Pacific Northwest
NATIONAL LABORATORY

# Energy Storage Regulatory Program Overview

October 26, 2023

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2023 OE Energy Storage Program Peer Review

U.S. DEPARTMENT OF ENERGY BATTELLE

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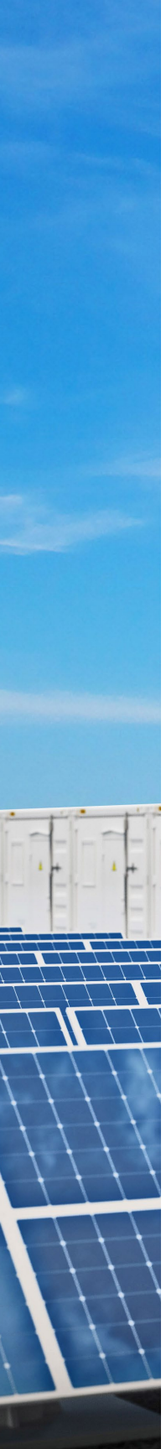

# Acknowledgment

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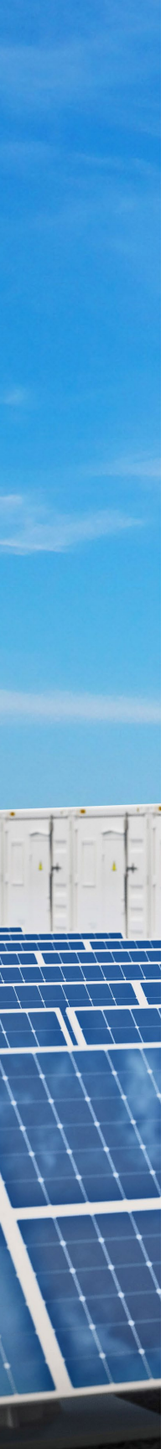
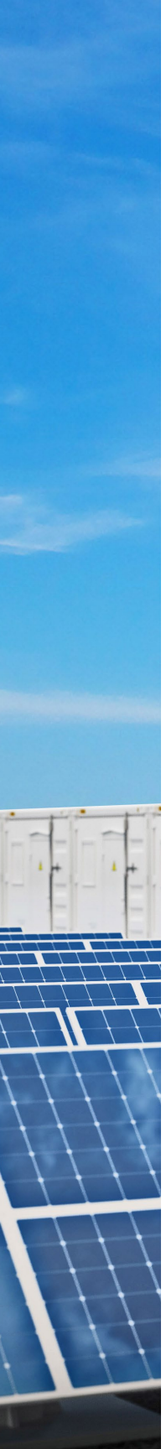


# Agenda

- **Equitable Regulatory Environment: Thrust Area Overview**
- **2023 Accomplishments**
  - Long-Duration Energy Storage
  - Energy Storage Siting
  - Quantitative Policy Analyses
  - EV Infrastructure
  - Other Accomplishments
  - Outreach and Engagement
- **Looking Ahead**



