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National Association of Regulatory Utility Commissioners

Lessons from Energy Storage Deployment: Challenges & Opportunities for State Utility Commissions



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Acknowledgments and Disclaimers

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About this Document

This document serves as a practical guide for state utility commissions to leverage lessons learned from across the United States to foster faster and more efficient energy storage implementation that achieves state goals. This paper synthesizes research and expert perspectives from a diverse set of developers, utilities, state utility commissioners, and researchers to identify key challenges facing storage development coupled with a cohesive set of opportunities for utility commission action to increase storage at a state level. The paper also includes ample state examples and references to existing publications for additional background and details about the challenges and opportunities.

NARUC has produced several resources on energy storage that complement this document:

- A [primer](#) that provides energy storage definitions and context on the energy storage market, ownership options, grid services, valuation, compensation, policy, and incentive mechanisms.
- A [Storage Resource Library](#) that enables further learning on energy storage challenges, potential solutions, and technologies.
- A [Financial Toolbox on Behind-The-Meter Storage](#) that discusses the benefits and barriers to BTM battery energy storage, specifically.

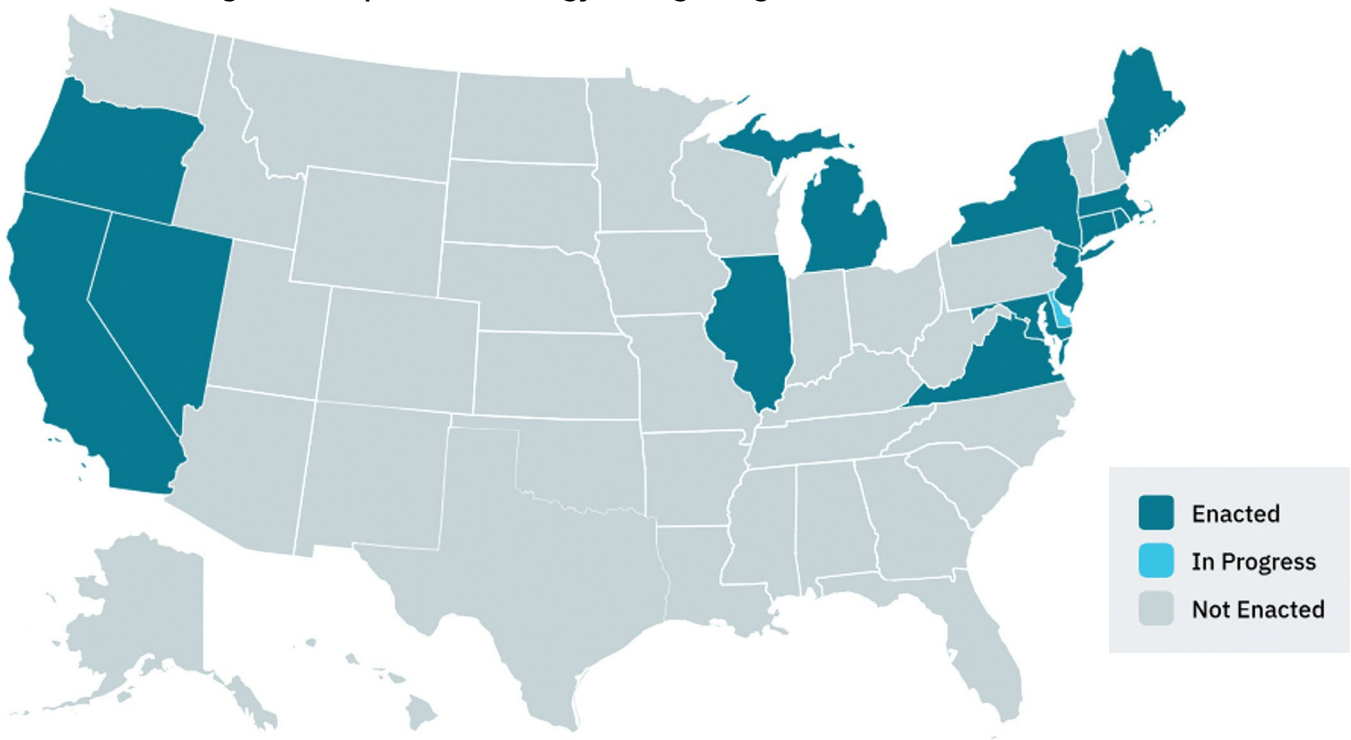
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Challenges and Opportunities to Widescale Storage Deployment

Thirteen states have energy storage procurement targets overseen by public utility commissions (see **Figure 1**), and many more states have incentives and deployment programs in place.¹ Energy storage has been growing rapidly in the U.S. over the past five years. More than 50 GW/144 GWh of energy storage has been installed in the US since 2019.² More than 35 percent of that total was installed in 2025 alone, with a record 18.9 GW / 51 GWh of storage installed (a 52% increase compared to 2024). Storage growth is projected to reach roughly 500 GWh by 2030, a 250% increase compared to 2020–2025.³ Residential storage saw the largest growth in 2025, with installations increasing 92% year-over-year in capacity.⁴ Despite this recent growth, deployment has been slower in some states than anticipated, and not all states are on a path to achieve their policy targets.⁵

Figure 1. Map of State Energy Storage Targets (13 states as of June 2026)⁶



To understand the barriers behind energy storage deployment in the states, NARUC conducted an investigation to better recognize the challenges states face in achieving their storage goals. This report is intended to assist stakeholders in understanding the most common barriers in the deployment of energy storage coupled with successes and opportunities to overcome these challenges based on real-world examples. Not every state will have the same challenges or opportunities, but this diverse list should assist states in finding lessons learned that can support overcoming their particular challenges. Some items are within the purview of public utility commissioners while others might be influenced by other state agencies.

- 1 Clean Energy States Alliance. "Table of State Energy Storage Targets and Progress." Accessed July 28, 2026. <https://www.cesa.org/projects/energy-storage-policy-for-states/table-of-state-targets/>.
- 2 Wood Mackenzie. "US Energy Storage Monitor." August 6, 2018. <https://www.woodmac.com/industry/power-and-renewables/us-energy-storage-monitor/>.
- 3 *Ibid*
- 4 *Ibid*
- 5 For more information on deployment statistics and foundational information, see the NARUC Energy Storage Primer: https://pubs.naruc.org/pub/00095B86-AA95-8916-B412-88A74F17DC6D?_gl=1*zv8xt*_ga*MTlwMTE1NjA4MC4xNzUyMTU2NDE0*_ga_QLH1N3Q1NF*cZ3ODUyNjE5NjlkZUxNCRnMSR0MTc4NTI2MTI5NiRqMjYkbDAkaDA.
- 6 State Climate Policy Dashboard. "Energy Storage Targets." Accessed July 28, 2026. <https://www.climatepolicydashboard.org/policies/electricity/energy-storage-targets>.

In addition to documenting opportunities from existing research, NARUC interviewed experts on energy storage to hear their perspectives on challenges and barriers to energy storage deployment in the United States, as well as opportunities for improvement. NARUC anticipated receiving different ideas from different stakeholders; however, there was consistent agreement across all perspectives about actions states could take to more effectively support energy storage growth, which allowed for a cohesive set of suggestions. See **Appendix A** for more information on the thirteen interviews, including sectors represented by interviewees and interview questions.

Table 1 summarizes eight common challenges limiting growth and corresponding opportunities and examples. More information on each challenge, opportunity, and examples can be found in the following sections alongside resources for additional details.

