Deploying Regulatory Sandboxes to Support Grid Resilience

Presentation for the Maine Public Utilities Commission

Inquiry Regarding Improving Resiliency and Addressing Escalating Storm Costs, Docket 2024-00191

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Presentation Objectives and Agenda

- Objectives
  - Provide an overview of regulatory sandboxes and similar mechanisms
    - Benefits
    - Design and implementation considerations
    - National landscape
  - Demonstrate how sandbox-type mechanisms can support improvements in electric system resilience

- Agenda
  - Introduction and Background
  - Regulatory Sandboxes as Innovation Tools
  - Deploying Sandboxes to Advance Resilience
  - Wrap up and Q&A

Introduction and Background

Berkeley Lab Research

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

Research objectives include:

- Identify regulatory sandboxes and related processes
- Assess emerging best practices
- Assess state needs to implement sandboxes
- Create a toolkit that provides considerations for states looking to develop a sandbox (forthcoming)

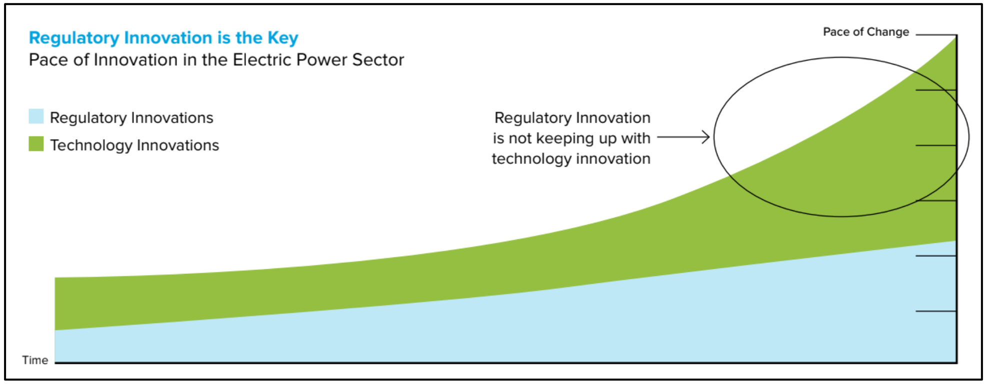
Research methods include:

- Literature review
- Interviews with key stakeholders
- Review of regulatory proceedings and related resources

Element	Details
Scope	The Grid Modernization Study offered that a sandbox could focus on grid modernization initiatives, including the integration of distributed energy resources and advanced grid management technologies. The Seed Grant program is designed for companies working on the development or testing of clean technologies aimed at reducing or capturing greenhouse gas emissions and/or criteria pollutants, or facilitating such reduction or capture. The target areas include energy distribution and storage.
Objectives	The Grid Modernization Study proposed that a future sandbox could aim to create an environment in which EDCs can test novel and innovative technologies and processes with the broader goal of better understanding performance outcomes/power quality/deliverability/reliability related to connecting new and more innovative facilities to the contiguous power system (e.g., renewable generators). The objectives of the Clean Tech Seed Grant Program include the following - • *Help early-stage clean technology/clean energy companies in accelerate development and innovation of clean technologies to transform new discoveries from research stage into commercially viable technologies* • *Enable clean technology and clean energy companies make significant progress and have a meaningful impact on their commercialization outcomes*
Derogations	A future sandbox may include expedited review process and heightened flexibility to adapt operational practices to the diverse market sectors within each EDC service area, while ensuring grid safety and reliability under the standard oversight of the NJ BPU. The Clean Tech Seed Grant Program allocates ratepayer funding to directly third party companies, including up-front funding for programs (80% at the outset, 20% after final report).
Eligibility	To be eligible for the Clean Tech Seed Grant Pilot Program, applicants must meet criteria showing that they are small businesses based in NJ.
Application Process	To be eligible for a grant, applicants must achieve a minimum score of 70 points across the following criteria: • Innovation: Maximum of 30 points • Market Opportunity and Strategy: Maximum of 20 points • Implementation Plan (Budget and Milestones): Maximum of 20 points • Economic and Broader Impact: Maximum of 10 points • Team: Maximum of 20 points
Funding and Cost Recovery Mechanism	Eligible applicants can secure grants of up to $75,000 through the Clean Tech Seed Grant Pilot Program, which has a total funding pool of $1,500,000 for its third pilot phase. The funding is provided by the NJBPU's Clean Energy Program.
Oversight and Governance	The New Jersey Commission on Science, Innovation, and Technology (CSIT) oversees the application and grant award process for the Clean Tech Seed Grant Program.
Evaluation and Reporting	Applicants must create quarterly milestone projections. They are instructed to "include milestones on Innovation development, Customer discovery, Markets and IPs, Partnership and Collaborations."
Overall program timelines	12 months
Other innovation ecosystem elements	The 2019 Energy Master Plan identified expansion of NJ's clean energy innovation economy as a primary objective. It included six sub-goals focused on growing R&D, workforce training, innovative financing, offshore wind opportunities, establishing an innovation center, and establishing a clean buildings hub.
Exit Strategies	None detailed.