# Equitable Regulatory Environment Mission

Mission Statement

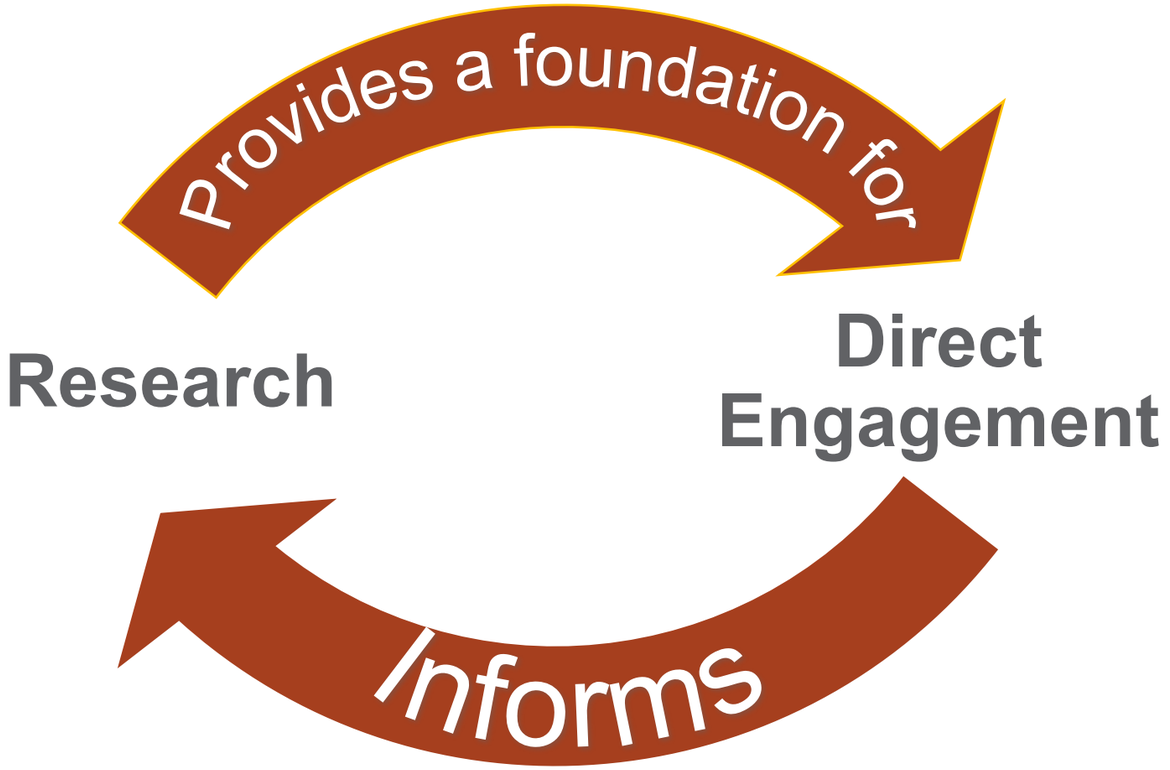
**“Value propositions for grid storage depend on reducing institutional and regulatory hurdles to levels comparable with those of other grid resources.”**

**Program Tasks:**

- **Document** federal, state and local policies affecting storage deployment
- **Review** integrated resource plans (IRPs) and similar analytic processes affecting storage development and deployment
- **Explore** alternative policies that may affect technology attributes and deployment
- **Maintain** publicly available information on storage technology and attributes affecting its deployment
- **Disseminate** comprehensive information on storage technology status, experience, and realizable contributions to grid resilience, emergency response, renewable deployment, and asset utilization
- **Provide** best practices for installation and use of energy storage to regulators, policy makers and industry

# Program Model

- Policy options and impacts
- Planning obstacles and best practices
- Emerging use cases (i.e. resilience, transmission, energy system equity)
- Discrete issues (ownership, etc.)
- Energy Storage Policy Database



