From Pilot to Progress: Unlocking the Full Potential of Utility Innovation

Regulatory Sandboxes and Other Processes to Expedite Utility Adoption of Advanced Grid Technologies

Grace Relf, Lawrence Berkeley National Laboratory

NARUC Summer Policy Summit

July 27, 2025

This work was funded by the U.S. Department of Energy, Office of Electricity, under Contract No. DE-AC02-05CH11231.

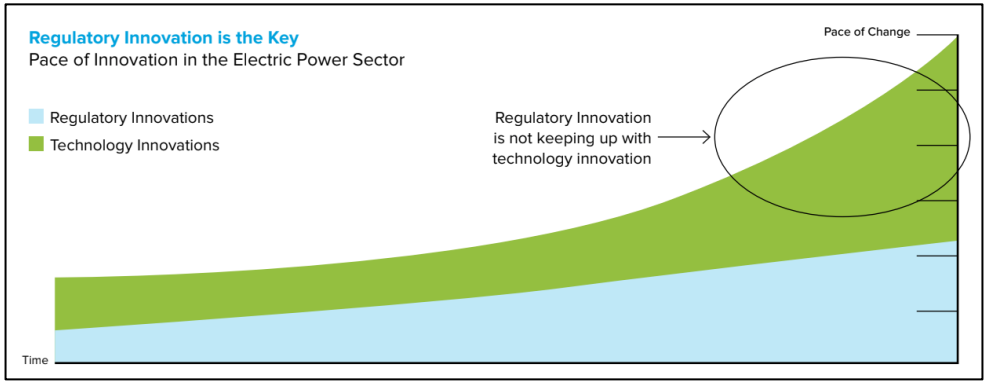
Agenda

- Introduction and Background
  - Project motivation and context
  - Barriers to utility innovation
  - Berkeley Lab's research
- The Landscape of Regulatory Sandboxes
  - Defining regulatory sandboxes
  - Sandboxes in the U.S. and abroad
- Examples of specific projects resulting from sandboxes
- Wrap up
  - Findings
  - Emerging best practices

Introduction and Background

Project Motivation and Context

- Load growth, aging assets, variable energy resources, and increasingly severe and frequent weather events are challenging utilities to simultaneously:
  - Expand T&D capacity
  - Improve asset management and utilization
  - Adopt new operational practices
  - Expand resilience programs
  - Maintain energy affordability
- Traditional regulatory processes can discourage utility interest in testing and deploying advanced grid technologies to help meet these challenges.
- ***Regulatory sandboxes* aim to bridge the gap between need and opportunity to deliver solutions at scale.**



Source: McDonnell, Gorman, and Field 2022

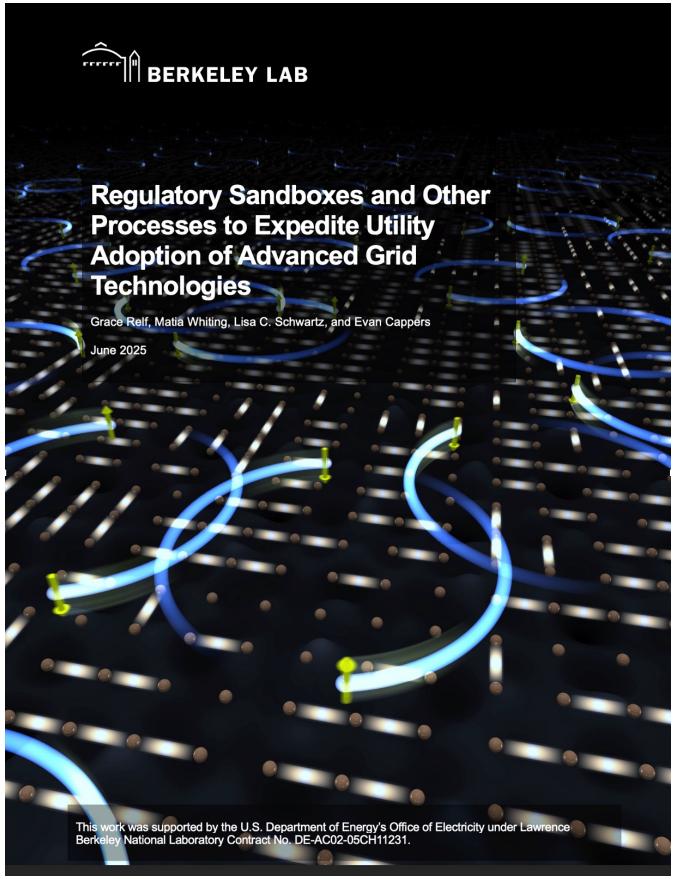
Berkeley Lab Research

Berkeley Lab published research on regulatory sandboxes and other processes to expedite adoption of advanced grid technologies.