Table 1. Summary of Challenges and Opportunities for Widescale Storage Deployment

CHALLENGES	OPPORTUNITIES
1. Proactivity & Defined Needs	
- Storage will not just appear; policy signals are needed - States lack understanding of storage needs and full range of grid services - Many states have not developed energy storage tariffs that compensate storage for grid services	- Determine why storage is needed and what services storage can provide before initiating support - Craft storage programs around state policy and procurement goals <i>Examples:</i> Connecticut (Energy Storage Solutions Program),⁷ Maryland Energy Storage Workgroup,⁸ California Energy Storage Procurement Program⁹
2. Compensation & Valuation	
- Hard to quantify reliability and resilience benefits - Cost-benefit analyses account for all costs but only some benefits - Limited experience modeling storage value in utility planning	- Compensate energy storage for all grid services it can provide - Select an accurate cost-benefit tool to evaluate all benefits - Place monetary value on reliability, resource adequacy, pollution reductions <i>Examples:</i> California (Self-Generation Incentive Program),¹⁰ PacifiCorp IRP,¹¹ Arizona (BYOD Pilot Program),¹² CT PURA cost-benefit analyses options,¹³ MD PSC Unified Benefit Cost Analysis¹⁴

7 CT.Gov - Connecticut's Official State Website. "Energy Storage Solutions Program." Accessed July 28, 2026. <https://portal.ct.gov/pura/electric/office-of-technical-and-regulatory-analysis/clean-energy-programs/energy-storage-solutions-program>.

8 Maryland Public Service Commission. "New Workgroup on Energy Storage-Notice." October 13, 2023. <https://psc.maryland.gov/news/2023/new-workgroup-on-energy-storage-notice/>.

9 California Public Utilities Commission. "Energy Storage." Accessed July 28, 2026. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/energy-storage>.

10 California Public Utilities Commission. "Self-Generation Incentive Program." Accessed July 28, 2026. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/self-generation-incentive-program>.

11 Lumen Energy Strategy. "Energy Storage." Accessed July 28, 2026. <http://lumenenergystategy.com/energystorage.html>.

12 Arizona Corporation Commission. "Arizona Corporation Commission Approves New Bring-Your-Own-Device Battery Pilot Program." Accessed July 28, 2026. <http://www.azcc.gov/news/2025/03/13/arizona-corporation-commission-approves-new-bring-your-own-device-battery-pilot-plan>.

13 Connecticut PURA. Docket #17-12-03RE03. Accessed July 28, 2021. [https://www.dpuc.state.ct.us/2nddockcurr.nsf/\(Web+Main+View/All+Dockets\)?OpenView&StartKey=17-12-03RE03](https://www.dpuc.state.ct.us/2nddockcurr.nsf/(Web+Main+View/All+Dockets)?OpenView&StartKey=17-12-03RE03).

14 Maryland Public Service Commission. Docket Number 9674. <https://webpsxcb.pscmaryland.com/DMS/case/9674>.

CHALLENGES	OPPORTUNITIES
3. Stakeholder Engagement & Local Permitting	
- Local permitting of behind-the-meter (BTM) storage where there is limited experience - Community pushback due to fire safety concerns	- Proactively engage communities to educate public on safety - Engage with local officials on permitting, especially fire departments for awareness and training <i>Examples:</i> New York (State Inter-Agency Fire Safety Working Group),¹⁵ California Senate Bill 283¹⁶
4. Interconnection Queues	
- Time-consuming, complex, inadequately staffed interconnection processes for utility-scale projects - Smaller, more numerous storage projects clogging interconnection queues	- Update interconnection processes to be straightforward, automated, and fully staffed - Utilize opportunities to bring storage online outside standard interconnection queues - Flexible interconnection practices <i>Examples:</i> California – Moss Landing (clean repowering),¹⁷ Virginia FAST Act¹⁸
5. Ownership	
Restructured markets define energy storage as a generation asset, making it challenging for utilities to own and third-party owners to access retail value streams	- Allow utilities to own storage, especially in restructured markets, by defining it for grid reliability (e.g., transmission and distribution reliability) or as a transmission asset - Support diverse ownership models for different contexts and participants <i>Examples:</i> California,¹⁹ Texas,²⁰ Massachusetts (ConnectedSolutions),²¹ Vermont (Green Mountain Power),²² Maryland²³

- 15 NYSEDA. "New York's Inter-Agency Fire Safety Working Group." Accessed July 28, 2026. <https://www.nyserda.ny.gov/All-Programs/Energy-Storage-Program/New-York-Inter-Agency-Fire-Safety-Working-Group>.
- 16 California Senate Bill - SB-283 Energy storage systems. October 7, 2025. https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=202520260SB283.
- 17 Inside Climate News. "Inside Clean Energy: In California, the World's Largest Battery Storage System Gets Even Larger." September 2, 2021. <https://insideclimatenews.org/news/02092021/inside-clean-energy-california-energy-storage-vistra-corp/>.
- 18 Advanced Energy United. "Virginia's 2026 Legislative Session Delivered Major Clean Energy Wins." April 29, 2026. <https://advancedenergyunited.org/blog/virginias-2026-legislative-session-delivered-major-clean-energy-wins/>.
- 19 Commission, California Energy. "Energy Storage Targets - Publicly Owned Utilities - AB 2514." Accessed July 28, 2026. <https://www.energy.ca.gov/data-reports/reports/energy-storage-targets-publicly-owned-utilities>.
- 20 "88(R) SB 2627 - Committee Report (Substituted) Version - Bill Analysis." Accessed July 28, 2026. <https://capitol.texas.gov/tlodocs/88R/analysis/html/SB02627H.htm#:~:text=2627%20requires%20the%20PUC%2C%20not,under%20state%20public%20information%20law>.
- 21 Clean Energy Group. "ConnectedSolutions Resource Page." Accessed July 28, 2026. <https://www.cleangroup.org/initiatives/energy-storage-policy-and-regulation/connectedsolutions/>.
- 22 Green Mountain Power. "Home Energy Storage." Accessed July 28, 2026. <https://greenmountainpower.com/rebates-programs/home-energy-storage/>.
- 23 In Maryland, there is an exception in statute for utilities to own generation. Public Utilities Article § 7-510(c) (6)) states "In order to meet long-term, anticipated demand in the State for standard offer service and other electricity supply, the Commission may require or allow an investor-owned electric company to construct, acquire, or lease, and operate, its own generating facilities, and transmission facilities necessary to interconnect the generating facilities with the electric grid, subject to appropriate cost recovery."

CHALLENGES	OPPORTUNITIES
6. Policy & Market Uncertainty	
Uncertainty around federal policy, pace & intensity of energy transition, cost of electricity, load growth	- Establish clear policy and market horizons to provide certainty for companies - Encourage sustained investment through deliberate and proactive policy making to avoid companies entering and exiting the market <i>Examples:</i> California,²⁴ Maine,²⁵ and Connecticut²⁶ utilize a combination of up-front incentives/rebates and performance incentives, California (Self-Generation Incentive Program),²⁷ Maine (LDES Study²⁸ & Energy Storage Market Assessment²⁹)
7. Supply Chain & Technology Risks	
- Risk from price fluctuations, concerns over availability, and non-commercial long-duration energy storage (LDES) technologies - Pressure to meet federal supply chain standards to capture expiring federal tax credits	- Support early-stage technology adoption and pilot projects through grant funding or fixed/low-interest loans - Provide clear metrics for success and pre-development technical assistance <i>Examples:</i> New York (LDES Demonstration Program),³⁰ New York Index Credit,³¹ California (California Energy Commission LDES Program)³²
8. Expertise Requirements	
- Difficult to understand large number of services storage can provide - Optimization of services requires specific expertise	- Ensure an appropriate and comprehensive model is chosen for energy storage technology analysis, feasibility, use cases, and value - Talk directly to industry and storage developers <i>Examples:</i> Michigan (legislatively mandated LDES report),³³ The Salt River Project's IRP,³⁴ PacifiCorp's IRP,³⁵ Colorado (Energy Resource Planning requirements),³⁶ California Public Utilities Commission IRP³⁷

24 "Self-Generation Incentive Program." Accessed July 28, 2026. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/self-generation-incentive-program>.