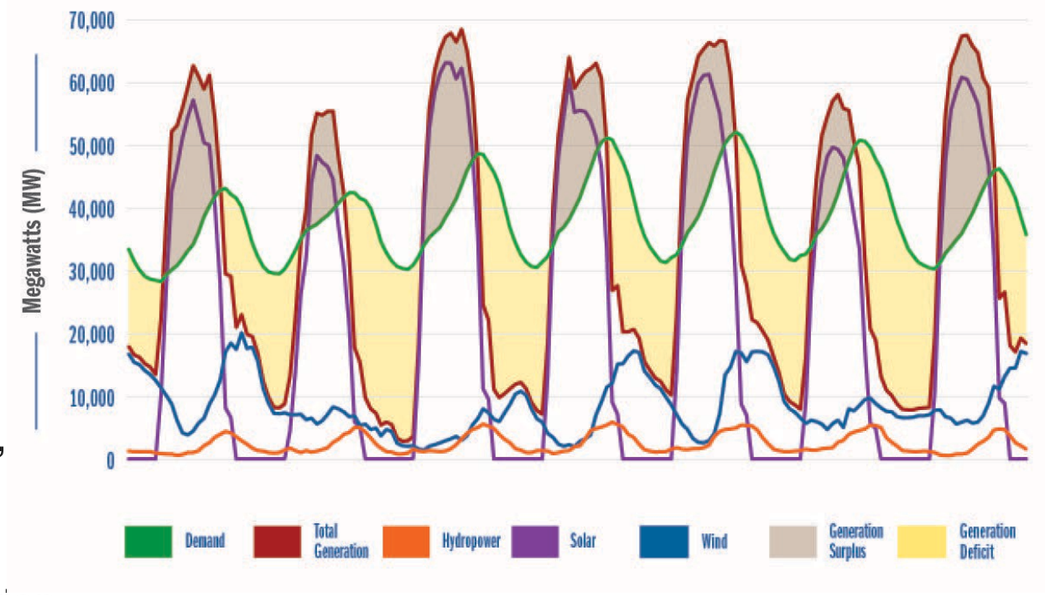

- Technical Workshops
- Conference Presentations
- Regulatory filing review
- Valuation
- Interconnection standards
- Codes and safety tutorials

# Long-Duration Energy Storage

**Project objectives:** Quantify the need for LDES technologies, identify policy and market barriers to their development, and explore options for reducing those barriers.

**Publications:**

- FY22: "Defining Long-Duration Energy Storage," *Journal of Energy Storage*
  - Illustrate the necessity of LDES in a decarbonized grid
  - Planning processes need to send clearer long-term signals for LDES development
- "Energy Storage: A Key Enabler for Renewable Energy," *The Bridge (National Academy of Sciences)*
  - Describe the role of energy storage in renewable integration
  - Review efforts made to address modeling challenges presented by energy storage technologies
  - Long-duration energy storage technologies will be needed to accommodate high levels of renewable energy