Introduction

- 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.**

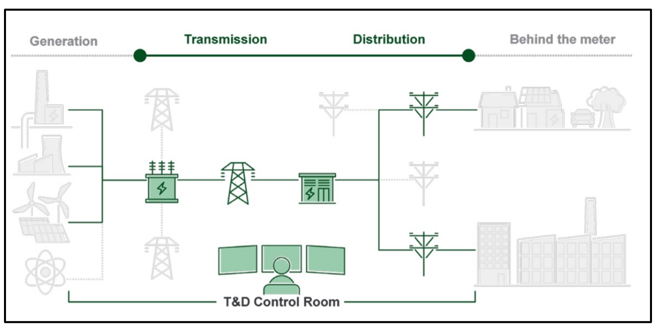


Source: McDonnell, Gorman, and Field 2022

The Potential for Advanced Grid Technologies

Advanced grid technologies that are commercially available today, but have not yet reached full market transformation, could be adopted within 3–5 years to increase peak capacity of U.S. T&D systems by 20–100 gigawatts (GW) at lower cost than like-for-like replacements.

- Many of these technologies directly support resilience.



Scope and Impact of Advanced Grid Technologies

Advanced Grid Solutions			T&D capacity impact	Affordability	Reliability	Resilience	Sustainability
Advanced Transmission Technologies	Advanced Conductors		Primary	Significant	Significant	Significant	Significant
	Point-to-Point HVDC systems		Primary	Significant	Significant	Primary	Significant
Situational Awareness and System Automation Solutions	Advanced Sensors		Low	Significant	Primary	Significant	Significant
	Power Factor Correction		Significant	Primary	Significant	Moderate	Significant
	Smart Reclosers		Low	Low	Primary	Significant	Low
	Substation Automation & Digitization		Low	Low	Significant	Primary	Low
	ADMS	*Base ADMS* (D-SCADA, OMS)	Low	Moderate	Significant	Significant	Moderate
		System efficiency: VVO	Primary	Primary	Moderate	Moderate	Primary
		DER integration: DERMS	Primary	Low	Moderate	Moderate	Primary
		Reliability: FLISR	Low	Moderate	Primary	Primary	Low
Grid Enhancing Technologies and Applications	Dynamic Line Ratings (DLR)		Primary	Primary	Significant	Moderate	Significant
	Adv. Power Flow Control (PFC)		Primary	Primary	Significant	Moderate	Significant
	Topology Optimization		Primary	Primary	Primary	Significant	Significant
	Energy Storage		Primary	Significant	Primary	Primary	Significant
	Advanced Flexible Transformers		Low	Moderate	Primary	Moderate	Moderate
	Virtual Power Plants (VPPs)		Primary	Significant	Moderate	Moderate	Significant

Low	Moderate	Significant	Primary
Indirect, limited impact	Direct, moderate impact	Direct, operationally significant impact	Direct, primary impact

Source: White, et. al. 2024

Regulatory Barriers to Utility Innovation and Adoption of Advanced Grid Technologies

Challenge to Innovation	Specific Barriers
Cost-of-service regulation and cost recovery	Business models incentivize capital-intensive investments which may inhibit investment in non-capital innovative grid technologies and less costly capital solutions.
	Regulation creates a lag between investments and cost recovery, favors tried-and-true technologies, and creates risk aversion at utilities.
	Utilities do not have certainty about cost recovery for expenditures.
	Utilities have monopoly power that can reduce incentives to control certain costs.
	Regulatory processes can be lengthy and litigious and may require de-prioritization of innovation proceedings in favor of other efforts.
	Reliance on traditional approaches to utility innovation, such as research and development (R&D) and pilots, typically have not resulted in transformative change.
Technological concerns	Utilities are cautious about introducing new technologies where impacts on reliability or safety have not been fully vetted.
	Regulators and stakeholders often challenge early replacement of existing technologies.
Education and leadership	Utilities, regulators, and stakeholders lack awareness and education about regulatory sandboxes and other innovation vehicles, and organizational champions often drive sandbox development.
	Lack of information sharing creates uncertainty and limits spillover effects to expand the benefits of sandboxes.