25 Efficiency Maine. "Energy Storage System Projects" Accessed July 28, 2026. <https://www.efficiencymaine.com/energy-storage-system-projects/>.

26 Homeowner FAQ – Energy Storage Solutions. Accessed July 28, 2026. <https://energystoragect.com/homeowner-faq/>.

27 "Self-Generation Incentive Program." Accessed July 28, 2026. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/self-generation-incentive-program>.

28 Maine Department of Energy Resources. "Long Duration Energy Storage Study." Accessed July 28, 2026. <https://www.maine.gov/energy/studies-reports-working-groups/current-studies-working-groups/longdurationstorage>.

29 Maine Department of Energy Resources. "Energy Storage Market Assessment." Accessed July 28, 2026. <https://www.maine.gov/energy/studies-reports-working-groups/current-studies-working-groups/energy-storage-assessment>.

30 Utility Dive. "New York Bets on Long-Duration Energy Storage with \$15M Award to Form Energy, Others." Accessed July 28, 2026. <https://www.utilitydive.com/news/new-york-long-duration-energy-storage-nyserda-form-energy/691322/>.

31 Utility Dive. "New York Launches 1 GW Bulk Energy Storage Solicitation Using New Credit." Accessed July 28, 2026. <https://www.utilitydive.com/news/new-york-bulk-energy-storage-solicitation-battery-fire-trump/756197/>.

32 Commission, California Energy. "Long Duration Energy Storage Program." Accessed July 28, 2026. <https://www.energy.ca.gov/programs-and-topics/programs/long-duration-energy-storage-program>.

33 Michigan Public Service Commission. "Study of Long-Duration and Multi-Day Energy Storage." February 27, 2025. <https://www.michigan.gov/mpsc/-/media/Project/Websites/mpsc/workgroups/2023-Energy-Legislation/Study-of-LDES-and-MDES.pdf?rev=19cb096812f8414393b0d65d6030da14&hash=C2F5E6FAFD75C4FA2488B00897C0BAD7>.

34 Salt River Project. "Integrated System Plan." 2023. <https://www.srpnet.com/grid-water-management/future-planning/integrated-system-plan>.

35 PacifiCorp. "Integrated Resource Plan." Accessed July 28, 2026. <https://www.pacificorp.com/energy/integrated-resource-plan.html>.

36 Colorado Department of Regulatory Agencies. Decision C18-1124. December 12, 2018. https://www.dora.state.co.us/pls/efi/EFI_Search_UI.Show_Decision?p_dec=25951&p_session_id=

37 California Public Utility Commission. "Integrated Resource Plan and Long Term Procurement Plan (IRP-LTPP)." Accessed July 28, 2026. <https://www.cpuc.ca.gov/irp/>.

1. Intentional Policy and Planning

Challenge: Lack of Proactivity and Defined Needs

Energy storage will not “just appear” on the grid; deliberate and proactive policy signals are needed. Some states lack an understanding of why energy storage is needed and what services it can provide. Without a clear understanding of the “value stack” and grid needs, programs may not be well-designed to achieve desired benefits with reasonable participation rules.

Opportunity: Proactively Define Needs to Determine Why Storage is Needed and What Services it can Provide before Initiating Support³⁸

Map out the desired use cases for storage over time and then decide what technology and approach make the most sense for each use case. Proactively determine priorities first and design programs around the priorities, such as state policy and procurement goals.

State Examples: Proactive Program Design

The **Connecticut** Energy Storage Solutions Program is a successful example of combining procurement goals, financing, and incentives for smaller scale distributed storage projects. The state’s Energy Storage Solutions initiative was launched in 2022 in response to SB 95 and is aimed at helping the two utilities’ (Eversource and United Illuminating) residential, commercial, and industrial customers deploy more behind-the-meter energy storage resources. The program runs through Dec. 31, 2030. Under the revamped program, residential customers can get as much as \$16,000 in upfront incentives — up from the previous maximum of \$7,500 — while low-income customers’ upfront incentives were raised from \$400/kWh to \$600/kWh.³⁹

The **Maryland** Storage Program Workgroup was initiated in response to Maryland’s General Assembly energy storage target of 3 GW of energy storage deployed by 2033. The Workgroup was tasked with designing a comprehensive energy storage program to achieve deployment targets equitably and cost-effectively, while enabling the PSC to conduct an efficient process involving numerous stakeholders and perspectives.⁴⁰

Additional Resources on Policy and Planning

- Cook, Jeffrey, Xu, Kaifeng, Jena, Sushmita, Sana Qasim, Minahil, and Jenna Harmon. [“Check the Storage Stack: Comparing Behind-The-Meter Energy Storage State Policy Stacks in the United States.”](#) *National Renewable Energy Laboratory*. August 2022.
- McNamara, Will, Passell, Howard, and Todd Olinsky-Paul. [“States Energy Storage Policy: Best Practices for Decarbonization.”](#) *Clean Energy States Alliance and Sandia National Laboratories*. February 2023.
- Olinsky-Paul, Todd. [“Energy Storage Policy Best Practices from New England: Ten Lessons from Six States.”](#) *Clean Energy Group and Clean Energy States Alliance*. August 2021.

38 Olinsky-Paul, Todd. “Energy Storage Policy Best Practices from New England: Ten Lessons from Six States.” Clean Energy Group and Clean Energy States Alliance. August 2021. <https://www.cleanegroup.org/publication/energy-storage-policy-best-practices-from-new-england/>.

39 CT.Gov - Connecticut’s Official State Website. “Energy Storage Solutions Program.” Accessed July 28, 2026. <https://portal.ct.gov/pura/electric/office-of-technical-and-regulatory-analysis/clean-energy-programs/energy-storage-solutions-program>.

40 Energy Policy Design Institute. “Energy Policy Design Institute.” Accessed July 28, 2026. <https://www.epdiusa.org/projects/maryland-energy-storage-initiative-workgroup>.

2. Compensation and Valuation

Challenge: Compensation and Valuation Deficiencies

It is difficult for energy storage developers and owners to be fairly compensated for all the services energy storage can provide to the grid. This limits project financing because potential value remains unaccounted for and uncompensated. It is hard to quantify and prove the reliability benefits (e.g., transmission & distribution deferral, reduced emissions) of battery projects before they are built and tested. In particular, backup power is often not included in assessments of value. It is also difficult to put a dollar value on resilience and other societal goods or externalities, often defaulting to zero in cost-benefit analyses.⁴¹

In most U.S. states (outside California and Texas), single income sources are generally insufficient for a positive return on investment for storage projects; therefore, multiple financing streams are almost always required.

