# Energy Storage

## Description:

Energy storage can be described in two ways: power capacity and energy capacity. Power capacity is a measure of a system's maximum rated output, expressed in kilowatts (kW) or megawatts (MW). Energy capacity is the total amount of energy a system can store, measured as kilowatt hours (kWh) or megawatt hours (MWh). Duration is another common way of describing a battery storage system and is a function of its power and energy capacities – describing how long a system can discharge at its rated output. Different energy storage technologies provide different benefits and services because they vary in terms of energy and power capacities, contributing to different deployment applications. Storage plays distinct roles between services on the utility's side of the meter and on the customer's side (behind the meter).

Energy storage offers a unique opportunity to dynamically manage supply and demand while also maximizing the value of grid resources. By deploying storage to strategic locations, utilities can more effectively manage their energy portfolios, because:

- Storage allows utilities to manage intermittent demand – helping reduce peak demand requirements. The generation resources that provide peak power are the system's most expensive, so reducing peak demand can save consumers money.
- The responsiveness of energy storage can allow utilities to implement voltage regulation and other ancillary services, which improve system efficiency and reliability.
- Storage technologies can both store and dispatch power, allowing better integration of intermittent power generation resources, like wind and solar, to the grid.

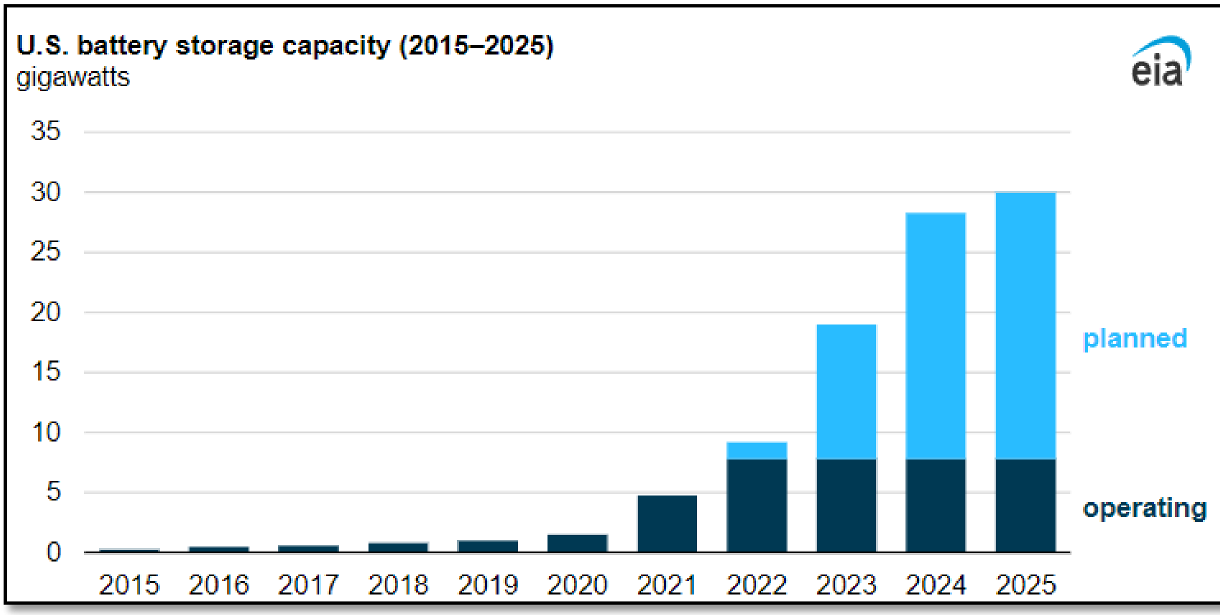
The flexibility of battery storage combined with advanced metering infrastructure can allow customers to control how and when they use energy from the grid or from solar panels installed on their home or business. In most cases, this can provide greater cost savings than standalone solar systems. Combined with time-varying rates or real-time pricing programs, state policy can further support customer choice and open a new market for energy services. Prices that better reflect the time-varying and location-dependent costs of producing and delivering electricity can also lead to a number of economic and environmental gains.

