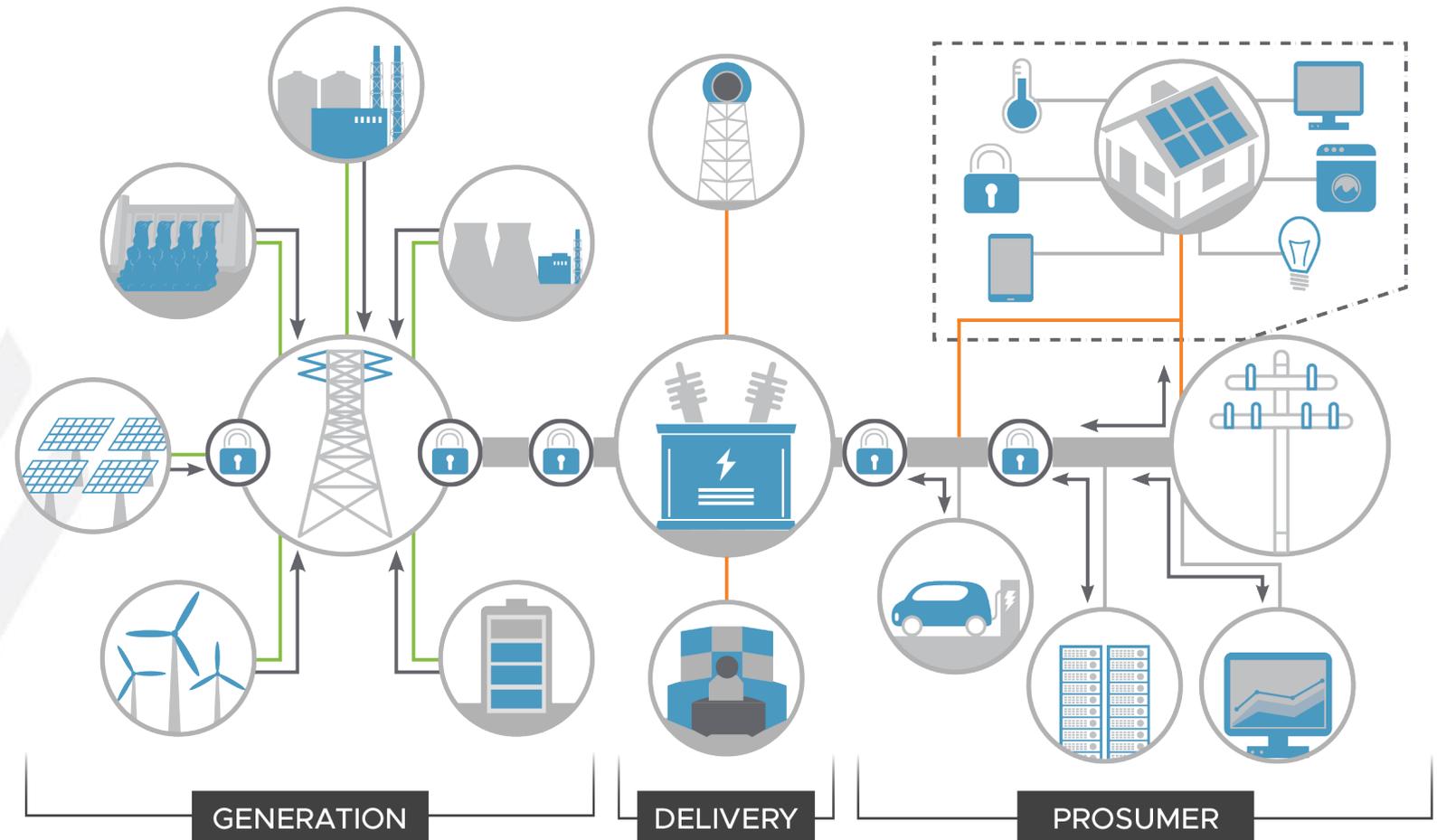
Encompassing the energy system from fuel to generation to load, including interdependent infrastructures

▶ Reliability and Resilience:

This effort will strengthen, transform, and improve the resilience of energy infrastructure to ensure access to reliable and secure sources of energy, secure all malicious threats, natural disasters, and other systemic risks such as human error or the grid's dependence on other critical systems

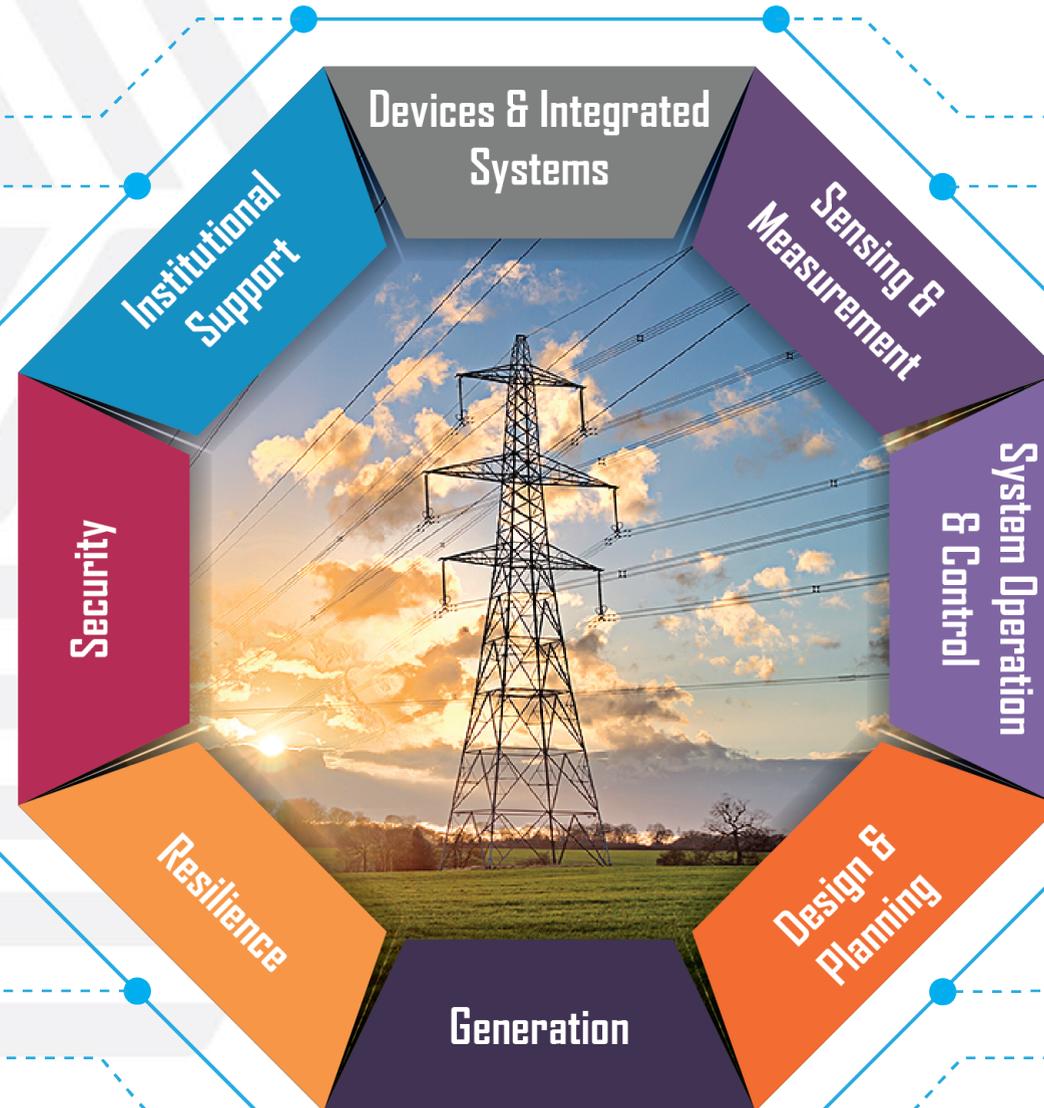
▶ Participation:

A collaborative partnership of five DOE Offices to leverage the talent and expertise in the Office of Fossil Energy (FE), the Office of Nuclear Energy (NE), the Office of Electricity (OE), the Office of Energy Efficiency and Renewable Energy (EERE), and the Office of Cybersecurity, Energy Security, and Emergency Response (CESER)



DOE's Grid Modernization Laboratory Consortium

14 National Labs 200+ Partners



DOE Grid Modernization Investments

- GMLC Lab Calls
- Competitive Funding Opportunities



2019

Grid Modernization Initiative

Department of Energy's Grid Modernization Lab Call (2019)

May 29, 2019

Gil Bindewald (OE), Kevin Lynn (EERE), Alicia Dalton-Tingler (FE), Trevor Cook (NE), Carol Hawk (CESER)



2017

Resilient Distribution Systems

An FY17 Project Call for the Grid Modernization Laboratory Consortium

A. Description/Background

Overview

The U.S. Department of Energy (DOE) has developed this Grid Modernization Laboratory Consortium (GMLC) Project Call as part of the Grid Modernization Initiative (GMI). This Project Call aims to advance research of resilient distribution systems through rigorous field validations. In particular, the Call focuses on the integration of clean distributed energy resources (DERs) and emerging grid technologies at regional scale.¹ The project results are expected to deliver credible information on technical and economic viability of the solutions as well as demonstrate viability to key stakeholders who are ultimately responsible for approving and investing in grid modernization activities. This FY17 GMLC Project Call builds on the momentum from the ongoing GMLC Foundational Activities of the FY16 GMLC Lab Call and continues research in the six technical areas laid out in the Grid Modernization Multi-Year Program Plan (MYPP). This FY17 GMLC Project Call is jointly developed and funded by the Office of Energy Efficiency and Renewable Energy (EERE) and the Office of Electricity Delivery and Energy Reliability (OE).

Objectives

This GMLC Project Call seeks to develop and validate innovative approaches to enhance the resilience of distribution systems (including microgrids) with high penetration of clean DERs. Technological advancements include control/coordination strategies, real-time system monitoring, robust communications infrastructure, grid planning and analytical platforms, and integration of multiple DER technologies.²

Grid modernization presents a complex bundle of technological, institutional and regulatory challenges. Thus, projects must include field validations that incorporate regionally appropriate solutions that verify the viability of distribution system design, validate architectural relationships and interoperability, quantify costs and benefits (i.e. characterize value proposition), ensure protection of system networks and data against cyber threats, and inform

¹ For the purpose of applications submitted under this Project Call, DER is defined as any controllable energy resource connected at the distribution level. This can include generation, load, and/or energy storage. "Clean" characterizes the technology's role in reducing or eliminating pollution, with emphasis on energy efficiency and renewable energy technologies such as solar, wind, energy storage, building efficiency technologies, and electric vehicles.

² These technologies are further defined in the Grid Modernization Multi-Year Program Plan (MYPP) as six key technical areas: a) Devices and Integrated Systems Testing, b) Sensing and Measurements, c) System Operations, Power Flow, and Control, d) Design and Planning Tools, e) Security and Resilience and f) Institutional Support.

2016

DEPARTMENT OF ENERGY GRID MODERNIZATION LABORATORY CALL

An Integrated and Coordinated Approach

This laboratory call is a coordinated funding call for the Grid Modernization Cross-cut Initiative for FY2016. Offices contributing to the lab call include the Office of Electricity and Energy Reliability, the Office of Energy Efficiency and Renewable Energy, and the Office of Energy Policy and Systems Analysis.

Since only DOE National Laboratories are eligible to apply as primary recipients under this Lab Call, the ensuing awards will be issued through the Work Authorization System based on a Field Work Proposal (FWP), an Inter Entry Work Order (IEWO), an Annual Operating Plan (AOP) or other allowable instrument deemed appropriate by the Government.