Some cost-benefit methodologies may not fully capture certain storage benefits, such as resilience, reliability, or avoided future infrastructure costs. See footnote for best practices in designing balanced benefit-cost tests.⁴²

Energy storage is often not properly evaluated or modeled in utility integrated resource plans (in vertically integrated states), utility distribution planning processes, or regional transmission organizations (RTO)/independent system operators (ISO)-developed long-term planning leading to gaps where contributions to the grid are not fully recognized or valued.⁴³ Modeling software often only uses partial-year data, for example, 3-4 hours of storage needs, rather than whole-year data (8760 hours), which would reveal the need for longer duration storage, especially for extreme events.

RTOs often commit inflexible generators out-of-market to cover forecasted day-ahead energy shortfalls (increasingly with a margin for uncertainty). Because market prices do not fully reflect these costs (covered through uplift), the investment signal for availability and flexibility that storage can provide, especially during scarcity, is weakened.⁴⁴

Opportunities: Ensure Comprehensive Compensation for all Grid Services

Energy storage should be compensated for all the grid services it can provide. Any compensation for a service is better than none and enabling developers or customers to capture value from as many revenue streams as possible supports continued storage growth. Ensuring there are monetary values available for reliability, resource adequacy, and pollution reductions is particularly important. Compensation should be performance-based, not solely deployment-based, to ensure benefits from all grid services and to send accurate price signals for behavior.

State Examples: Compensation

California utilizes both market compensation and non-market values through its IRPs or resource adequacy programs to enable multiple revenue streams.⁴⁵ Energy providers sign resource adequacy contracts that help lessen economic risk in developing energy storage.⁴⁶

41 The NARUC Resilience Framework can assist decision makers in identifying local resilience priorities and benefits as a necessary precursor to establishing resilience metrics and values: <https://pubs.naruc.org/pub/1037E2EB-D1FE-747C-C0DD-2A78CF3ECDE3>.

42 National Association of State Energy Officials. "National Standard Practice Manual." Accessed July 28, 2026. <https://naseo.org/nesp/nspm>.

43 American Clean Power. "Energy Storage Market Design Reforms: A Roadmap to Unlock the Potential of Energy Storage" for more information on a suggested reform on storage modeling alternatives. https://cleanpower.org/wp-content/uploads/gateway/2025/04/Storage-Market-Reform-Roadmap-Analysis_FINAL-05-01-25.pdf.

44 *Ibid*

45 Lumen Energy Strategy. "Energy Storage." Accessed July 28, 2026. <http://lumenenergystrategy.com/energystorage.html>.

46 California Public Utility Commission. "Resource Adequacy Homepage." Accessed July 28, 2026. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/resource-adequacy-homepage>.

Arizona's Bring Your Own Device (BYOD) storage pilot, in conjunction with APS's Residential Battery Pilot, allows up to 5,000 APS residential customers and their battery storage providers to enable APS to dispatch participating batteries and provide aggregate demand response capacity, which would function like a virtual power plant. Customers must agree to participate in up to 60 events per year, each event expected to last one to four hours, which will occur between 4:00 P.M. and 10:00 P.M. from May 1 through October 31. Participating customers will be compensated with an annual \$110/kW capacity payment based on the average kW performance delivered by their battery systems during all DR event hours called throughout the program season.^{47, 48}

Specific opportunities include:

- The selection of an accurate cost-benefit analysis (CBA) tool to evaluate the true value of all the benefits storage can provide is critical.⁴⁹ The National Standard Practice Manual can be used to develop symmetrical state-specific CBA frameworks and formulas.⁵⁰ Avoid inaccurate CBA methodologies, such as using statewide averages for highly variable benefits like demand charges.

State Examples: Cost-Benefit Analyses

The **Connecticut** Public Utilities Regulatory Authority created a comprehensive list of cost-benefit analyses options for storage, each with multiple categories of benefits and costs.⁵¹

The **Maryland** Public Service Commission (PSC) tasked a working group with developing a Maryland-specific Unified Benefit Cost Analysis (UBCA) framework to address the cost-effectiveness of all distributed energy resources (DER), including energy storage. The PSC indicated that the development of a UBCA could assist with the identification of the least-cost means to achieve Maryland's policy goals, increase transparency and efficiency in the assessment of energy resources, and provide the utilities with greater regulatory certainty in preparing filings.⁵²

- Improve resource adequacy accounting methodologies (e.g., Loss of Load Expectation, Effective Load Carrying Capacity) to accurately value reliability, as in California.⁵³
- Utilities, states, and/or grid operators should determine and share the optimal locations on the grid for storage to provide the most value. Regions with high wind and solar penetration and increasing curtailment rates have a natural need for storage and provide strong economic propositions.

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- 47 Arizona Commerce Commission. "Arizona Corporation Commission Approves New Bring-Your-Own-Device Battery Pilot Program." Accessed July 28, 2026. <http://www.azcc.gov/news/2025/03/13/arizona-corporation-commission-approves-new-bring-your-own-device-battery-pilot-plan>.
- 48 National Association of Regulatory Utility Commissioners. "Aggregated Distributed Energy Resources in 2024: The Fundamentals." July 2024. <https://pubs.naruc.org/pub/98FBE453-02C0-1FE3-0249-3A456BA1E3E7>.
- 49 Olinsky-Paul, Todd. "Energy Storage Policy Best Practices from New England: Ten Lessons from Six States." Clean Energy Group and Clean Energy States Alliance. August 2021. <https://www.cleanegroup.org/publication/energy-storage-policy-best-practices-from-new-england/>.
- 50 National Association of State Energy Officials. "National Standard Practice Manual." Accessed July 28, 2026. <https://naseo.org/nesp/nspm>.
- 51 Connecticut PURA. Docket #17-12-03RE03. July 28, 2021. [https://www.dpuc.state.ct.us/2nddockcurr.nsf/\(Web+Main+View/All+Dockets\)?OpenView&StartKey=17-12-03RE03](https://www.dpuc.state.ct.us/2nddockcurr.nsf/(Web+Main+View/All+Dockets)?OpenView&StartKey=17-12-03RE03).
- 52 Synapse Energy. "Maryland Benefit Cost Analysis Framework for Distributed Energy Resources." December 31, 2024. <https://www.synapse-energy.com/maryland-benefit-cost-analysis-framework-distributed-energy-resources>.
- 53 National Association of State Utility Commissioners. "Resource Adequacy for State Utility Regulators: Current Practices and Emerging Reforms." November 2023. <https://pubs.naruc.org/pub/0CC6285D-A813-1819-5337-BC750CD704E3>.

Additional Resources on Compensation and Valuation

- Alberg, Andrew. [“Valuation of Distributed Energy Resources – Information and Application.”](#) National Association of Regulatory Utility Commissioners. May 2025
- Bhatnagar, D. et al. [“Compensation Mechanisms for Long-Duration Energy Storage.”](#) Pacific Northwest National Laboratory. August 2022.
- Bieler, Stephanie, Goldenberg, Cara, McEvoy, Avery, Stephan, Katerina, and Walmsley, Alex. [“Aggregated Distributed Energy Resources in 2024: The Fundamentals.”](#) National Association of Regulatory Utility Commissioners. July 2024.
- NASEO. [The National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources.](#) National Association of State Energy Officials. 2026

3. Stakeholder Engagement and Local Permitting

Challenge: Regulatory and Permitting Hurdles

Local permitting often creates barriers, especially for BTM storage, as each jurisdiction’s approach, timeline, and priorities for permitting varies, which leads to delays and inconsistency for companies. Community pushback resulting from safety concerns, particularly fires, has become a large barrier to deployment in some states.