The research:

- Assesses the need for, and barriers to, utility innovation
- Identifies regulatory sandboxes and related processes
- Assesses emerging best practices

Berkeley Lab is creating an accompanying toolkit to support states looking to develop a sandbox (forthcoming) and can provide technical assistance to state PUCs.



Research available at: https://emp.lbl.gov/publications/regulatory-sandboxes-and-other

Report Methodology

- Literature review & synthesis of common and key findings
- With E9 Insight, comprehensive review of regulatory proceedings & deep-dive into regulatory filings, utility innovation webpages, pilot databases, and other sources
- Structured interviews with utilities, regulators, consumer advocates, industry trade groups, and consultants
- Analysis and synthesis of findings

Organizations Interviewed
American Public Power Association (APPA)
Connecticut Public Utilities Regulatory Authority (PURA)
Current Energy Group
Duke Energy Corporation (via written correspondence)
Hawaiian Electric (HECO)
Hawaii Public Utilities Commission (HPUC)
Green Mountain Power (GMP)
Public Staff – North Carolina Utilities Commission
San Diego Gas & Electric (SDG&E)
United Illuminating
Vermont Public Utilities Commission (VT PUC)
Vermont Electric Power Company (VELCO)
WATT Coalition / Grid Strategies

The Landscape of Regulatory Sandboxes

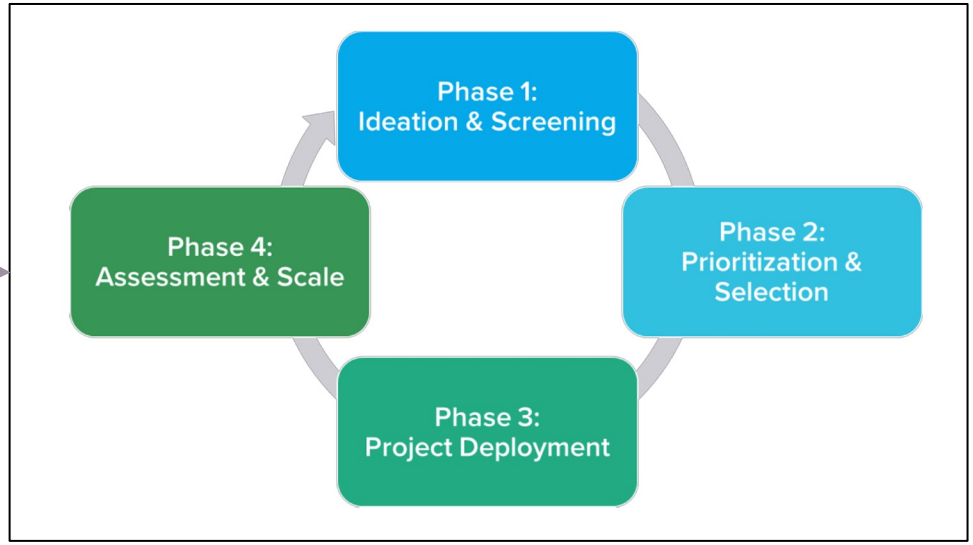
Defining Regulatory Sandboxes

Regulatory Sandboxes

Mechanisms that provide a structured environment for testing new technologies and business approaches under modified rules to increase the speed of adoption

Example

The Connecticut Innovative Energy Solutions (IES) sandbox mechanism selects cutting-edge project proposals to run for a 12- to 18-month trial period before assessing results and quickly determining scaling strategies.