DOE GMLC Lab Calls 2016 - 2019

Over 200 GMLC Partners

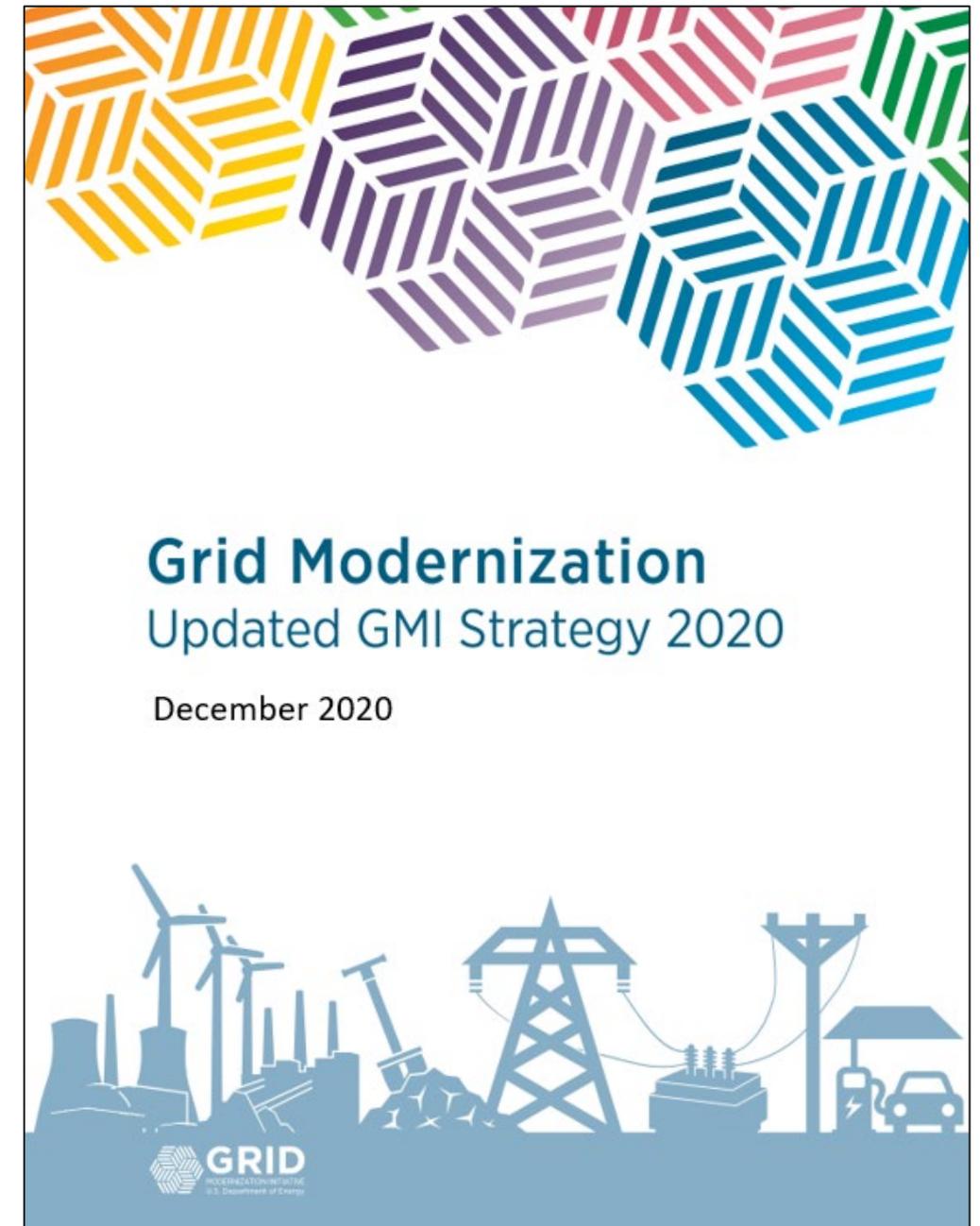


- ▶ 41 utilities
- ▶ 12 bulk system operators
- ▶ 67 vendors
- ▶ 33 Industry organizations
- ▶ 30 universities
- ▶ 29 federal, state and local entities



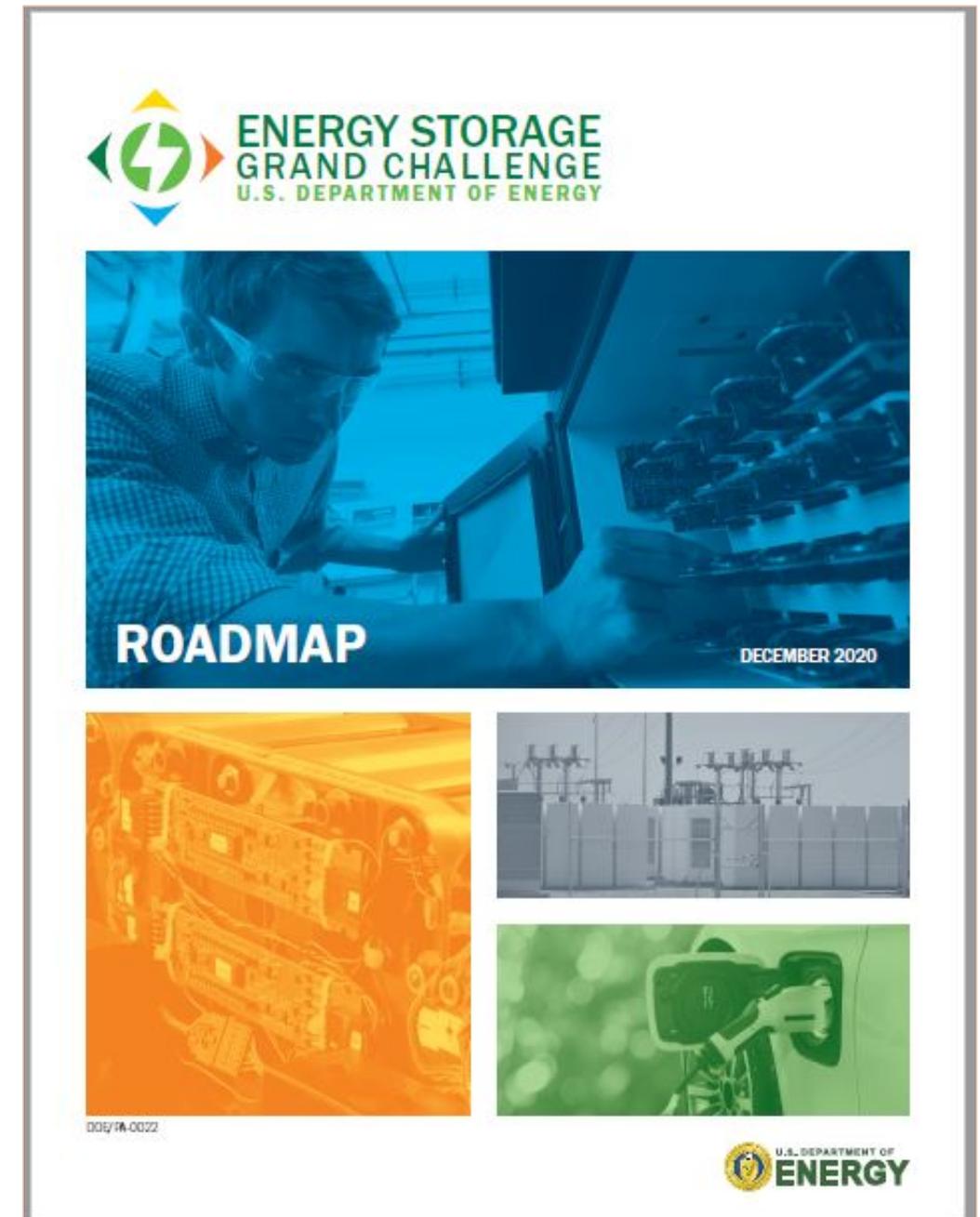
Strategy in Transition

- Revised 2020 to reflect generation and resilience emphasis of Trump Administration
- Expect a pivot to reflect Biden Administration climate agenda
- Transition messages to date:
 - Carbon neutral power system 2035 goal
 - Anticipate resilience a joint goal
 - Jobs and equity important in DOE programs
 - Congressional and transition team support for cross-cut initiatives
 - Increased emphasis on industry engagement and demos
- Increasing discussion on Infrastructure Bill



Energy Storage Grand Challenge

- New cross-cut started FY20; continued support in transition discussions
- Broad approach
 - Bi-directional batteries (grid and transportation)
 - Chemical & thermal
 - Flexible gen and load
- Vision as key to power system flexibility for clean and resilient power system
 - Innovate here
 - Build here
 - Deploy everywhere
- DOE stewarding Grid Storage Launchpad facility to open in 2023