Opportunity: Addressing Local Permitting Challenges with Stakeholder Outreach

State utility commissioners and policymakers can look to and learn from other states or entities that have already approved energy storage projects.⁵⁴ Decision-makers benefit from talking directly to industry and storage developers to understand what conditions they need to have to develop projects in a given market.

Engage and coordinate with all relevant local government agencies; for example, encourage developers to offer training on battery fires to the local fire department.

State Examples: Fire Safety

The **New York** State Inter-Agency Fire Safety Working Group (FSWG) ensures the safety and security of energy storage systems following several fire incidents within New York State. In doing so, the Division of Homeland Security and Emergency Services (DHSES), Office of Fire Prevention and Control (OFPC), New York State Energy Research and Development Authority (NYSERDA), Department of Environmental Conservation (DEC), Department of Public Service (DPS), and the Department of State (DOS) were directed to create a working group to independently examine energy storage facility fires and safety standards. Since forming, the FSWG has guided New York State towards the adoption of some of the nation’s most robust safety standards for energy storage systems, reinforced by stringent oversight and independent, third-party review. NYSERDA now requires independent peer reviews for a project design’s code compliance conducted by nationally recognized subject matter experts for all NYSERDA-supported projects to ensure consistency, quality, and alignment with current codes and standards.⁵⁵

California requires developers to meet and confer with the local fire authority before submitting an application to review design, potential fire and life-safety risks, and emergency response planning.⁵⁶

54 Olinsky-Paul, Todd. “Energy Storage Policy Best Practices from New England: Ten Lessons from Six States.” Clean Energy Group and Clean Energy States Alliance. August 2021. <https://www.cleangroup.org/publication/energy-storage-policy-best-practices-from-new-england/>.

55 NYSERDA. “New York’s Inter-Agency Fire Safety Working Group.” Accessed July 28, 2026. <https://www.nyserda.ny.gov/All-Programs/Energy-Storage-Program/New-York-Inter-Agency-Fire-Safety-Working-Group>.

56 California Legislature. SB-283 Energy storage systems. October 7, 2025. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202520260SB283.

In addition, **California** Senate Bill 38 requires battery energy storage facility owners and operators to develop emergency response and emergency action plans in coordination with local emergency management agencies, fire departments, and other first responders. To further support continuous improvement and knowledge sharing, the California Office of Fire Marshal hosts an annual BESS Battery Safety Symposium to facilitate knowledge sharing and disseminate lessons learned among code officials, industry experts, and fire professionals.⁵⁷

Provide educational opportunities for community members and ensure regulatory audit reports and safety-related information is publicly accessible to ease safety concerns and build public confidence.

State Example: Regulatory Audit Reports

In response to permitting challenges, **California** developed the Clean Energy Permitting Playbook and Toolkit to help California's local planning authorities improve and streamline permitting processes. While the playbook focuses on local permitting practices, California has also established an alternative permitting mechanism for BESS through the California Energy Commission Opt-In Certification Program. This alternative pathway provides eligible projects with streamlined state-level review and permitting process intended to improve the permitting process and facilitate timely project development.⁵⁸

Additional Resources on Permitting and Stakeholder Outreach

- American Clean Power. [“Energy Storage: Considerations for Government Partners on Siting & Permitting.”](#) American Clean Power. March 2023.
- Center for Sustainable Energy. [“Energy Storage Permitting Guidebook.”](#) Center for Sustainable Energy. January 2026.
- McAdams, Jasmine. [“Public Utility Commission Stakeholder Engagement: A Decision-Making Framework.”](#) National Association of Regulatory Utility Commissioners. January 2021.
- California Public Utility Commission. [“GO 167-C Compliance Audits.”](#) Accessed July 28, 2026.

4. Interconnection Queues

Challenge: Interconnection Queue Timelines and Complexity

Interconnection queue processes for utility-scale projects are often time-consuming, complex, or inadequately staffed, leading to significant delays in project deployment. The grid is accustomed to large power plants, so there are fewer staff to assist with the deployment of smaller, more numerous renewable and storage projects, which clog up the interconnection queue. The opaque and reactive nature of interconnection processes often means long study times and unexpected upgrade costs, which frequently makes projects uneconomical.

Opportunity: Streamline Interconnection Queue Processes and Enable Alternatives

The processes for granting permission to interconnect storage projects to the grid (interconnection queues) should be as straightforward, automated, and adequately staffed as possible. Utilize opportunities to bring storage online outside the standard interconnection queue, where available, such as using surplus interconnection service (e.g., at existing fossil fuel plants with unused export rights, new demand centers like

57 California Legislature. SB-38 Battery energy storage facilities: emergency response and emergency action plans. October 9, 2023. https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB38.

58 “GO-Biz Renewable Energy Permitting Initiative.” California Governor’s Office of Business and Economic Development. April 22, 2025. <https://business.ca.gov/industries/climate-and-clean-energy/go-biz-renewable-energy-permitting-initiative/>.

data centers) or developing storage and renewables at the site of retiring power plants (“clean repowering”). Explore emerging opportunities to implement flexible interconnection approaches that contractually or electrically limit import and export at certain times. Make grid information more transparent and proactively available (e.g., grid data sharing, hosting capacity maps, so non-utility actors can effectively position projects for locational grid services).

State Examples: Interconnection Queue Alternatives

Moss Landing in **California** is an example of clean repowering, a strategy to accelerate the clean energy transition by developing new clean energy generation or storage at the same location as existing or retiring fossil fuel power plants. Moss Landing is one of the largest battery storage facilities in the world, with the three phases commissioned in 2020, 2021-2022, and 2023, replacing a natural gas power plant and helping to provide resource adequacy and flexible and carbon-free power to a part of the California grid that sometimes struggles with reliability.⁵⁹ A fire in January 2025 destroyed the 2020-installed 300-MW battery installation. Vistra Energy, the battery array owner, has decided not to return one of the three battery energy storage facilities at the Moss Landing Power Plant to service, concluding that the cost to recommission it would exceed any potential future revenues.⁶⁰ There are still 450-MW of batteries onsite in addition to an adjacent 182.5-MW facility.⁶¹

The **California** Independent System Operator (CAISO) Interconnections Process Enhancements initiative is a stakeholder process to modernize and streamline the interconnection process for new generating and storage resources to ensure timely alignment with state reliability, policy, and procurement goals. The California Public Utilities Commission has an active rulemaking to update distribution level interconnections for generating and storage resources. The objective of the proceeding is to maintain the safety and reliability of the electric grid as distributed technologies continue to evolve, promote greater transparency and certainty around interconnection processes and to contain ratepayer costs.⁶²

Recently passed in **Virginia**, the Facilitating Access to Surplus Transmission (FAST) Act(HB 1065/SB 508), focuses on tapping unused capacity and grid infrastructure at existing generation sites to create a pathway to deliver new clean energy in months rather than years, while helping avoid transmission upgrades and infrastructure buildouts.⁶³ The law requires Dominion Energy and Appalachian Power Company to assess how much interconnection capacity is available at their existing and planned intermittent generating facilities. The new legislation also directs the utilities to establish pilot programs for energy storage resources and solar facilities that use surplus interconnection service, including a request for proposals.⁶⁴

59 Inside Climate News. “Inside Clean Energy: In California, the World’s Largest Battery Storage System Gets Even Larger.” September 2, 2021. <https://insideclimatenews.org/news/02092021/inside-clean-energy-california-energy-storage-vistra-corp/>.