Regulatory Sandboxes as Innovation Tools

Key Terminology

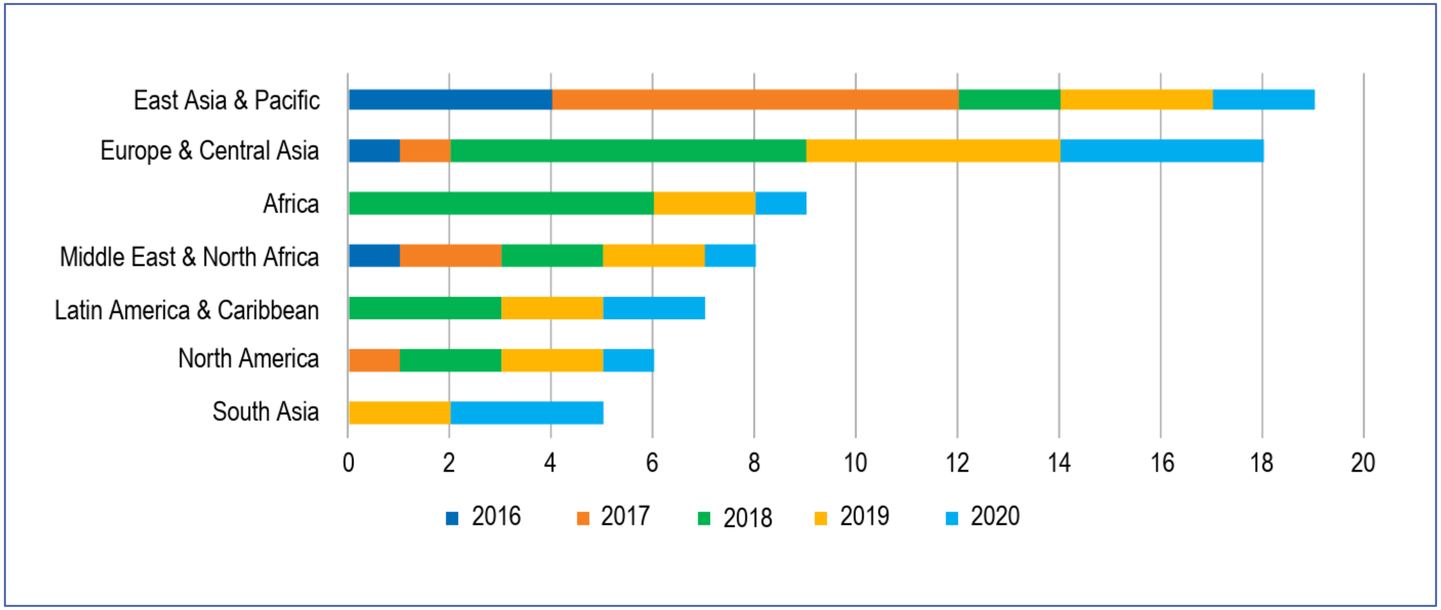
Term	Definition
Innovation	"The search for, and the discovery, development, improvement, adoption and commercialization of new processes, new products, and new organizational structures and procedures."* Innovation requires both creating new ideas and implementing those ideas.
Innovation vehicle	A program or mechanism specifically designed to promote testing and acceleration of ideas that go beyond the status quo
Regulatory sandbox	A type of innovation vehicle that offers a structured environment for testing new technologies and business approaches under modified rules to increase the speed of adoption. Regulatory sandboxes establish processes, with appropriate guardrails, for utilities to take on calculated risks that might not otherwise be feasible under standard regulatory practices and to quickly adapt to learnings during the trial phase and through identified scaling strategies.
Derogation	A modification to or exemption from typical regulations or rules deployed as part of a regulatory sandbox
Sandbox-type mechanisms	A group of programs and mechanisms that act similarly to regulatory sandboxes, but have specific or unique identifying characteristics
Advanced grid technologies	Advanced technologies, services, and applications (both hardware and software) that enhance T&D systems by unlocking new capacity and capabilities to meet system needs

*Costello, 2016 (definition from Shy, 1995)

The History of Regulatory Sandboxes

- The term “sandbox” originated in the IT industry, where programmers created isolated environments to test new or suspicious programming, code, and software.
- In the 2010s, the Financial Technologies sector adapted sandboxes to help regulation respond to the financial crisis and rapid technology advancements and coined the term “regulatory sandboxes.”
- The objectives and processes from early sandboxes are foundational for today’s energy-sector sandboxes.