Planning for the **Grid Storage Launchpad**

Validate

Accelerate

Collaborate

100

WORKSTATIONS

30

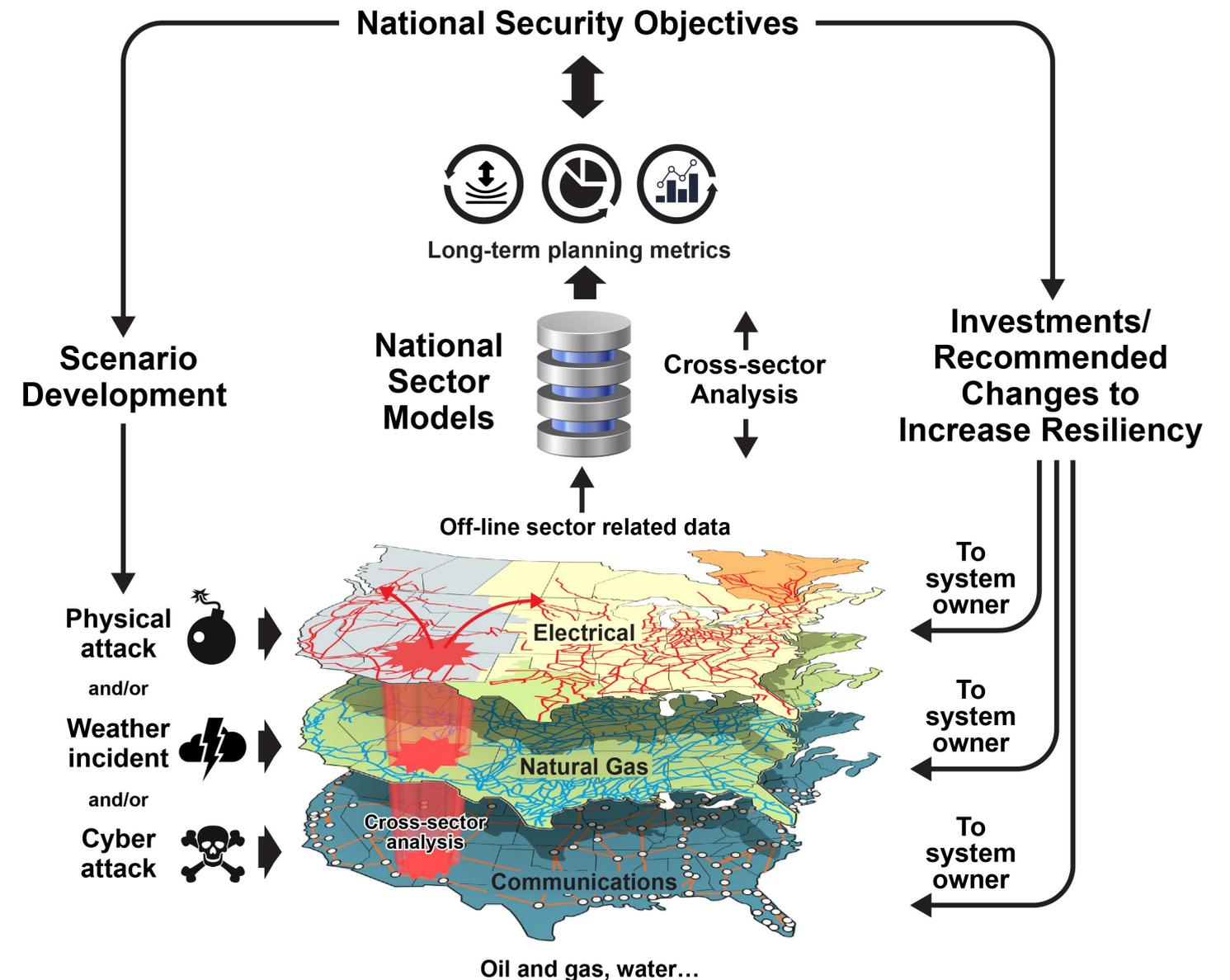
LAB MODULES

~\$75M

TOTAL
ESTIMATED
COST

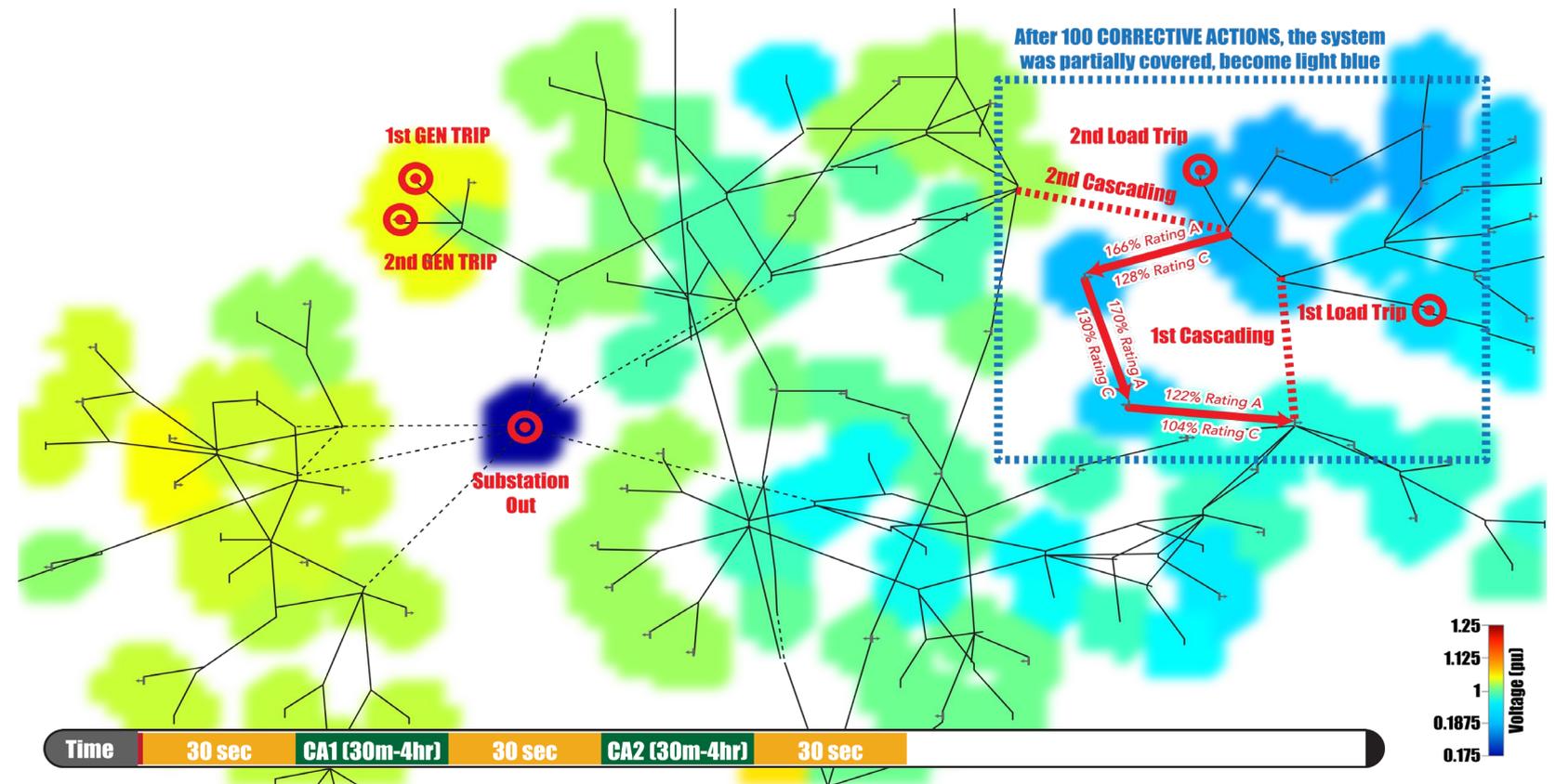
North America Energy Resilience Model (NAERM)

- Rapidly predict consequences and responses to known and emerging threats to national energy infrastructure
- DCAT: faster and better realistic situational awareness and decision support
- HELICS v2.0, scalable to 100,000 domain simulators, a core engine for NAERM to co-simulate grid, communication, and natural gas system