60 See Below. “Vistra to Permanently Close Moss 100 Battery Facility at Moss Landing Site.” April 17, 2026. <https://tpgonlinedaily.com/vistra-to-permanently-close-moss-100-battery-facility-at-moss-landing-site/>.

61 Utility Dive. “Moss Landing Battery Fire Sparks Calls to Improve Safety, ‘Accountability’ for Industry.” January 21, 2025. <https://www.utilitydive.com/news/moss-landing-battery-fire-vistra/737837/>.

62 “California ISO - Interconnection Process Enhancements 5.0.” Accessed July 28, 2026. <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Interconnection-process-enhancements-5-0>.

63 Gerke, Paul. “Virginia Targets Surplus Interconnection Capacity in First-of-Its-Kind Legislation.” Factor This. March 3, 2026. <https://www.renewableenergyworld.com/solar/virginia-targets-surplus-interconnection-capacity-in-first-of-its-kind-legislation/>.

64 Utility Dive. “Virginia, Indiana Lawmakers Pass Surplus Interconnection Bills | Utility Dive.” Accessed July 28, 2026. <https://www.utilitydive.com/news/virginia-indiana-surplus-interconnection-bills-miso-spp/813442/>.

Additional Resources on Interconnection

- Boff, Daniel and Sarah Barrows. [“Waiting in Queue: A Historical Evaluation of Interconnection Policy.”](#) Pacific Northwest National Laboratory. June 2023.
- The Storage Interconnection Committee. [“Toolkit & Guidance for the Interconnection of Energy Storage & Solar-Plus-Storage.”](#) Interstate Renewable Energy Council. May 2022.
- McLaren, Joyce, Abraham, Sherin, Darghouth, Naïm, and Sydney Forrester. [“Use of Operating Agreements and Energy Storage to Reduce Photovoltaic Interconnection Costs: Technical and Economic Analysis.”](#) Lawrence Berkeley National Laboratory. March 2022.
- Twitchell, J.B., Bhatnagar, D., Barrows, S.E., and K. Mongird. [“Enabling Principles for Dual Participation by Energy Storage as a Transmission and Market Asset.”](#) Pacific Northwest National Laboratory. February 2022

5. Ownership

Challenge: Ownership Restrictions and Limited Visibility into Grid Needs

In wholesale markets, energy storage is defined as a generation asset, making it challenging for restructured distribution utilities to own it. In vertically integrated states, it is difficult for third-party owners to access value streams for storage, like transmission and distribution deferrals, because utilities own and operate the grid as monopolies. Few utilities share sufficient grid information to allow non-utility actors to know where to best position projects for locational grid services or where they can be interconnected without significant added costs.⁶⁵

Opportunity: Foster Flexible Regulatory Frameworks for Ownership Restrictions

Allow utilities to own storage, especially in restructured markets, by defining it for grid reliability (e.g., transmission and distribution reliability) or as a transmission asset to enable larger entities to deploy more storage. Support diverse ownership models (e.g., third-party, aggregation, utility, municipal) to cater to different contexts and participants.

Facilitate more utilities posting reliable, timely hosting capacity information for their grids. See NARUC Grid Data Sharing Framework (2023) for relevant information on grid data sharing options and trade-offs, along with companion resources to help use the framework.⁶⁶

State Examples: Utility Ownership of Utility-Scale Storage

California allows utilities to own storage for greater reliability.⁶⁷

Texas recently allowed utilities to own storage under their “delivery system” (Senate Bill 2627) for “TMD reliability” (transmission and distribution) after Winter Storm Uri.⁶⁸

65 U.S. Department of Energy. U.S. Atlas of Hosting Capacity Analyses shows 58 utility service territory or statewide hosting capacity analysis maps available in 26 states, DC, and Puerto Rico: www.energy.gov/eere/us-atlas-electric-distribution-system-hosting-capacity-maps. However, developers note that these maps are often out of date. NARUC published a Grid Data Sharing Framework in 2023 to support PUCs and stakeholders in considering questions around utilities sharing grid data with developers and the public. See: www.naruc.org/core-sectors/energy-resources-and-the-environment/smart-grid-grid-modernization/grid-data-sharing/

66 National Association of Regulatory Utility Commissioners. “NARUC Grid Data Sharing Framework.” https://pubs.naruc.org/pub/7411B065-B9E5-DE03-4CA4-1F875B0A0416?_gl=1*3m8rys*_ga*MTAwOTA3ODE3OC4xNjk1MzIxMTA5*_ga_QLH1N3Q1NF*MTY5OTk4NzY4MC4xNjYuMS4xNjk5OTkwODE0LjAuMC4w

67 Commission, California Energy. “Energy Storage Targets - Publicly Owned Utilities - AB 2514.” <https://www.energy.ca.gov/data-reports/reports/energy-storage-targets-publicly-owned-utilities>.

68 Texas Legislature. “88(R) SB 2627 - Committee Report (Substituted) Version - Bill Analysis.” Accessed July 28, 2026. <https://capitol.texas.gov/tlodocs/88R/analysis/html/SB02627H.htm#:~:text=2627%20requires%20the%20PUC%2C%20not,under%20state%20public%20information%20law>.

State Examples: Utility Ownership of Behind-the-Meter Storage

ConnectedSolutions was first developed in **Massachusetts** but has now been adopted by other states in the Northeast.⁶⁹ It is an innovative battery funding program that offers incentives to residential and commercial electric customers in exchange for allowing their electric utility to draw on the energy stored in their grid-connected behind-the-meter batteries at times of peak electric demand. The program uses multi-year contracts between the utility and customer to create a virtual power plant that can be called upon to provide valuable grid services, while providing revenue and back-up power to battery owners. The program is frequently, but not always, run through state energy efficiency programs. The ConnectedSolutions program demonstrates how robust pilot testing and iteration can lead to long-term program success. The multi-device-type nature of the program enabled high levels of participant uptake.⁷⁰ The Massachusetts program is run primarily by utilities, which is a unique approach, according to our experts.

The Green Mountain Power (GMP) Energy Storage Systems Program in **Vermont** allows customers to lease a battery system from GMP for 10 years, for \$5,500 as an up-front payment or \$55 per month, in exchange for GMP's ownership and operation of the battery. The ESS program is unique because GMP owns and operates the devices, while making battery storage more accessible to customers who cannot afford to purchase a battery on their own. It can enroll 2,500 customers and 22 MW per year.⁷¹ The program demonstrates the power of flexible ownership models leading to high customer adoption in a state with high exposure to extreme weather.⁷²

Additional Resources on Ownership

- McNamara, Will. [“Policy ‘Deep Dives’: Net Metering and BTM Ownership Models.”](#) Sandia National Laboratories. November 2022.
- Olinsky-Paul, Todd and Tym, Olivia. [“Energy Storage Program Design for Peak Demand Reduction.”](#) Clean Energy Group/Clean Energy States Alliance. December 2024.

6. Policy and Market Uncertainty

Challenge: Risks Resulting from Policy and Market Ambiguity

Uncertainty around federal policy from Congress, such as the Investment Tax Credit (ITC) and Federal Foreign Entity of Concern (FEOC) guidance, makes it harder to finance and deploy projects. There is uncertainty about the pace and commitment to the energy transition, as well as the costs of electricity due to external factors like supply chains and tariffs. Additionally, uncertainty about load growth presents a challenge for investments and financing. Technology advances faster than policy, programs, and regulatory structures, leading to a constant need for state utility commissioners and federal, state, and local policymakers to scramble to catch up.