Financial Sector Regulatory Sandboxes by Region



Source: World Bank Group, 2020

Timeline of Sandbox-Type Mechanisms in the Electricity Sector

Regulatory Sandboxes

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

2011
- California EPIC Program

2013
- Arizona Innovations and Technological Developments exploration

2015
- New York Reforming the Energy Vision (REV) Demonstrations

2016
- PowerPath DC Pilot Project Fund

2017
- Portland General Electric's Smart Grid Testbed
- Singapore Energy Market Authority's Regulatory Sandbox
- U.K.'s Office of Gas and Electricity Market (Ofgem)'s Innovation Fund

2018
- Wisconsin Energy Innovation Grant Program

2019
- Ontario Energy Board's Innovation Sandbox
- Vermont Innovative Pilots Program

2020
- New Hampshire Grid Transformation and Enablement Program considered
- New Jersey Clean Technology Grant Programs
- Hawaii Public Utilities Commission's Innovative Pilot Framework
- Michigan New Technologies and Business Models

2021
- Minnesota Rate Case Pilot Projects considered (sandbox not adopted)

2022
- Connecticut Innovative Energy Solutions
- New Jersey Regulatory Sandbox recommended

2024
- North Carolina Innovation Prototyping Process

Potential Benefits of Sandboxes

Benefit Category	Details
Advancing innovation	• Advances within businesses and create spillover effects (e.g., new partnerships, reduced silos) • Highlight areas for revised regulations and gaps where new guidance or policy may be needed • Reduce cost by removing barriers for innovative technologies and testing ideas before scaling • Create evidence that there is a market for innovative technologies
Improving information collection and sharing	• Collect insights and real-world data on new ideas • Build evidence to support a regulatory decision • Provide opportunities for a more collaborative approach to achieve energy-related state goals • Improve coordination between stakeholders with clear and well-implemented practices for knowledge-sharing and collaboration
Improving economic outcomes	• Improve ability to identify and capitalize on new economic opportunities and scale more quickly • Create new pathways for ideas to reach commercialization, stimulating investment and new jobs • Test emerging technologies that are more cost-effective than like-for-like replacements
Improving grid reliability and resilience	• Test emerging technologies that support the grid, such as advanced distribution management and situational awareness tools
Better meeting customer needs	• More nimbly adapt to changing customer desires such as for better access to electric vehicle charging, improved building resilience, and adoption of distributed storage technologies
Increasing access to technologies	• Support access to advanced technologies for varied populations, such as by targeting programs to specific locations on the system to reduce congestion

Potential Risks of Sandboxes

Risk Category	Details and Mitigation Strategies
Market distortions	• Disrupt competition as businesses participating in the regulatory sandbox gain an advantage, creating barriers to other firms entering the market • Potentially erode a utility's monopoly status Mitigation strategies: Transparent eligibility criteria, objectives, selection criteria, exit options, level opportunities for participation by different entities, and knowledge-sharing obligations
Negative impacts to customers	• Reduce consumer protection (e.g., create undue advantages for certain customer segments) • Fail to produce intended benefits (e.g., technology costs are higher than expected, reduced reliability) Mitigation strategies: Include consumer safeguards among the eligibility criteria for submitted projects, maintain technology neutrality, create flexibility to adjust to program learnings in real time or end projects early
Negative impacts to the grid or society	• Fail to produce intended benefits (e.g., grid flexibility is not realized) Mitigation strategies: Embrace learning/failure as a successful outcome, create flexibility to adjust to program learnings in real time or end projects early
Undue investment of time and resources in sandbox implementation	• Distract from other regulatory or utility needs • Fail to achieve innovation objectives of the sandbox • Act as an imperfect substitute for other regulatory change or enablers Mitigation strategies: Deploy best practices for sandbox design, consider whether a sandbox is the appropriate innovation vehicle, create clear project management tools, build in opportunities to adjust the sandbox framework over time

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

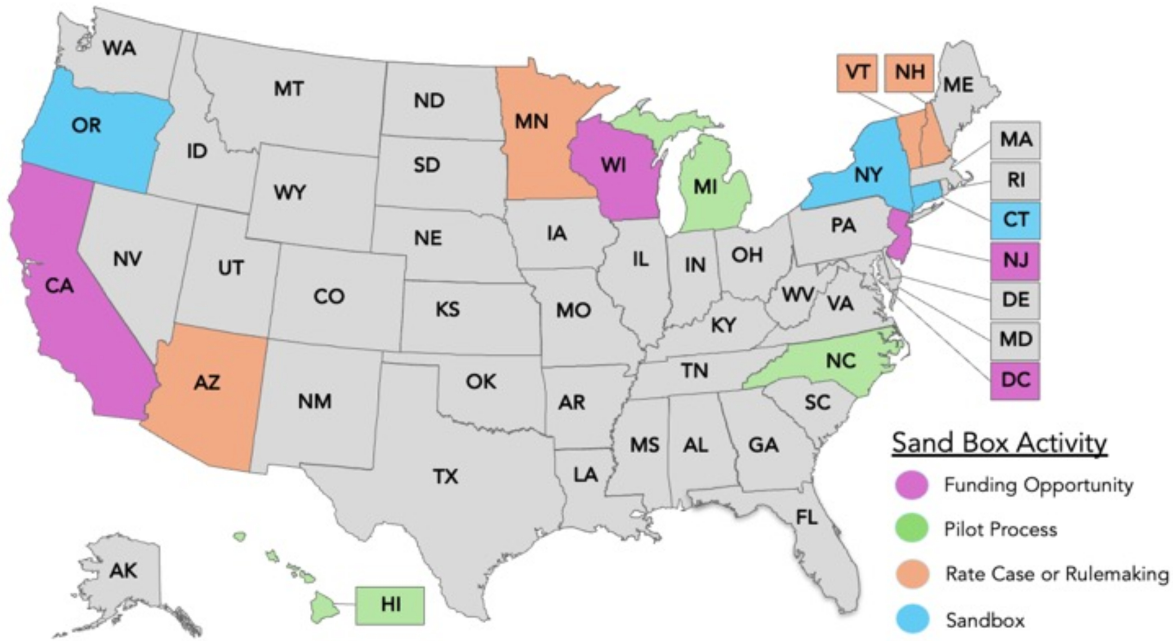
Vehicles for broader innovation efforts that may include reforms including sandbox-like initiatives