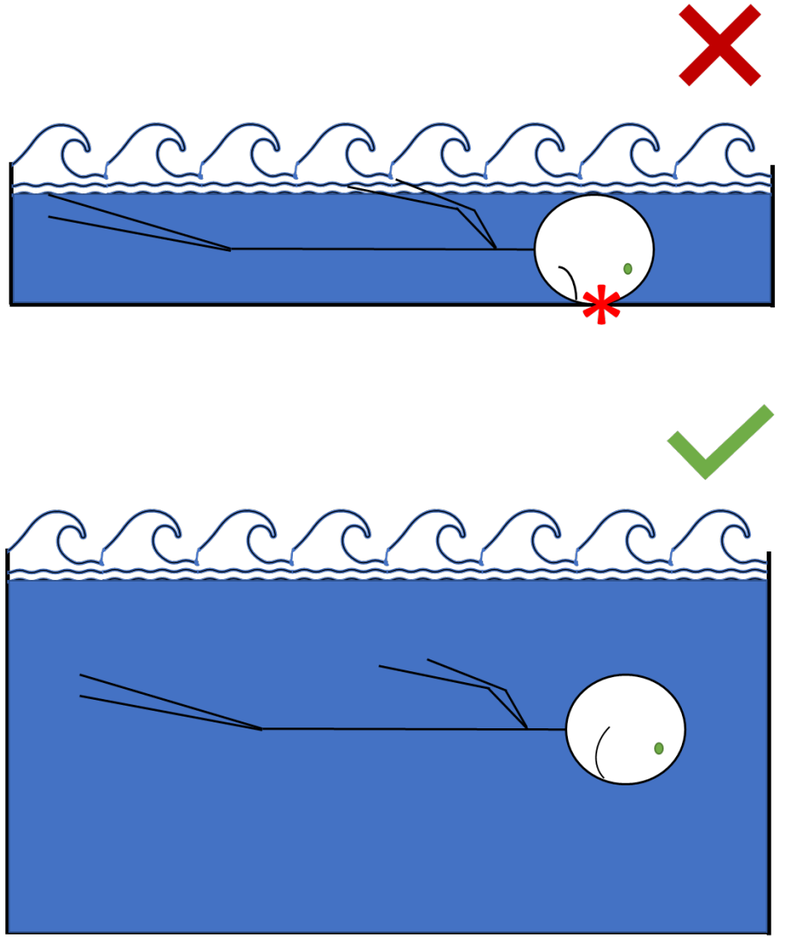

*From "Defining Long-Duration Energy Storage"*

High-renewable grids have strong daily and seasonal cycles of excess and insufficient generation

# Long-Duration Energy Storage

**Additional Publication:** "Laying the Groundwork for Long-Duration Energy Storage," *Bulletin of the Atomic Scientists* (in press)

- Compare and contrast battery energy storage deployments in the two states with the most battery storage:
  - CA: 6,045 MW total, 3.5 hours average duration
  - TX: 2,813 MW total, 1.3 hours average duration
- Develop an analogy using swimming pools to illustrate the benefits of LDES
- Identify the factors driving longer durations in CA and what they tell us about the types of reforms needed to support LDES:
  - Evolved Planning: Capacity expansion models use slices of the year, but full-year modeling required to capture LDES benefits
  - Lengthen Procurement Cycles: Most grid procurement happens on 2-3 year cycles; LDES technologies need more time to scale
  - Compensation: Market products must move beyond hourly paradigm to value resources based on long-term reliability benefits



Just as a deeper pool can lesson the pain of a belly flop, long-duration storage can lessen the pain of grid events

# Long-Duration Energy Storage

**Additional Publication:** "Energy Storage Market Transformation through Stored Energy Targets," EESAT Conference 2024 (accepted)

- Describe the limitations of current storage mandates and other policies in sending long-term investment signals for LDES
  - Average duration of battery storage projects among 15 leading states: 2.73 hours
  - Average duration, excluding California: 1.94 hours
- Propose stored energy targets (MWhs instead of MWs) as a policy to support LDES investments
  - Shift economic focus from capacity cost to energy cost
  - Send technology-neutral investment signal; storage of any duration is eligible
  - Can be designed based on an identified grid need
    - How much stored energy will be needed to keep peak demand at a manageable level?
    - How much stored energy will be needed to replace lost production during a wind drought?

| System Size | 1 MW/1 MWh | 1 MW/4MWh |
|---|---|---|
| Unit cost ($/MWh) | $211,000 | $199,000 |
| Total cost ($) | $211,000 | $796,000 |

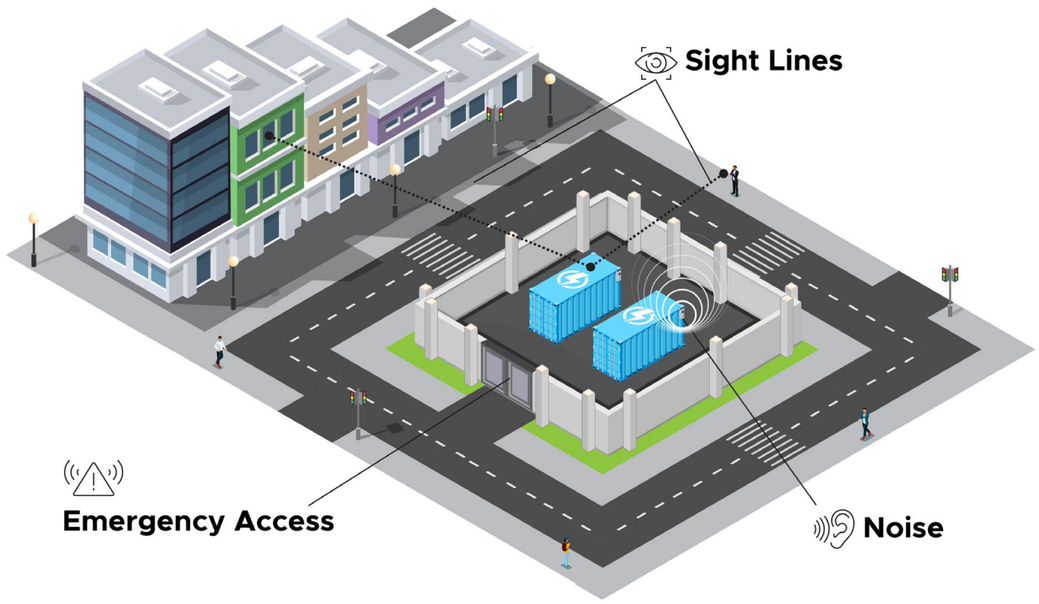
Least-cost option under a capacity-based target