Source: CT PURA

Taxonomy of Sandbox-Type Mechanisms

Funding Opportunity

Funding carveout for innovative grid transformation projects

Pilot Process

Activities to improve how pilot projects are approved and managed

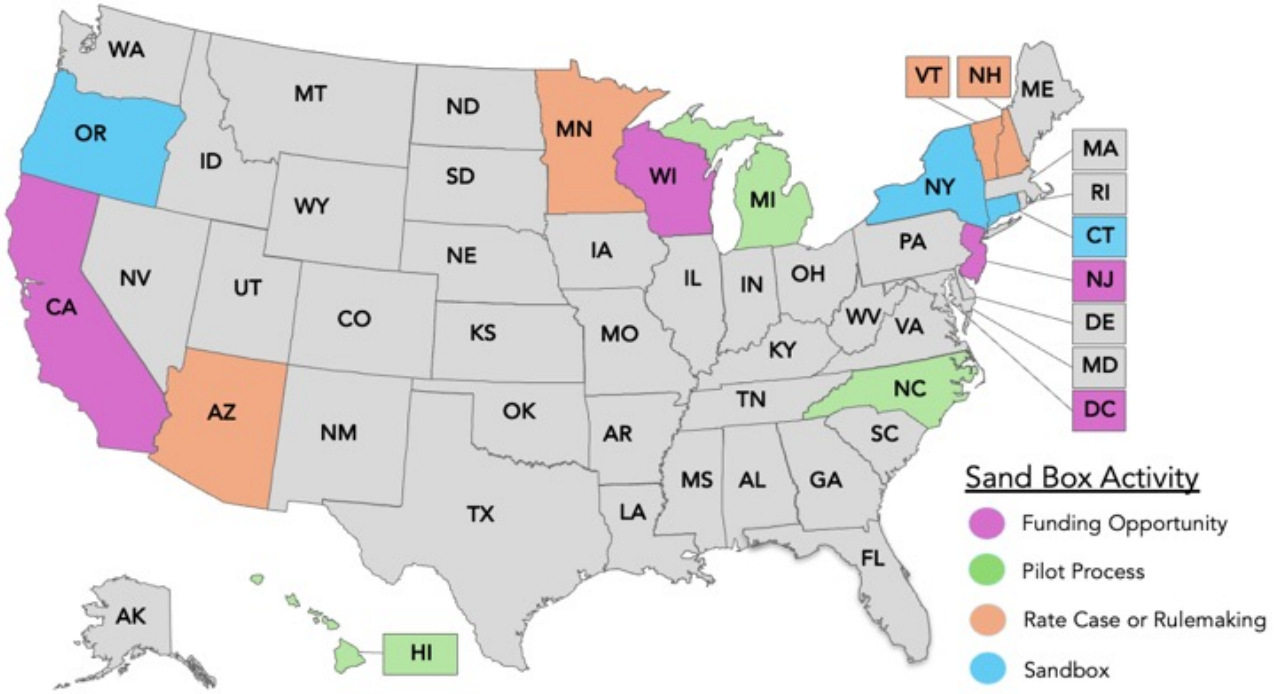
Rate Case or Rulemaking

Vehicles for broader innovation efforts that may include reforms including sandbox-like initiatives

Regulatory Sandbox

Mechanism that provides a structured environment for testing new technologies and business approaches under modified rules to increase the speed of adoption

U.S. States Exploring and Implementing Sandbox-Type Mechanisms



State	Program
National	American Public Power Association (APPA) DEED Program
Arizona (not adopted)	Innovations and Technological Developments
California	EPIC Program
Connecticut	Innovative Energy Solutions
Hawaii	Innovative Pilot Framework
Michigan	New Technologies and Business Models
Minnesota (not adopted)	Rate Case Pilot Projects
North Carolina	Innovation Prototyping Process
New Hampshire (not adopted)	Grid Transformation and Enablement Program
New Jersey	Clean Tech Grant Programs and Future Regulatory Sandbox
New York	Reforming the Energy Vision Demonstration Projects
Oregon	Smart Grid Testbed
Vermont	Innovative Pilot Program
Washington, DC	PowerPath DC Pilot Project Fund
Wisconsin	Energy Innovation Grant Program

Sandbox Examples

Connecticut Innovative Energy Solutions

- Reduces barriers for deploying new technologies and to facilitate collaboration between product innovators and utilities.
- Follows a four-phase process: ideation and screening, prioritization and selection, project deployment, and assessment and scaling.
- Uses thematic program cycles, three participation pathways and an innovation advisory council.