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



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 PBR 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

Regulatory Sandbox Scoping Elements

Scoping Element	Best Practices
Program objectives	● Clearly state objectives aligned with state policy ● Use stakeholder engagement processes to develop objectives ○ Acknowledge that “failure” is still an informative outcome ● Anchor objectives in showing that technologies can operate in real energy markets/systems and with real consumers ● Ensure that learning, speed, and eventual scaling are primary objectives
Program scope	● Clearly identify the regulatory barriers that the sandbox intends to address ● Provide information on what markets, technologies, programs, and regulations are in scope
Derogations	● Carefully design derogations to address barriers to innovation ● Identify foundational legal and regulatory frameworks to enable responsible innovation and regulatory flexibility ● Deploy other innovation vehicles instead of a sandbox when appropriate
Funding and cost recovery	● Reduce uncertainty over cost recovery ● Look into funding sources beyond customers rates ○ Consider allowing cost recovery even if trials aren’t successful ○ Consider risk or cost sharing design elements

Regulatory Sandbox Participation Requirements

Participation Requirements	Best Practices
Program and project eligibility	● Develop eligibility and selection criteria well in advance with stakeholders ● Provide examples and information about previous successful innovators ● Use templates and standard format documents ● Create multiple participation pathways for different entity types ● Follow best practices for pilot/demonstration design ○ Jurisdictions can create unique eligibility requirements to meet their goals, such as local vendor preferences or vendor cost sharing criteria ● Carefully specify eligibility criteria to protect customers from possible sandbox risks ● If applicable, develop a comprehensive and specific list of selection criteria ● Calibrate eligibility and selection requirements to recognize that developing a strong business case and demonstrating financial and technical capabilities can be challenging for emerging technologies or businesses
Application process	● Consider whether to use open calls for applications, thematic calls, or to allow continuous applications ○ Identify how many cycles or calls will happen before undertaking a more comprehensive sandbox review ● Calibrate the process to avoid burdensome or prohibitive administrative requirements, but ensure transparency about use of public funds

Regulatory Sandbox Governance and Oversight

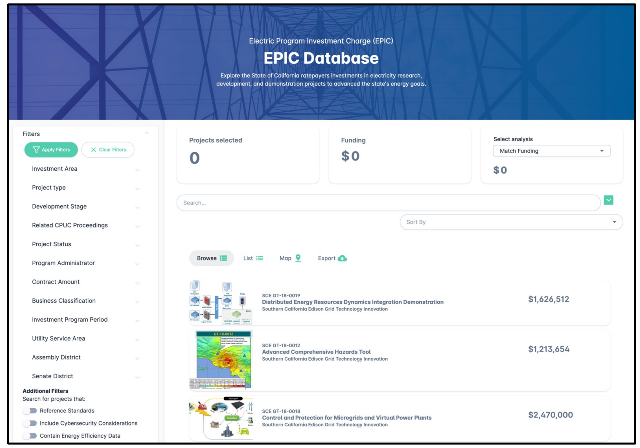
Element	Best Practices
Oversight and governance	● Ensure transparency in all aspects of the sandbox ● Conduct an upfront feasibility assessment ● Maintain time limits on the sandbox or derogation and individual projects ● Ensure commitment from leaders and stakeholders at the outset ● Limit regulatory oversight and administrative and provide flexibility in project implementation ● Create robust risk management procedures and go/no-go checkpoints and criteria ● Create opportunities for open, non-punitive interaction amongst stakeholders ● Ensure sufficient resources are dedicated to management and oversight of sandbox
Evaluation and reporting	● Establish clear evaluation criteria and metrics for success that aligned with sandbox objectives ○ Solicit participation by both utilities and innovators in evaluations ○ Use customer/participant surveys ● Create public reporting obligations for finished projects
Scaling strategies	● Clearly identify project exit options ● Set up procedures for transitioning results into permanent regulation
Communication	● Create a stakeholder engagement plan that includes all relevant stakeholders ● Create enthusiasm and momentum with pitch-fests, newsletters, webpages, webinars, press releases and other communication tools ● Stay in touch with innovators with ongoing light-touch surveys ● Create channels and processes to retain learnings and other information over time