Least-cost option under an energy-based target

Energy-based storage targets capture the economies of scale provided by LDES technologies

# Energy Storage Siting

**Project objective:** Provide objective, fact-based guidance to local zoning officials responsible for developing ordinances to govern energy storage siting and reviewing project proposals.




Devyn Powell will provide an in-depth presentation on this work.

**Accomplishments:**

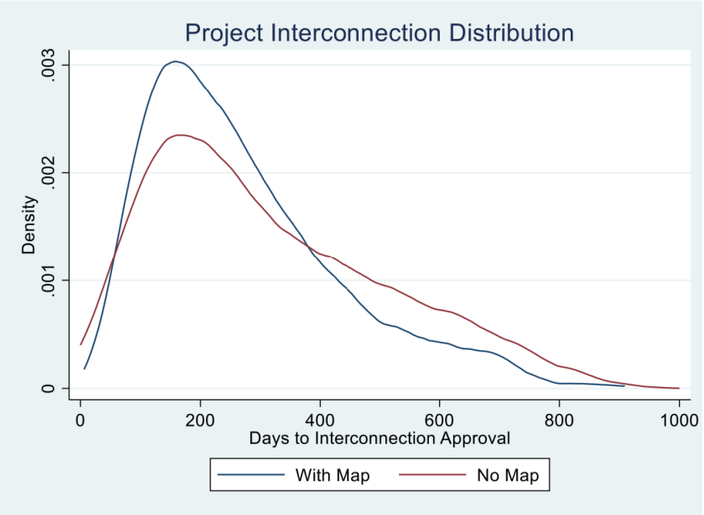
- Technical Report: “Energy Storage in Local Zoning Ordinances”
  - Identify the community impacts of storage projects and zoning measures to mitigate them
  - Review the status of energy storage in zoning ordinances around the country
- Multiple additional reports in development
- Webinar with the Washington State Department of Commerce for local planners around the state
- Presentation at the American Clean Power Association’s Siting and Permitting Conference

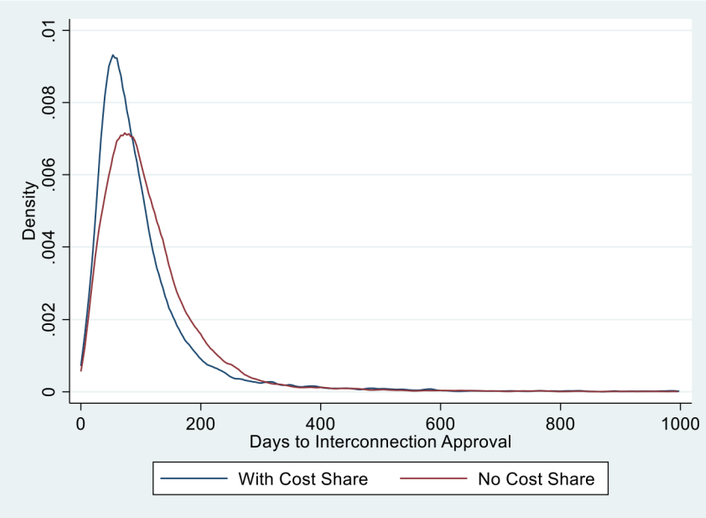
# Quantitative Policy Analyses

**Project objective:** Quantify the impacts of energy storage policies.

**Project Deliverables:**

- FY22: Impact of the California energy storage mandate on deployments and system costs (publication in review)
- FY23: Effects of interconnection queue reforms on queue waiting times (Publication: Waiting in Queue: A Historical Evaluation of Interconnection Policy)
- FY24: Relationship between mandates and storage system soft costs