New York Reforming the Energy Vision Demos

- Allows utilities to develop new business models and effectively unlock new revenue streams and private investments.
- Encourages flexibility, innovation, value distribution, partnerships, customer engagement, market creation, scalability and cost recovery.

Ontario Energy Board Innovation Sandbox

- Allows proposals from utilities and businesses that support consumer value, identify relevant regulatory barriers, and have potential to scale.

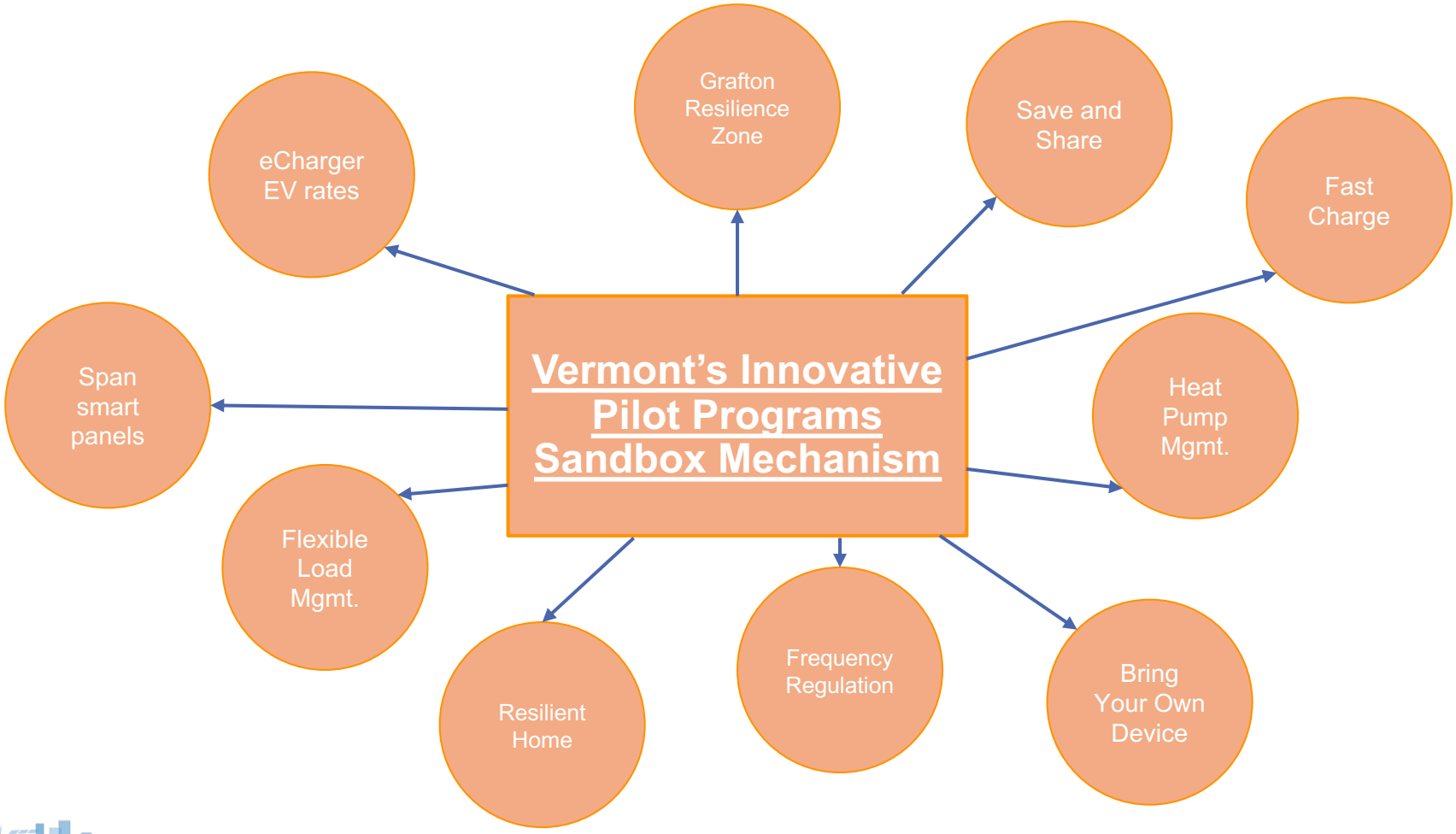
Notable Examples from Abroad

- The U.K's Office of Gas and Electricity Markets (OFGEM) developed an Energy Regulation Sandbox in 2017 as part of its performance-based regulation framework.
  - The sandbox enables demonstrations and trials in the regulated electric and gas sectors, particularly those that may require modified or reduced regulations in order to move forward.
- The Ontario Energy Board established an Innovation Sandbox in 2016 to support achievement of the goals identified in its Strategic Blueprint document.