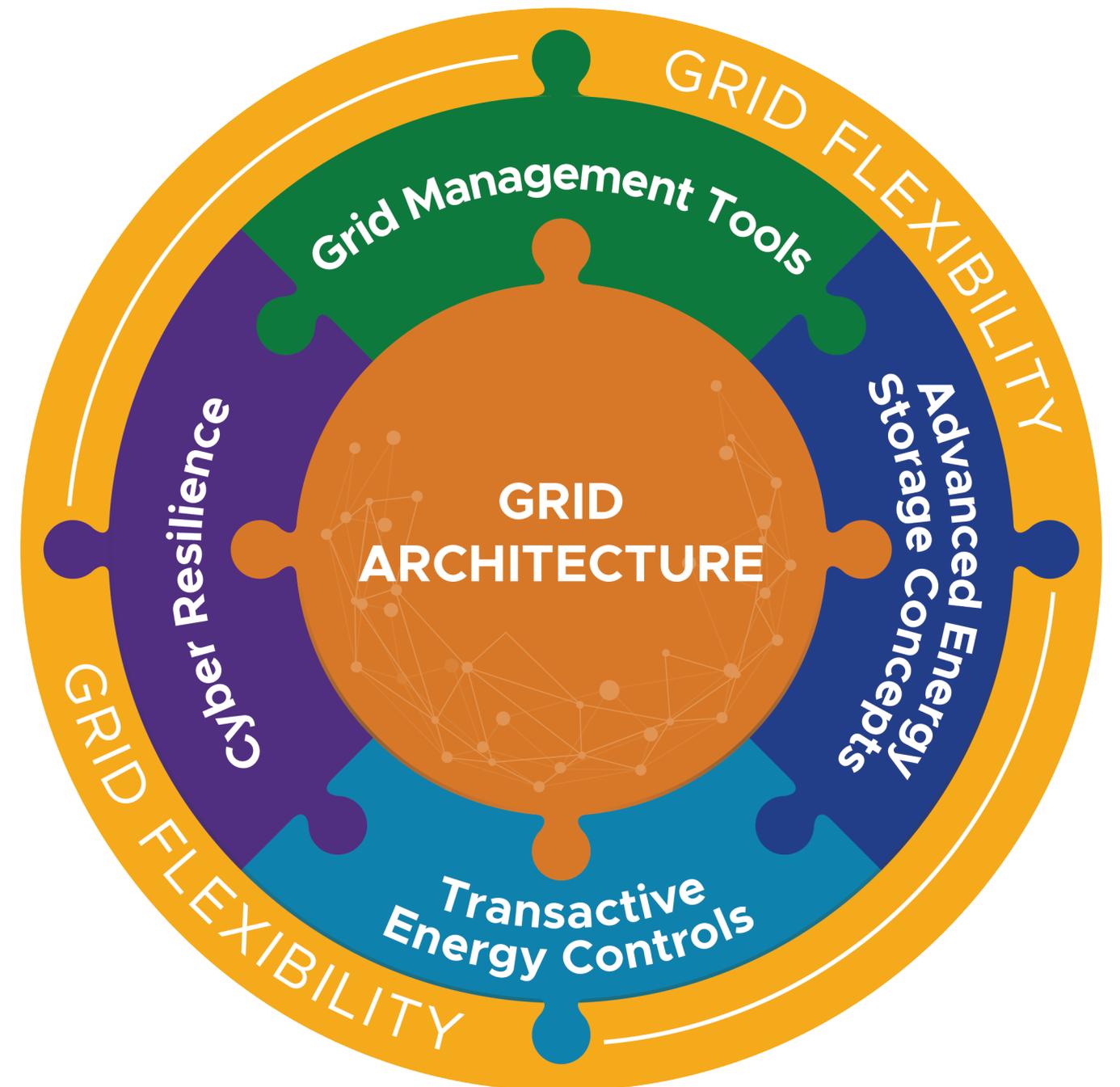
Dynamic Contingency Analysis Tool (DCAT)

- High-fidelity, high-performance methods and tool for N-1-1 contingency analysis
- A hybrid dynamic and steady-state approach to mimic cascading failure process, including both fast dynamic and slower events
- Integrated dynamic models with protection scheme models
 - special protection schemes and remedial action schemes
 - automatic and manual corrective actions
- DCAT is used in NAERM electricity analysis, as well as our transmission-level resilience assessment work in Puerto Rico



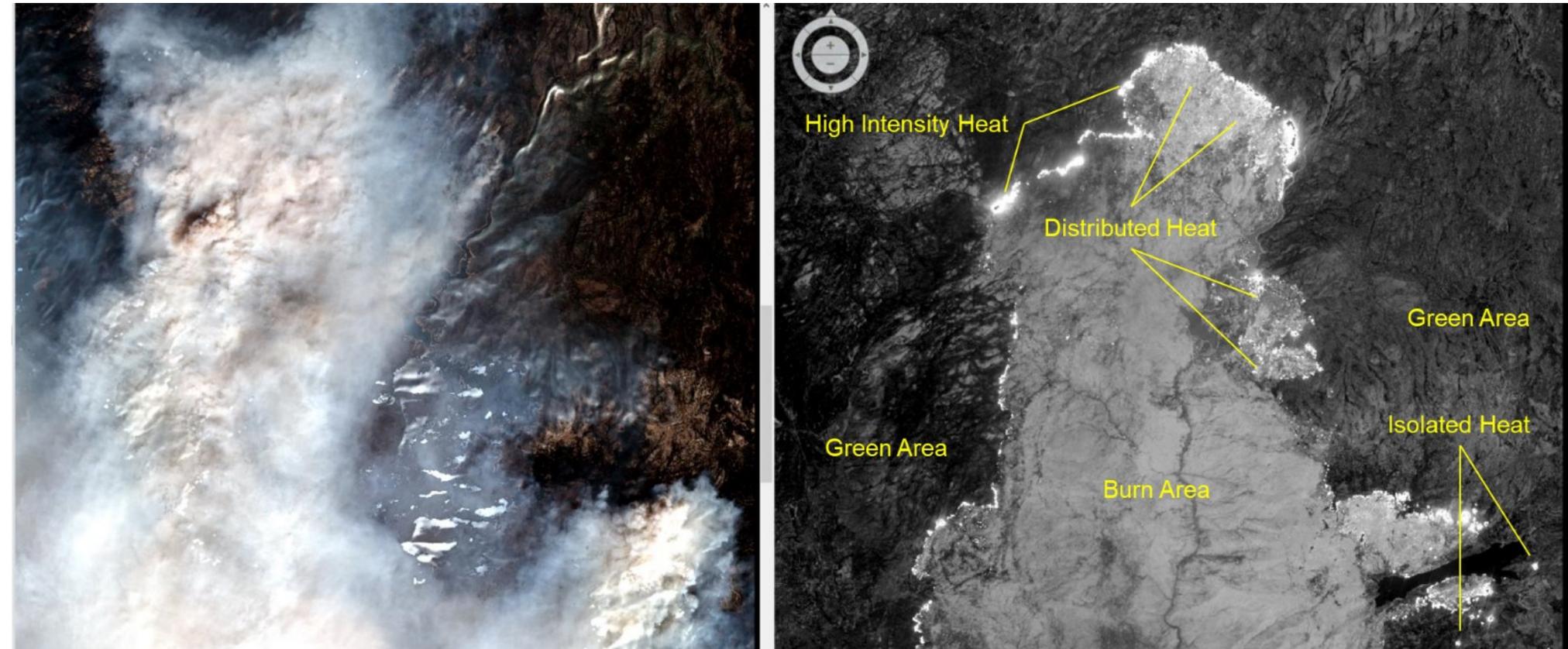
Grid Flexibility is Core to Deep Decarbonization & Resilience Agendas