Legal Frameworks for Sandboxes

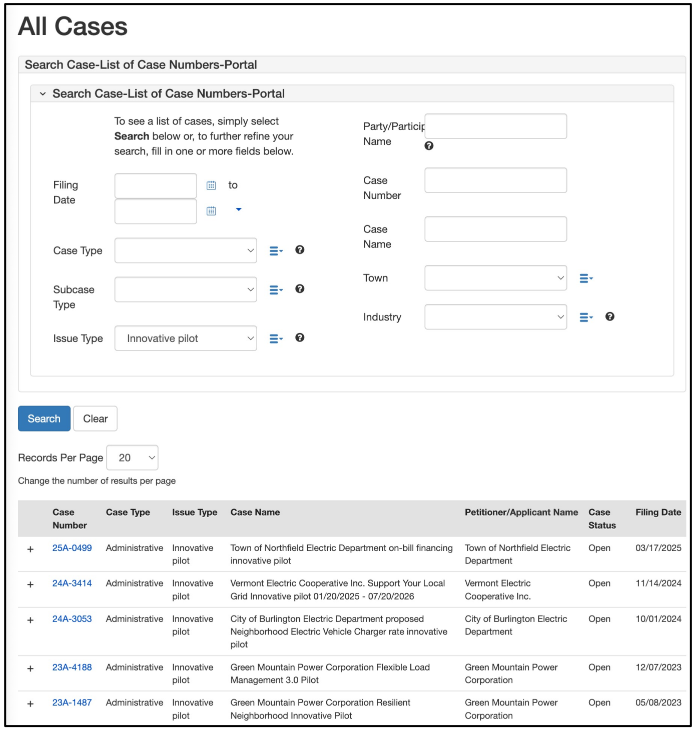
- Commissions cite their broad regulatory authority and obligations as justification to establish a sandbox.
  - The District of Columbia cited its obligation to take meaningful steps to achieve its energy commitments.
  - Connecticut cited its broad statutory powers and obligations to oversee electric distribution companies and requirements to partner with third parties for enhanced demand-side management programs.
- Some states have more explicit legal authority for sandboxes.
  - California preserved an expiring funding carve-out under a Public Goods Charge statute for the EPIC program.
  - Hawaii cited statutes requiring implementation of performance-based regulation (PBR).
- Commissions may have existing frameworks to draw on in the design of regulatory sandboxes.
  - Hawaii mimicked an existing Commission process for expedited approval of programs.

Sandbox Repositories and Information Sharing

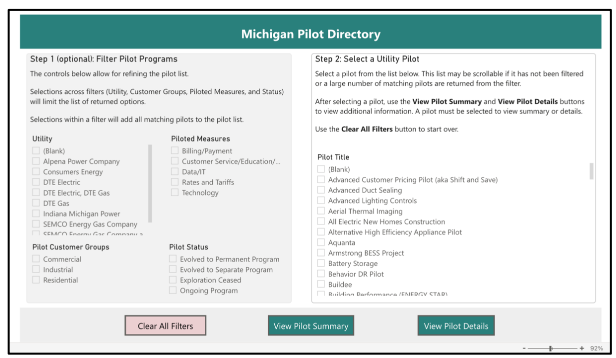
California's EPIC Database



Vermont Docket Search for Pilots



Michigan Pilot Directory



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Creating an Ecosystem of Innovation

- Regulatory sandboxes do not address every regulatory barrier to innovation.
- Innovators require some level of certainty that there will be demand for their product or service confidently invest in development.
  - Deployment of multiple innovation vehicles creates a supportive environment and an ecosystem of innovation.
  - Varied entities can deploy innovation vehicles to support innovation at different stages.
- Common innovation vehicles in states with sandbox-type mechanisms include PBR, policy directives and vision statements, and information sharing platforms.

Types of Innovation Vehicles

Utility-driven approaches

- R&D
- Demonstrations
- Pilot programs
- Organizational changes that focus on innovation

Legal- or Regulatory-driven approaches

- Topical explorations and information gathering processes
- Performance-based Regulation (PBR)
- Changes to legislative policies and utility regulations
- Wait-and-see approach