Daniel Boff will provide an in-depth presentation on this work.

Impact of queue reforms on wait times in MA (left) and NY (right).

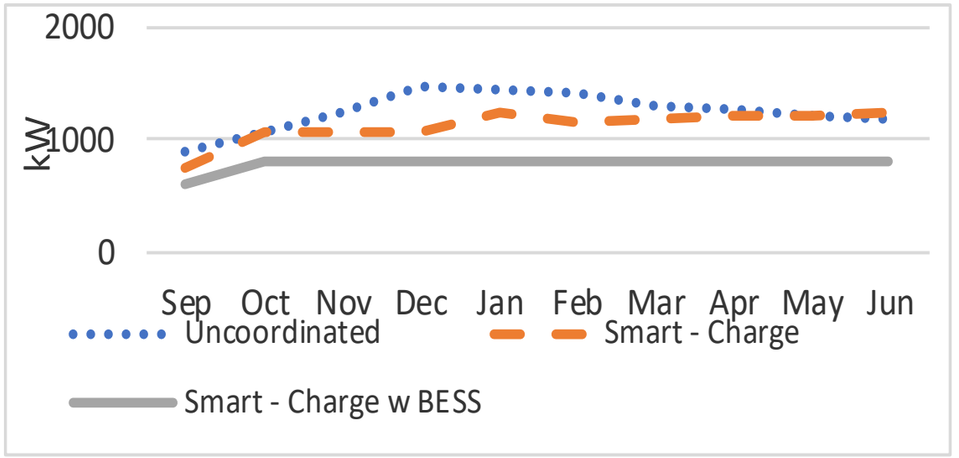
# Energy Storage and EV Infrastructure

**Project objective:** Study the potential for energy storage to act as a buffer between high-power EV charging infrastructure and the grid, using a real-world scenario.

**FY23 Activities:**

- Analyze the economic tradeoffs of vehicle-to-grid and fleet-to-grid to identify grid services that can be cost-effectively provided by EVs
- Work with Franklin Pierce School District in Tacoma, WA to analyze the impacts to school district electricity costs and to the grid of a central charging hub for the district's planned fleet electrification
  - Results to be presented at EESAT 2024

Christine Holland will provide an in-depth presentation on this work.




Impact of various charging strategies on charging facility monthly peaks

# Other Accomplishments

## Other Accomplishments:

- Conference Paper: “Calculating Behind-the-Meter Energy Storage Incentives on an Avoided Cost Basis.” Accepted for EESAT 2024.
- Contributed to the congressionally directed report: Study of Energy Storage Codes & Standards by adding regulatory and policy context for codes and standard adoption
- Contributed to a paper on the Energy Storage for Social Equity program for EESAT 2024, working with colleagues at Sandia National Laboratories.
- Acted as co-coordinator for the Policy & Valuation track of the Energy Storage Grand Challenge; reported on track activities at the ESGC Summit

| Scenario | Net Present Avoided Costs | Incentive Level ($/kWh) | Change from Baseline | Installed System Costs Covered |
|---|---|---|---|---|
| **Baseline** | $1,312.17 | $119.29 | - | 10.1% |
| **Low SCC** | $1,677.76 | $152.52 | +27.9% | 12.9% |
| **High SCC** | $2,516.46 | $228.77 | + 91.8% | 19.4% |
| **High Gas** | $2,125.39 | $193.22 | + 62% | 16.3% |
| **Low Gas** | $883.84 | $80.35 | - 32.6% | 6.8% |
| **High Heat Rate** | $1,627.09 | $147.92 | + 24% | 12.5% |
| **Low Heat Rate** | $853.76 | $77.61 | - 34.9% | 6.6% |
| **High Return** | $1,255.48 | $114.13 | - 4.3% | 9.7% |
| **Low Return** | $1,372.91 | $124.81 | +4.6% | 10.6% |