- **Resilience**: able to *resist outage* AND upon outage, mitigate scope and speed recovery *National Academy July 2017*
- **Grid flexibility** increases both **resilience** and capacity for **clean generation**; delivered through responsive generation, and coordination with storage and responsive loads
- **Lab Objective Elements** deliver resilience and flexibility jointly



AI/ML-enabled Imagery Analysis for Energy Infrastructure Damage Assessment

- Expanded to include wildfire analysis
- Used in 40 U.S. disasters since 2016
- Detailed damage assessments delivered within a few hours of event (8X faster)



The Creek Wildfire in California's Sierra National Forest, as seen through the lens of a multi-spectral imaging satellite on Sept 8, 2020. The image on the left is true color; on the right are results from a new Rapid Analytics for Disaster Response (RADR) algorithm using infrared spectra.

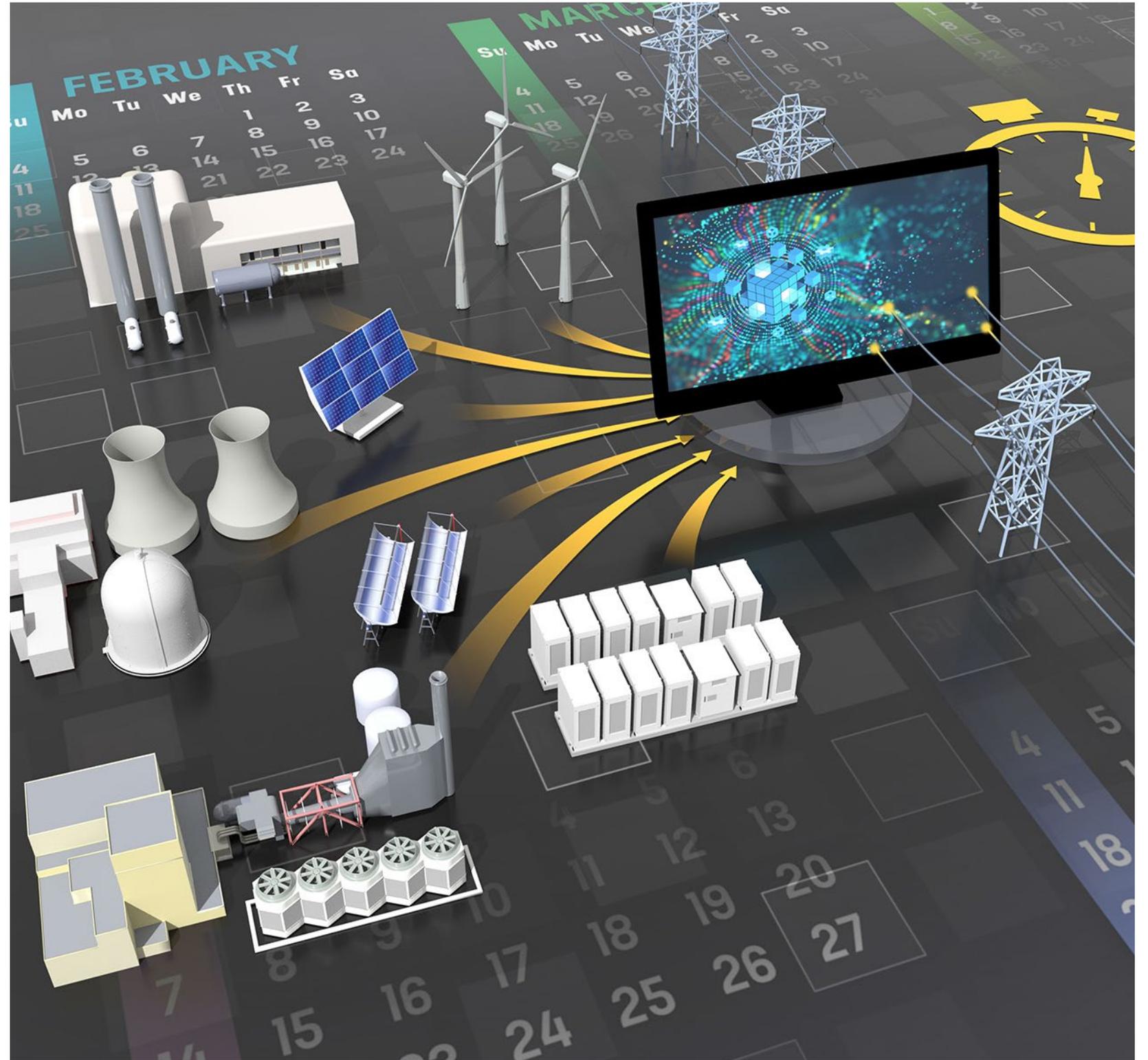
TRAST: Transforming Remedial Action Schemes

- High-performance computing and machine learning to accelerate RAS implementation
- Collaboration with PacifiCorp, Idaho Power, WECC
- Part of PNNL's commercialization portfolio



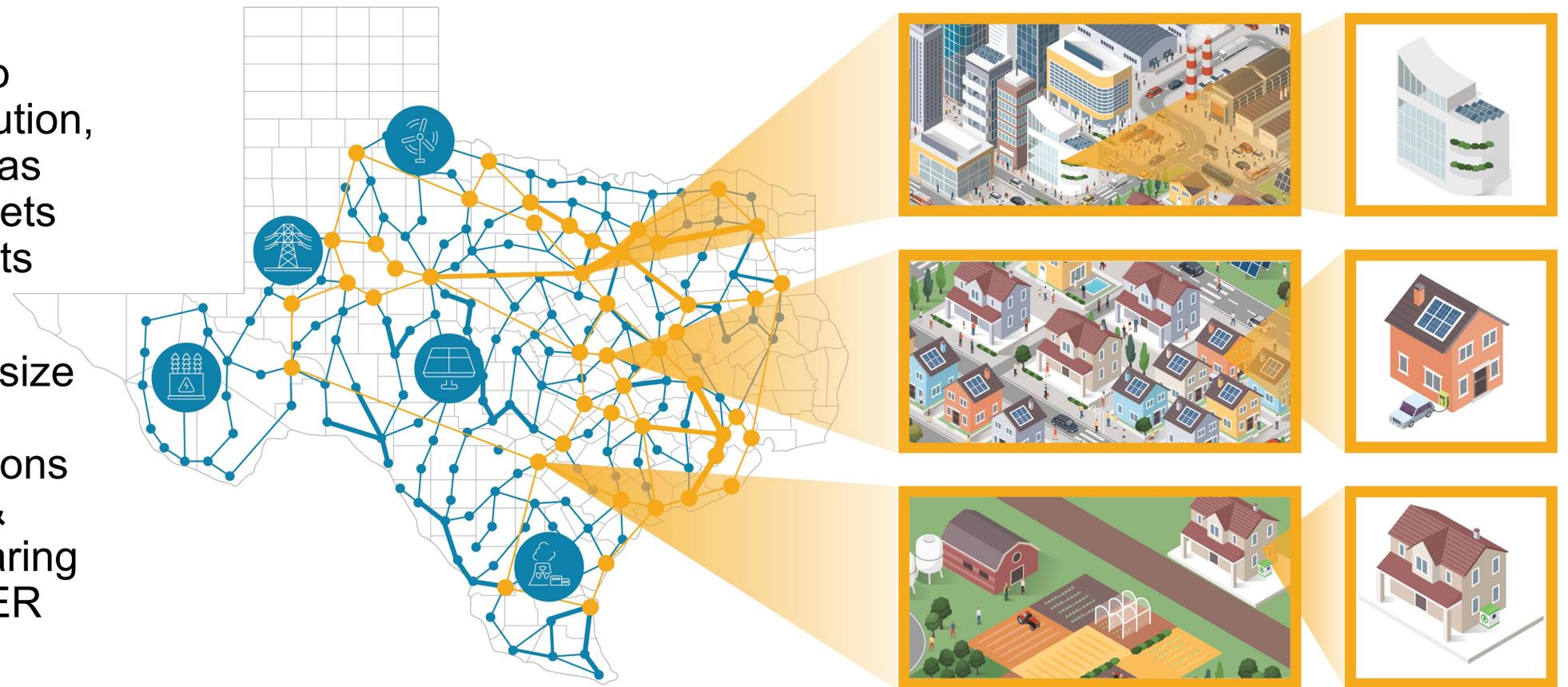
HIPPO: Optimizing a Diversifying Energy Resource Mix