69 Clean Energy Group. “ConnectedSolutions Resource Page.” Accessed July 28, 2026. <https://www.cleangroup.org/initiatives/energy-storage-policy-and-regulation/connectedsolutions/>.

70 National Association of Regulatory Utility Commissioners. “Aggregated Distributed Energy Resources in 2024: The Fundamentals.” July 2024. <https://pubs.naruc.org/pub/98FBE453-02C0-1FE3-0249-3A456BA1E3E7>.

71 Green Mountain Power. “Home Energy Storage.” Accessed July 28, 2026. <https://greenmountainpower.com/rebates-programs/home-energy-storage/>.

72 National Association of Regulatory Utility Commissioners. “Aggregated Distributed Energy Resources in 2024: The Fundamentals.” July 2024. <https://pubs.naruc.org/pub/98FBE453-02C0-1FE3-0249-3A456BA1E3E7>.

Opportunity: Establish Programs with Storage Procurement Targets and Incentives and Create Clear Policy/Market Horizons to Avoid Uncertainty⁷³

Mandates for energy storage procurement are more reliable in driving deployment and competition than unpredictable markets or changing regulations. To further the commercialization of LDES, specific state targets, and clearly defined pathways for reaching those targets, would be most valuable at this stage. Procurement targets with incentives prompt regulation to stay current in the face of technological advancements. Storage programs that are designed around state policy goals are more successful.⁷⁴ Design incentives that bridge the gap between costs and potential market-earned revenues to make deployment economically viable, such as the New York Index Storage Credit (described in further detail in **Section 7. Supply Chain and Technology Risks**).

State Examples: Storage Incentive Programs

A combination of up-front incentives or rebates and performance incentives (for utility-owned storage) has proven to be successful in states like **California**,⁷⁵ **Maine**,⁷⁶ and **Connecticut**.⁷⁷

The **California** Self-Generation Incentive Program (SGIP) is the United States' longest running and most successful storage incentive program for deployment of BTM storage. The program provides rebates for installing behind-the-meter energy storage and distributed generation systems installed on the customer's side of the utility meter.⁷⁸

Ensure that policy, permitting, and market structures have long-term horizons to provide certainty for companies and encourage sustained investment, preventing companies from entering and exiting markets due to fluctuating policies. Be deliberate and proactive with policymaking rather than sitting back and expecting storage to appear.

State Examples: Market Assessments

The **Maine** Energy Storage Market Assessment is a report that reviews the opportunities and challenges faced by the state in achieving its energy storage goals. It evaluates current and emerging storage technologies, assesses the market and policy landscape and hurdles to deployment, and includes a cost-benefit analysis of certain storage applications. It can serve as a template for storage market assessments.⁷⁹

The **Maine** LDES Study is a legislatively mandated report that includes a discussion of technology options for LDES, an overview of known cost and performance characteristics, a discussion of scenarios for long-

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- 73 Texas is the one exception to this conclusion. In 1999, Texas fully restructured its electric industry, and its fully restructured structure is unique. Investor-owned electric utilities were required to fully divest their generation assets and are now strictly wires-companies that own and operate distribution and transmission. After a phase-in, full retail access was implemented with no provider of last resort. The state's RTO, ERCOT, manages and operates the transmission grid, and operates wholesale ancillary services and energy markets within the state. ERCOT does not operate a capacity market or resource adequacy mechanism, and the energy market has a high \$5,000/MWh price cap. <https://www.ferc.gov/sites/default/files/2020-05/ercot.PDF>
- 74 Olinsky-Paul, Todd. "Energy Storage Policy Best Practices from New England: Ten Lessons from Six States." Clean Energy Group and Clean Energy States Alliance. August 2021. <https://www.cleangroup.org/publication/energy-storage-policy-best-practices-from-new-england/>.
- 75 "Self-Generation Incentive Program." Accessed July 28, 2026. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/self-generation-incentive-program>.
- 76 "Energy Storage System Projects - Efficiency Maine." Accessed July 28, 2026. <https://www.efficiencymaine.com/energy-storage-system-projects/>.
- 77 Energy Storage Solutions. "Homeowner FAQ." Accessed July 28, 2026. <https://energystoragect.com/homeowner-faq/>.
- 78 "Self-Generation Incentive Program." Accessed July 28, 2026. <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/self-generation-incentive-program>.
- 79 Maine Department of Energy Resources. "Energy Storage Market Assessment." Accessed July 28, 2026. <https://www.maine.gov/energy/studies-reports-working-groups/current-studies-working-groups/energy-storage-assessment>.

duration energy storage technologies, and consideration of whether and under what conditions the use of long-duration energy storage would be cost-effective for ratepayers in the state. The study can serve as a template for LDES viability evaluations.⁸⁰

Additional Resources on Policy and Markets

- Chernyakhovskiy, Ilya, Bowen, Thomas, Gokhale-Welch, Carishma, Zinaman, Owen. [“USAID Energy Storage Decision Guide for Policymakers.”](#) National Renewable Energy Laboratory. July 2021.
- McNamara, Will. [“Issue Brief: State Level Incentives for BTM Storage.”](#) Sandia National Laboratories. October 2020.
- Olinsky-Paul, Todd. [“Energy Storage Incentive Rate Setting for States.”](#) Clean Energy Group / Clean Energy States Alliance. March 2024.
- Twitchell, Jeremy. [“Laying the Groundwork for Long-Duration Energy Storage.”](#) Bulletin of Atomic Scientists. November 2023.

7. Supply Chain and Technology Risks

Challenge: Supply Chain and Technology Risks

Project delays and price increases cause pricing fluctuations and concerns over availability, delaying energy storage projects. Many LDES technologies are not yet at commercial scale, but rather early-stage and not widely adopted, which introduces more risk. For new technologies or pilot/first-of-a-kind projects, capital investment is very high, and a positive return on investment (ROI) is uncertain, making traditional financing difficult. Lenders often ask for a clear ROI and may be hesitant to invest without it.

Opportunity: Support Early-Stage Technology Adoption, Pilot Projects, and Financing

For pilot or first-of-a-kind projects, grant funding or fixed/low-interest loans are crucial due to high capital investment and uncertain ROI. Lenders should set clear metrics (e.g., performance, efficiency, discharge hours) to ensure quality. Begin with pilot projects to understand the technology before large investments, and once understood, standardize project designs to reduce long-term operation and maintenance costs.

Do not solely focus on lithium-ion batteries; explore other, potentially cheaper long-duration energy storage technologies (e.g., thermal storage) that may offer supply chain diversification.

Provide pre-development technical assistance alongside grants, especially for disaster compensation programs or less experienced participants, to ensure effective implementation.

State Examples: Demonstration Grants

The **New York** governor issued \$15 million in funding to four long-duration energy storage demonstration projects that can supply energy for at least 10 hours, called the LDES Demonstration Program. The grants include a \$12 million award to Form Energy to develop and construct a 10 MW/1,000 MWh demonstration of a new long-duration storage technology that uses iron-air batteries to provide multiple days' worth of power.⁸¹

80 Maine Department of Energy Resources. “Long Duration Energy Storage Study.” Accessed July 28, 2026. <https://www.maine.gov/energy/studies-reports-working-groups/current-studies-working-groups/longdurationstorage>.

81 Utility Dive. “New York Bets on Long-Duration Energy Storage with \$15M Award to Form Energy, Others.” Accessed July 28, 2026. <https://www.utilitydive.com/news/new-york-long-duration-energy-storage-nyserda-form-energy/691322/>.