*From Calculating Behind-the-Meter Energy Storage Incentives on an Avoided Cost Basis.*

Summary of costs avoided by BTM energy storage under various scenarios

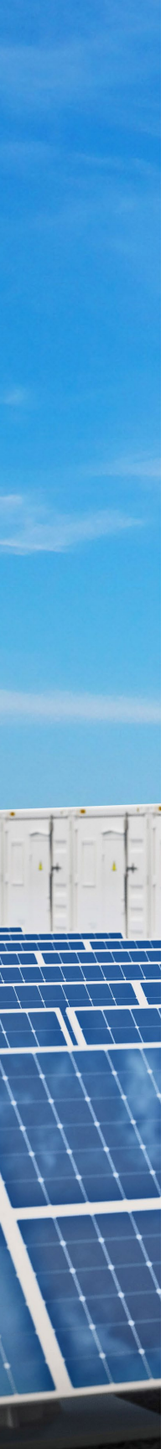
# Outreach and Engagement

## Guam

- Presented in two sessions of the Guam Conference on Island Sustainability, covering energy storage benefits, challenges, and policy options
- Assisted Guam Power Authority in reviewing responses to an energy storage request for proposals
- Interview with local news program


## World Bank

- Joined the World Bank's Energy Storage Partnership (ESP), which shares energy storage research across participants and provides technical assistance to developing nations
- Participated in ESP's Stakeholder Form and 9th Partner Meetings in England, presenting PNNL's work on energy storage safety and technical assistance
- Reviewed and provided input on ESP's guidance for energy storage contracting



# Selected Additional Engagements

**National Association of Regulatory Utility Commissioners (NARUC)**

- Webinar presentation: storage as a transmission asset
- Webinar presentation: barriers to energy storage and commission roles in overcoming them

**National Conference of State Legislators (NCSL)**

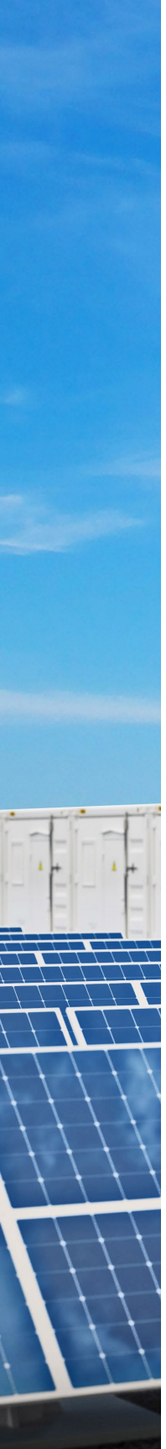
- Webinar presentation: energy storage for resilience

**Michigan**

- Presentation at the Michigan Energy Innovators Conference: energy storage trends
- Michigan Public Service Commission webinar: energy storage in integrated resource plans

**Louisiana**

- Louisiana Public Service Commission presentation: Energy Storage for Social Equity Program and Together New Orleans
- Discussions with commission staff



# Looking Ahead: Ongoing and Planned Projects

- Quantifying the potential for energy storage as a transmission asset
- Modeling energy storage for optimal (and minimal) transmission system expansion
- Additional reports on storage siting: motivations for moratoria, best practices in community engagement
- Emerging finance models for energy storage: community finance, use-case financing, standardized co-op financing for securitization
- Codes and standards primer for non-engineers
- Study of state code adoption processes
- Deploying energy storage in a co-op setting

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# Thank you

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