Economy-wide and broader approaches

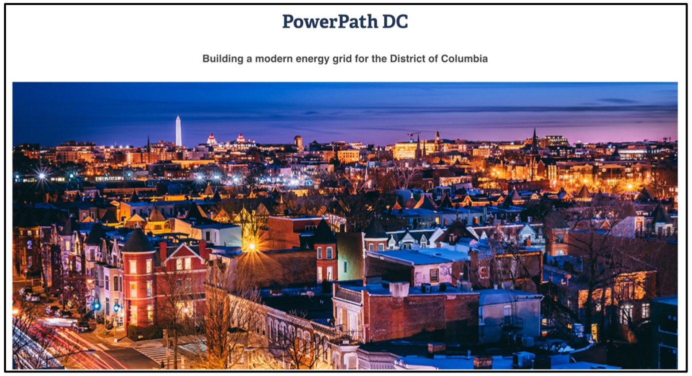
- Policy directives and vision statements
- Information sharing platforms and communication tools
- Innovative financing programs
- Innovation hubs and incubators
- Pitch fests
- Technical assistance

Deploying Sandboxes to Advance Resilience

Designing the Sandbox for Resilience

Options to focus sandbox outcomes on resilience include:

- Identifying resilience as a guiding objective of the sandbox
  - The Washington, DC, PowerPath Pilot program supports projects that align with "a modern, sustainable, and resilient energy grid."
  - The Wisconsin Energy Innovation Grant Program (EIGP) supports projects focused on energy efficiency, renewable energy, transportation, planning, and resilience.
- Using thematic program calls and/or employing resilience-focused selection criteria
  - Connecticut's Innovative Energy Solutions (IES) program uses cycles with themes like grid edge solutions and smart energy communities.
  - DC scores proposals based on desired features such as contributions to grid reliability.
  - Hawaii requires pilots to focus on pre-identified areas, including resilience.
- Tailoring the sandbox to explicitly enable resilience-focused programs
  - Hawaii's pilot framework was initially envisioned as an electrification of transportation effort.



Source: PowerPath DC

Project Example: Resilient Neighborhood Pilot

- Green Mountain Power launched the Resilient Neighborhood Pilot in 2023.
- The neighborhood will be a microgrid and have utility-scale storage.
- The pilot creates a fully electric, storm-resilient neighborhood by offering turnkey packages to 38 single- and multi-family homes, including:
  - Solar and storage systems
  - Smart electrical panels
  - Level 2 electric vehicle chargers
  - Whole home air source heat pumps
  - Induction stoves
- Green Mountain Power will request a Resilient Neighborhood 2.0 pilot to expand on initial learnings.

Objective	Measurement Method	Measure of Success
Prove that an all-electric home can be served by a 200 amp service.	We will work with SPAN to measure load in the homes.	Home loads remain under 200 amps naturally or by smart management of loads through the SPAN panel. No adverse customer experience.
Provide a mechanism for customers to install rooftop solar outside the scope of net metering.	GMP will be able to meter total generation and consumption as compared to expected generation and consumption as assumed in the program modeling.	Expected generation aligns with the actual output to provide the right value to non-participating GMP customers.
Show that a fully electric neighborhood can be used as a grid asset as a whole to provide grid and market benefits.	GMP will create three or more specific load "shapes" that we use for the neighborhood and run them. For example, the neighborhood is a load during high solar times, a source during peak demand times, and neutral when no power is flowing back and forth.	Actual measurements at the recloser feeding the development will show what the net load is for the neighborhood. If we are able to match our desired load shape, we would consider that a success.

Source: Green Mountain Power 2024 IRP, Green Mountain Power, 2023

Project Example: Grid Resilience Asset Investment Platform

Through the Connecticut IES program, Rhizome is implementing a project that creates a digital representation of the distribution system.

- The project will:
  - Quantify each distribution system asset's vulnerability to weather-related hazards
  - Estimate weather-related financial losses up to 50 years in the future
  - Project holistic, rather than one-off weather risk analysis
- Rhizome expects the project to result in a 3–5% improvement in outage metrics and restoration time and costs.
- The IES Innovation Advisory Council supported the project because of anticipated grid resilience impacts and alignment with the Authority's related efforts on resilience standards.

Sources: CT PURA, Rhizome

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

Project Example: Undergrounding Low-Voltage Distribution Lines

Consumers Energy is running a pilot for Undergrounding Low-Voltage Distribution (LVD) Lines, which will underground certain sections of overhead lines.