The **California** Energy Commission oversees a \$247 million program to invest in the demonstration and deployment of non-lithium-ion long duration energy storage technologies across California.⁸²

Make low or no-cost financing available, particularly for programs focused on low-to-moderate income households or smaller projects, to overcome financial barriers. Allow utilities to sign attractive Power Purchase Agreements with storage developers.

State Example: Market-Based Incentives

The **New York** Index Credit is an innovative market-based incentive mechanism providing contracted energy storage project owners with greater revenue certainty while incentivizing participation in New York's energy and capacity markets. The New York State Energy Research and Development Authority (NYSERDA) is employing a system of index storage credits adopted in 2024 and partially modeled on the state's renewable energy certificates to procure 1 GW from storage developers as part of a state goal.⁸³ Several experts noted that this credit is an innovative method to ensure energy storage market viability by truing up expected costs and realized costs.

Additional Resources on Technology

- GAO. ["Utility-Scale Energy Storage: Technologies and Challenges for an Evolving Grid."](#) U.S. Government Accountability Office. March 2023.
- PNNL. ["Energy Storage Grand Challenge Cost and Performance Database."](#) Pacific Northwest National Laboratory.
- Viswanathan, Vilayanur, Mongird, Kendall, Franks, Ryan, Li, Xiaolin, Sprengle, Vincent, and Baxter, Richard. ["2022 Grid Energy Storage Technology Cost and Performance Assessment."](#) Pacific Northwest National Laboratory and Mustang Prairie Energy. August 2022.

8. Expertise Requirements

Challenge: Expertise Requirements

Due to the large number of services storage can provide, utilities and state utility commissioners often lack understanding of how storage performs, making it more difficult to understand how storage can help meet their needs. Due to the many options for programming storage performance, it can be difficult for utilities to show state utility commissioners and consumer advocates that it is needed or cost-effective. The optimization of the range of grid services energy storage can provide requires specific expertise to operate. It is a technological challenge for storage to provide diverse services in real-time and requires sophisticated control software to manage diverse needs. Additionally, there is no consensus among experts on how to accurately model the role of distributed storage in grid operations. As a result, aggregated distributed storage is not being included in integrated resource planning and modeling.

82 "Long Duration Energy Storage Program." California Energy Commission. Accessed July 28, 2026. <https://www.energy.ca.gov/programs-and-topics/programs/long-duration-energy-storage-program>.

83 Utility Dive. "New York Launches 1 GW Bulk Energy Storage Solicitation Using New Credit." Accessed July 28, 2026. <https://www.utilitydive.com/news/new-york-bulk-energy-storage-solicitation-battery-fire-trump/756197/>.

Opportunity: Overcome Expertise Limitations by Requiring Utilities to Include Storage in their Planning and Modeling

Developers are hesitant to bid in utility requests for projects if they are unsure that their storage projects will be appropriately evaluated among the other proposals. Leverage integrated resource planning (IRP) to identify where storage can fill gaps in the system based on available generation resources and reliability requirements.

State Examples: Planning for Storage

The **Michigan** Public Service Commission released a legislatively mandated report on long-duration energy storage. The report provides recommendations for deploying multi-day energy storage systems, including recommended modeling approaches, guidelines and best practices for modeling long-duration and multi-day energy storage, and actions to support future consideration of these technologies. This report can serve as a template for determining LDES needs and feasibility and requiring LDES considerations in resource planning.⁸⁴

Decision No. C18-1124 of the **Colorado** Public Utilities Commission requires utilities to produce integrated resource plans (IRPs) to demonstrate how the utility will be able to meet long-term demand projections and mandated that electric utilities explicitly evaluate energy storage as an alternative to traditional generation, transmission, and distribution investments during their system planning.⁸⁵

In **Arizona**, Salt River Project's⁸⁶ and PacifiCorp's IRPs identify needs for long-duration energy storage.⁸⁷

Ensure an appropriate and comprehensive model is chosen for energy storage technology analysis, feasibility, use cases, and value. Enhance modeling systems to use whole-year data (8760 hours) to understand system needs, especially for longer duration storage. Develop a standardized, rigorous methodology for determining the cost effectiveness of storage.⁸⁸

Additional Resources on Resource Planning and Modeling

- Twitchell, Jeremy and Cooke, Alan. "[Emerging Best Practices for Modeling Energy Storage in Integrated Resource Plans: An overview and a comparison.](#)" *Pacific Northwest National Laboratory*. December 2021.
- Biewald, Bruce, Devi Glick, Shelley Kwok, Kenji Takahashi, Juan Pablo Carvallo, Lisa C Schwartz. "[Best Practices in Integrated Resource Planning: A guide for planners developing the electricity resource mix of the future.](#)" *Berkeley Lab*. November 2024.
- Pacific Northwest National Laboratory and U.S. DOE. "[Model Selection Platform.](#)" *PNNL and U.S. Department of Energy*.

84 Michigan Public Service Commission. "Study of Long-Duration and Multi-Day Energy Storage." February 27, 2025. <https://www.michigan.gov/mpsc/-/media/Project/Websites/mpsc/workgroups/2023-Energy-Legislation/Study-of-LDES-and-MDES.pdf?rev=19cb096812f8414393b0d65d6030da14&hash=C2F5E6FAFD75C4FA2488B00897C0BAD7>.

85 Colorado Department of Regulatory Agencies. Decision C18-1124. December 12, 2018. https://www.dora.state.co.us/pls/efi/EFI_Search_UI.Show_Decision?p_dec=25951&p_session_id=.

86 Salt River Project. "Integrated System Plan." 2023. <https://www.srpnet.com/grid-water-management/future-planning/integrated-system-plan>.

87 PacifiCorp. "Integrated Resource Plan." Accessed July 28, 2026. <https://www.pacificorp.com/energy/integrated-resource-plan.html>.

88 Lawrence Berkeley National Laboratory. "Best Practices in Integrated Resource Planning: A guide for planners developing the electricity resource mix of the future." November 2024. <https://emp.lbl.gov/publications/best-practices-integrated-resource>.

Appendix A: Methodology

In addition to desktop research, NARUC staff conducted thirteen structured interviews with energy storage experts, leading to the development of a list of eight challenges and ten opportunities.

Nine interviews were conducted virtually in June and July 2025, and four were conducted in-person at the NARUC Summer Policy Summit in Boston, MA in July 2025. One or more of the following sectors were represented by interviewees:

- Consultants supporting state decision-makers
- U.S. Department of Energy National Laboratories
- Former federal energy regulators
- State utility commissioners
- Storage developers or associations
- Utilities
- Utility-developer consortiums
- Technology providers
- Non-profit organizations

The following interview questions were asked during each of the thirteen interviews:

1. In what context are you providing your perspective? (in your own words: what perspective do you represent, is it from practical experience, in particular states or markets, specific technology)?
2. Which current policies / programs have you seen effectively support energy storage, and in what regulatory environment? What kind of storage / what services has it provided?
3. What approaches to valuing, compensating, or pricing (incentivizing) energy storage do you think have been effective?
4. What have been particular challenges with achieving adequate compensation for energy storage?
5. What recommendations would you have for improvements in approaches to compensation?
6. Either: What is the most important lesson you want someone new to this space to take away from our conversation if they want to see energy storage grow in market share? OR Where would you recommend that someone START as first steps if they want to incent energy storage? (You might have different recommendations for a PUC, RTO, utility, developer.)
7. Are there particular case study examples you can point us to that already describe how compensation is happening in practice and with what results? If not, would you be willing to answer some additional questions to provide a verbal case study?



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