  - The sandbox aims to better support innovation by introducing a simpler, less adversarial, and quicker way to trial new technologies and services.
- The Singapore Energy Market Authority created a regulatory sandbox in 2017.
  - The sandbox is a means of formalizing a previous effort to identify regulatory barriers to innovation on an ad hoc basis.

Source: OEB

Sandbox Outcomes

Utilities and innovators test specific innovations through regulatory sandboxes.



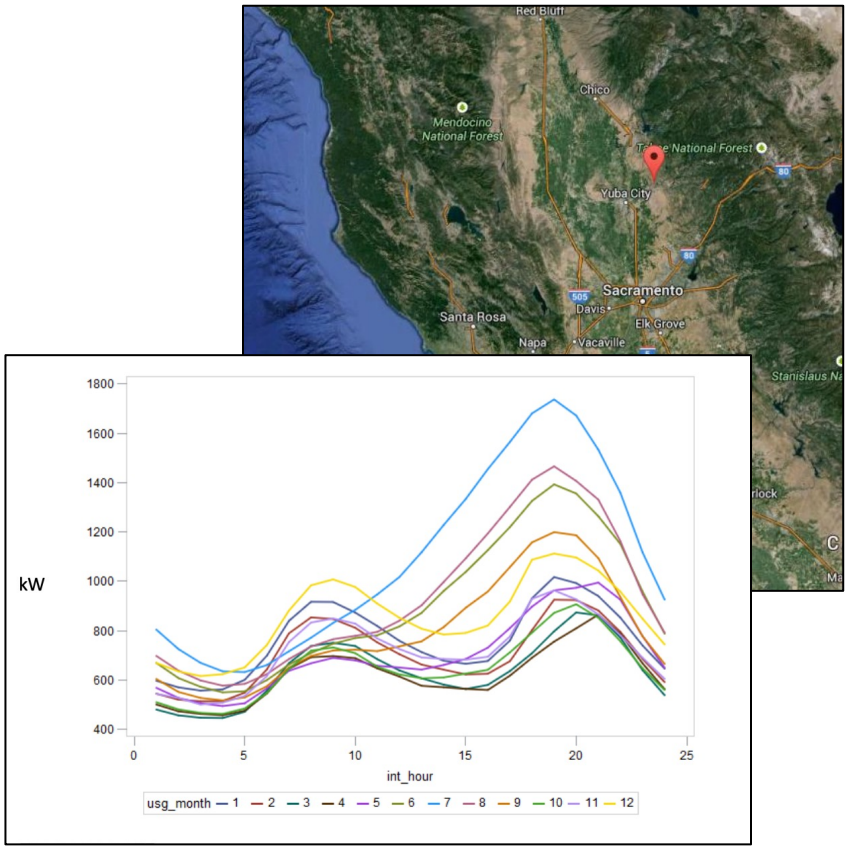
Examples of Specific Projects Resulting from Regulatory Sandboxes

Project Example: Distributed Storage for T&D Cost Reduction

Pacific Gas & Electric deployed energy storage at a substation to deliver autonomous distribution peak shaving.

- The project successfully demonstrated the ability to provide 500 kW of loading relief over 4 hours to delay T&D capacity expansions while maintaining or improving reliability.
- PG&E found that one ~30 MW storage solution can provide $5-15M in cost savings from avoided transmission upgrades.
- The project informed storage procurement practices, operational requirements and practices, and investments in distribution management controls.