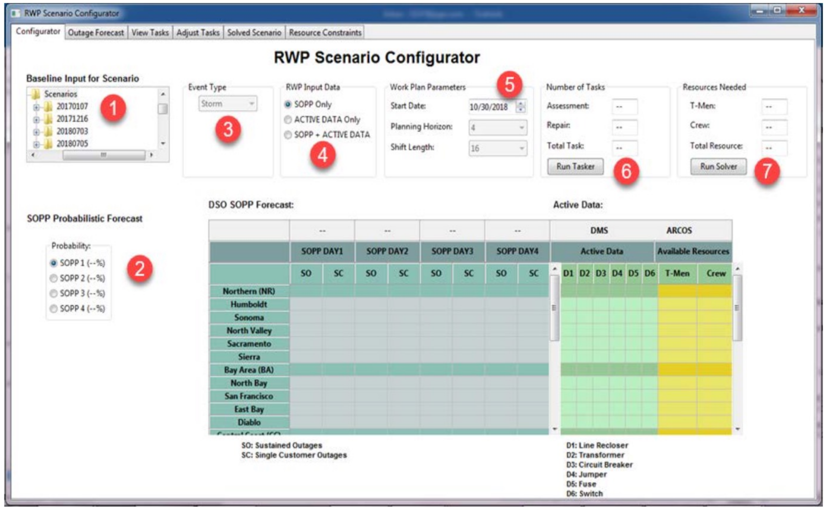
- The pilot seeks to collect data on the actual reliability and cost impacts of undergrounding LVD lines.
  - Consumers expects to spend $3.7 million and will compare costs to other reliability efforts.
  - Consumers will study actual reliability improvements.

Sources: MI PSC, Consumers Energy

Project Example: Emergency Preparedness Modeling

Pacific Gas & Electric's emergency preparedness modeling pilot uses predictive analytics and AI to recommend a restoration work plan after disruptive events.

- The model considers:
  - Damage predictions
  - Work demand
  - Resource requirements
  - Positioning of resources
- The pilot cost $4.7M and resulted in:
  - Successful demonstration of a tool to recommend restoration strategies
  - Models and algorithms that other utilities could leverage
  - A safer work environment, improved reliability, and transparency in restoration efforts



Source: [CEC EPIC Database]

Project Example: Proactive Wires Down Mitigation

Pacific Gas & Electric's Proactive Wires Down Mitigation pilot is testing methods for automatically and rapidly reducing current and risk of wildfire ignition from downed wires.

- The pilot will cost $14.7M and to date has:
  - Installed Rapid Earth Fault Current Delimiter technology
  - Conducted operator training
  - Solved initial commissioning and testing issues
  - Detected and mitigated a ground fault from a tree branch contacting a distribution line

Source: CEC EPIC Database

Other Project Examples

- Hot Springs Microgrid
  - A Duke Energy microgrid in North Carolina, including a 2 MW solar facility and a 4.4 MW battery storage system that can independently power the entire town during outages
- Tantalus
  - A Connecticut IES program that uses advanced metering infrastructure to collect granular power quality assessments and identify vulnerable distribution system assets
- Smart Pole Solutions
  - An APPA DEED program in Florida to explore potential for smart poles that can improve WiFi signals, heighten security (camera monitoring), offer level 2 EV charging, and display various messaging
- Quail Microgrid
  - A DTE Electric pilot that converted a 2 MW portable diesel generator into a blackstart stationary system and islanded microgrid
- Red Cliff Early Childhood Center Solar Energy System and Training Program
  - A Wisconsin EIGP program that installed a solar and battery microgrid system and integrates solar education into the school curriculum
- Proactive Storm Impact Analysis
  - Southern California Edison's EPIC project focused on resolving limitations in predictive models for storm-related outages

Duke Energy's Hot Springs Microgrid

Source: The Assembly

Wrap Up

Emerging Best Practices (1)

- Terms and objectives must be clear, ambitious, and have buy-in from relevant 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.

Findings

- Many U.S. sandboxes are still in early stages and findings are emerging.
- Sandboxes have demonstrated value, particularly for supporting learning and testing new technologies and approaches.
  - Nearly all of the utilities, regulators, and stakeholders interviewed by Berkeley Lab indicated that sandbox mechanisms in their state have been successful.
- Sandboxes can specifically support reliability and resilience efforts and be tailored to meet a jurisdiction's needs.
  - For example, sandboxes can enable deployment of customer-sited batteries, microgrids, and modeling tools.
  - Projects not focused explicitly on reliability and resilience may also have such benefits.
- While lessons learned are reported for sandboxes in other jurisdictions, sandbox mechanisms may need to be tailored to state- and utility-specific objectives and conditions.

Additional Resources

- A Handbook for Designing, Implementing, and Evaluating Successful Electric Utility Pilots (Cappers and Spurlock, 2020)
- Pathways for Innovation: The Role of Pilots and Demonstrations in Reinventing the Utility Business Model (Fairbrother et. al, 2017)
- Regulatory Sandboxes: Program Design to Accelerate Innovation for an Evolving Electric Grid (McDonnell, Gorman, and Field 2022)
- Global Experiences from Regulatory Sandboxes (Appaya et. al, 2020)
- How to Build a Regulatory Sandbox: A Practical Guide for Policy Makers (Jeník and Duff, 2020)
- Innovative Regulatory Approaches with Focus on Experimental Sandboxes: Casebook (International Smart Grid Action Network, 2019)
- The Role of Innovation in the Electric Utility Sector (Berkeley Lab, 2022)

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