- Security Constrained Unit Commitment (SCUC) a huge challenge with DERs
- High-Performance Power Grid Operation (HIPPO) computation engine utilizes advanced optimization theory, a high-performance computing cluster, and machine learning techniques
- Testing shows to 35X faster; cost within 0.1% of optimal
- Being deployed in MISO's cloud environment



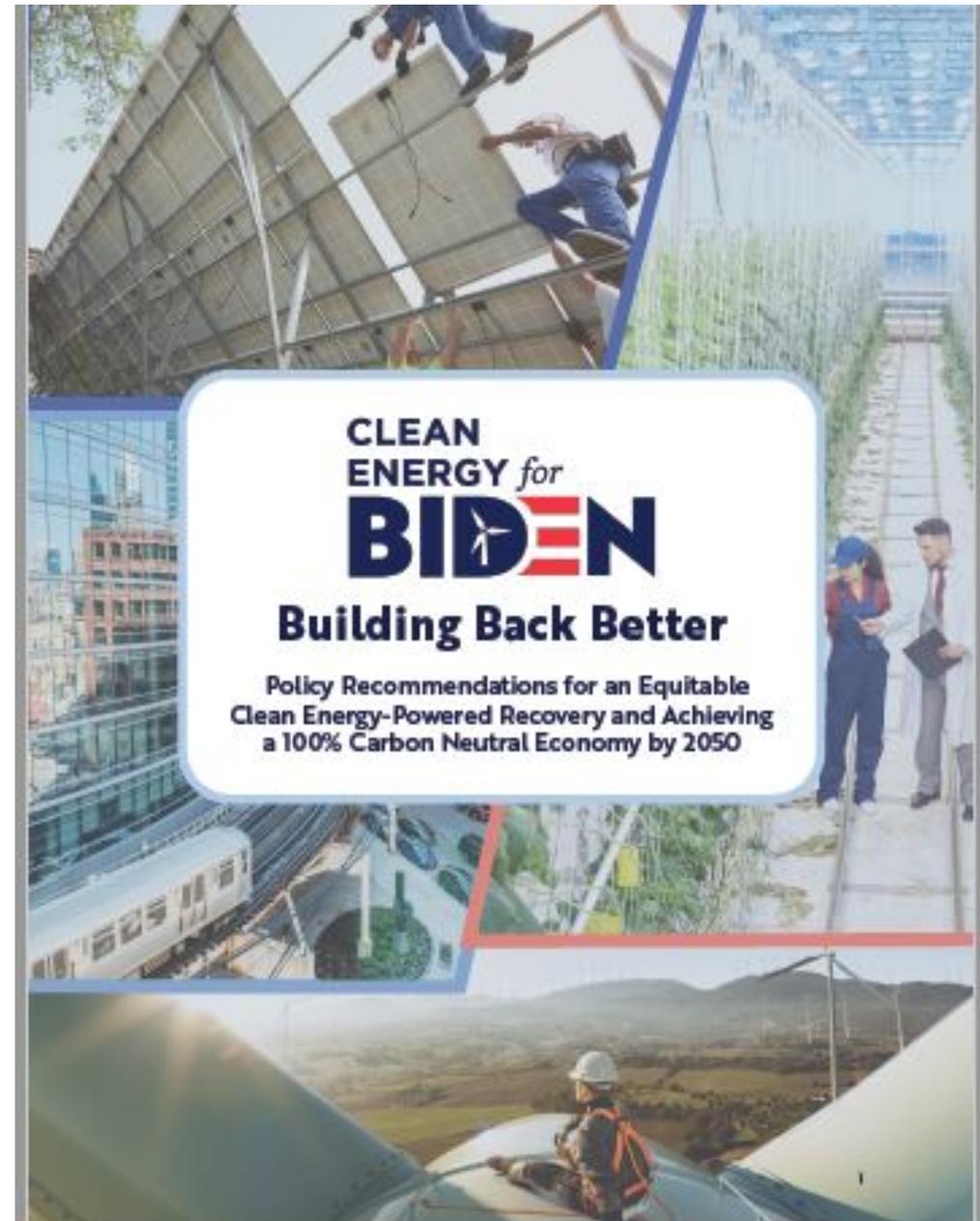
DSO+T: Modeling the Impacts of Transactive Energy Control at Scale

- **High-fidelity capability** to simulate customer, distribution, & bulk system operations as coordinated by retail markets linked to wholesale markets
- **Analysis** of the economic operation of a system the size of ERCOT subjected to moderate & high penetrations of renewable generation & electric vehicles by comparing business-as-usual with DER flexibility coordinated by Transactive Energy



Perspective on Transition, DOE Priorities, Opportunities for Engagement

- Industry input on Grid Modernization, Energy Storage Grand Challenge and Grid Decarbonization strategies
- Utility / vendor planning for regional infrastructure investments and demos
 - Address major obstacles to 2035 goals
 - Focus regionally Scale to national agenda
- Engage in DOE R&D portfolios
 - Peer reviews
 - Advisory groups
 - Partner in projects
- Advise on how to improve / accelerate progress and impact in public /private partnerships