Project Location and Average Substation Daily Load By Month



Source: CEC EPIC Database

Project Example: Noteworthy AI

Through the Connecticut IES program, Noteworthy AI is implementing a project that passively collects data on the condition of distribution system assets via smart cameras on utility vehicles.

- The project uses AI to analyze footage.
- Expected outcomes include:
  - Faster broadband deployment and easier pole attachment clearance
  - Improved vegetation management and associated better reliability and resilience
  - Reduced risk of outages by proactive identification of equipment defects
  - Analysis of 20% of the utility's poles, and 75% of poles in disadvantaged communities, within 18 months

Sources: CT PURA, Noteworthy AI

Wrap Up

Findings

Sandboxes have grown over time in the U.S. electricity sector

- 12 ongoing examples of sandbox mechanisms
- Sandbox types are varied

Sandboxes have demonstrated value

- Interviewees expressed enthusiasm for sandboxes
- Sandboxes are particularly good for creating a willingness to learn and an environment for experimentation

Programmatic focuses are varied

- Sandbox programs most commonly focus on demand-side resources
- Sandboxes can enable deployment of customer-sited batteries, distribution management technologies, modeling tools, and microgrids

Sandbox design can be improved to increase impact

- A stronger focus on advanced grid technologies may encourage more sandbox projects
- Scaling of programs isn't well documented and may need more focus

Sandboxes can:

- **Advance innovation**
- **Increase information collection and sharing**
- **Improve economic outcomes**
- **Enhance grid reliability and resilience**
- **Better meet customer needs**
- **Expand access to technologies**

Emerging Best Practices (1)

- Terms and objectives must be clear, ambitious, and have buy-in from utility and regulatory leadership and stakeholders.
  - Clearly define terminology such as “pilot,” “demonstration,” and “innovative” upfront and with stakeholder input.
  - Ensure that learning, speed, and eventual scaling are primary objectives.
  - Clearly identify scaling strategies and processes for projects that go through the sandbox mechanism.
- Identify barriers to innovation in the jurisdiction and determine which type of sandbox-type mechanism and other innovation vehicles are the best solutions.
  - For example, sandboxes can be structured to reduce uncertainty of utility cost recovery and burdensome regulatory processes and oversight.
- Provide clear information on project eligibility, application processes, and selection criteria that align with program objectives and employ templates or standard formats to reduce administrative burdens.
  - Create multiple pathways to participation so that innovators and stakeholders other than utilities can put ideas forward.
  - Structure projects to be simple and responsive to customer needs and desires.
  - Follow best practices for pilot design and implementation.

Emerging Best Practices (2)

- Establish clear reporting and evaluation requirements using metrics that align with desired outcomes.
  - Identify go/no-go checkpoints and criteria.
  - Require data and information-sharing as part of reporting by utilities and third-party participants.
- Dedicate sufficient staff resources, including cross-functional teams with pre-identified roles and processes for quickly reviewing applications (if relevant).
- Create channels for regular, candid, non-punitive conversations between regulators, utilities, innovators, and sandbox stakeholders.
  - Consider using advisory councils and assigning non-decisional Commission staff to help foster open dialogue.
- Create processes for continuous learning and checkpoints to adjust the sandbox mechanism over time.
- Spread the word and use multiple communication channels for sharing information on the sandbox mechanism and results and findings.

Register for our upcoming webinar on August 13th at 11 am Pacific.

Register at https://www.naruc.org/events/innovation-webinars/ or via QR code, below.

ENERGY MARKETS & POLICY

Contacts

Grace Relf: gerelf@lbl.gov, 510-926-0943
Lisa Schwartz: lcschwartz@lbl.gov, 510-926-1091

For more information

Download publications: https://emp.lbl.gov/publications
Sign up for our email list: https://emp.lbl.gov/mailing-list
Follow us on Bluesky: @BerkeleyLabEMP.bsky.social

Acknowledgements

This work was funded by the U.S. Department of Energy, Office of Electricity, under Contract No. DE-AC02-05CH11231.

Disclaimer

Copyright Notice