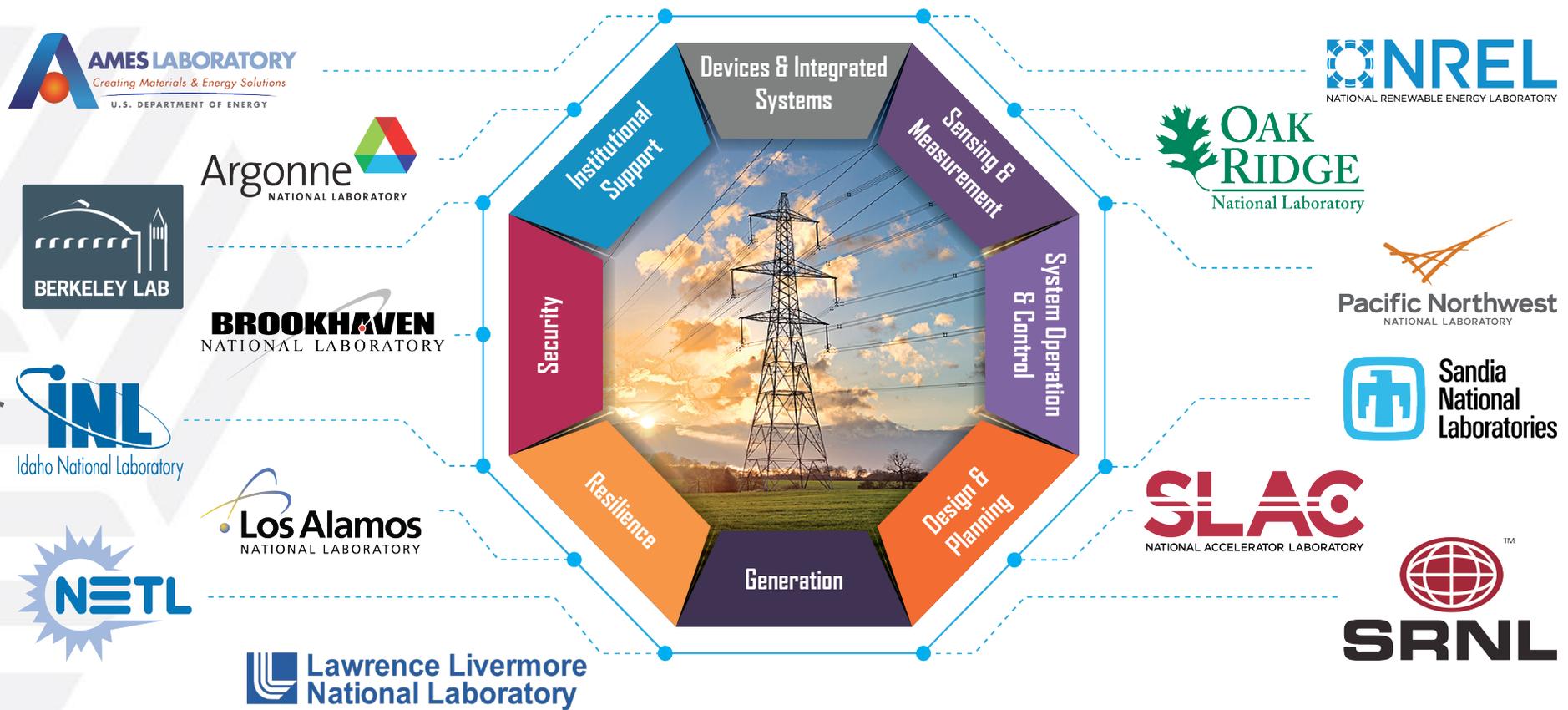


How Industry Engages GMLC



1. Join in upcoming funding opportunities
2. Participate in project advisory groups
3. Attend annual peer reviews
4. Follow progress on the website
 - gmlc@doe.gov
5. Participate in industry outreach for MYPP updates

- Contact GMLC Chairs
- Carl.Imhoff@Pnnl.gov
 - Juan.Torres@nrel.gov



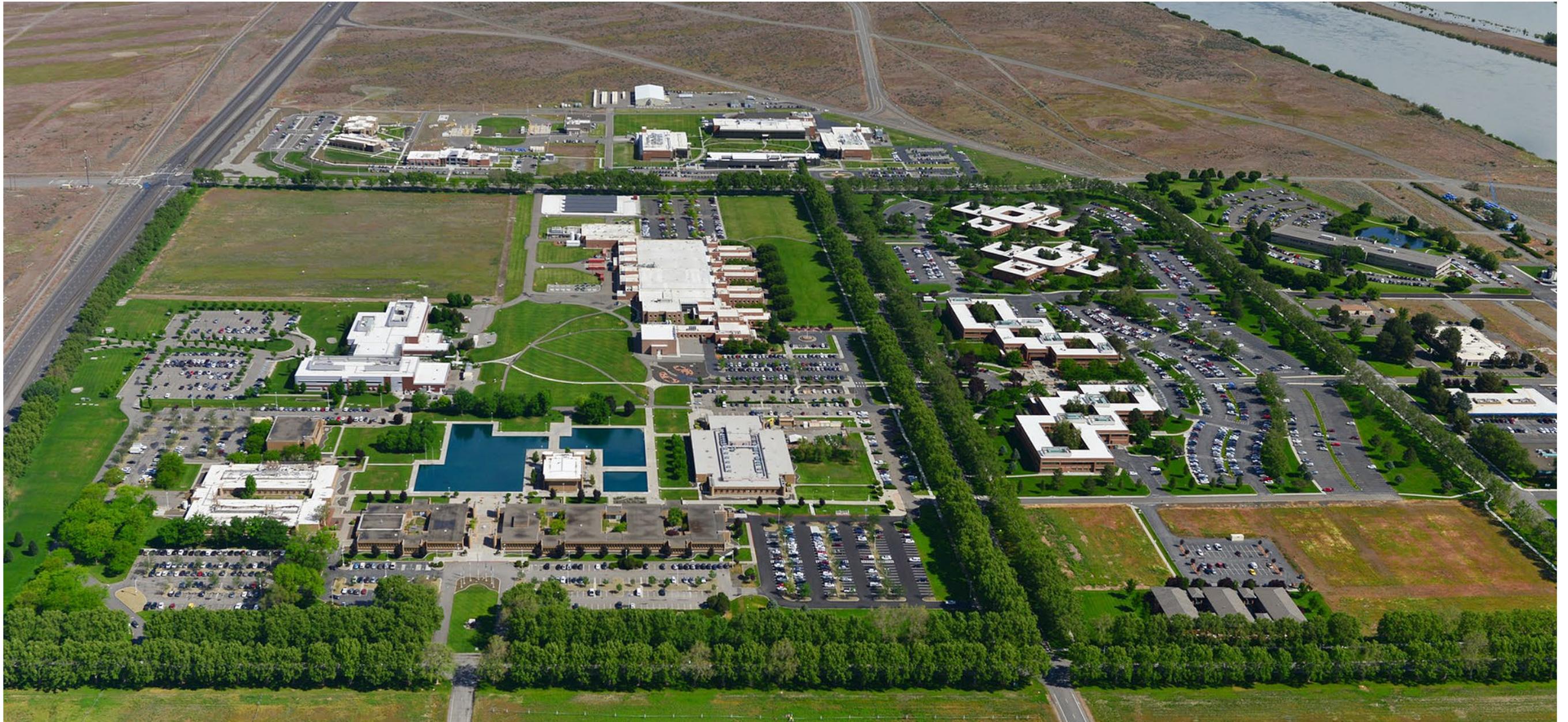


Thank you

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PNNL: A regional, national, and international scientific resource



PNNL's distinguishing
strengths enable
mission **impact**