Energy storage can also help the commercial sector avoid demand charges. Demand charges establish an incremental cost above energy usage based on the highest period (highest 15 minutes, for example) of demand during the month. Eliminating spikes in demand with storage can reduce these costly charges for businesses. As utilities around the country consider implementing or extending demand charges to other sectors, energy storage will become more relevant as both a customer cost-saving investment and a system efficiency measure.

## Discussion:

In general, the average cost of battery storage has declined in recent years. However, the wide array of applications and demands of battery systems and the different state regulatory environments in which these systems operate can make estimating expected costs fairly complicated. One of the biggest causes of variability in the cost of utility-scale energy storage systems is how to account for degradation of those systems over time. For instance, to continue functioning at their rated capacities years into the future, projects can either be overbuilt on the front end or later expanded to compensate for degradation. When estimating project costs, these two strategies manifest as either upfront costs or operational costs.

Declining costs and technological advancements in battery storage have contributed to increased deployment. Additionally, in 2020, the U.S. Department of Energy (DOE) launched the Energy Storage Grand Challenge (ESGC) as a comprehensive plan to further accelerate the development and buildout of energy storage systems. The EIA expects total battery storage deployment to triple from 7.8 GW in 2022 to 30 GW in 2025.




Source: EIA

State policies can further encourage deployment by establishing both a framework for easy integration of energy storage resources onto the grid and a marketplace that monetizes the benefits of energy storage for cost-effective investment. States can consider adopting the recommendations below, which draw heavily from the Interstate Renewable Energy Council's (IREC) 2017 report, "Charging Ahead – An Energy Storage Guide for Policymakers."

1. Amend existing interconnection and net metering policies to ensure that storage can connect to the grid through a transparent and simple process. States can establish best practices for interconnection and net metering in statute, or legislation can instruct the utilities commission to implement these best practices. With support from DOE's Solar Energy Technologies Office, IREC and its partners engaged in a three-year project designed to help states address technical and regulatory barriers to integrating storage: Building a Technically Reliable Interconnection Evolution for Storage (BATRIES). The culmination of this project was the publication of a toolkit which outlines solutions to address barriers to interconnecting storage.

2. Clarify the classification of energy storage as an energy management technology and not as "generation" to encourage utility investment in restructured markets. Most states that have restructured utility markets exclude utility ownership of generation.

3. Instruct the utilities commission to evaluate the value of energy storage in multiple strategic locations across the utility system and consider a requirement to deploy storage where it is cost-effective or identify the price point at which it will be cost-effective. Ensure that cost-effectiveness calculations include all the benefits storage can deliver to the system, including frequency regulation and avoided investments in additional infrastructure.

4. Require the inclusion of energy storage as a critical piece of the energy system as both a demand and supply management resource. Some states have required that utilities evaluate the cost effectiveness of non-wires alternatives to large transmission and generation investments. States can require that utilities evaluate energy storage in their integrated or long-term resource plans. Alternatively, states can require that utilities develop a distribution investment plan that identifies the locations on the distribution system where energy storage or other distributed resources would offer the greatest value.

5. Consider creating a mandatory energy storage procurement target or requirement for energy storage with a documented process for periodic review of progress towards that goal. Procurement targets can include provisions limiting the amount of utility-owned storage allowed to be procured, requiring that a certain percent of the storage procurement goal be targeted to low-income customers, and creating carve-outs for specific amounts of storage to be procured at the transmission, distribution, and customer levels. Procurement targets can jump-start market creation, spur fast learning, and guide the development of a regulatory framework.

6. Add energy storage as an eligible technology under existing clean energy policies like renewable portfolio standards or energy efficiency programs. Massachusetts became the first state in the nation to include energy storage in its three-year energy efficiency plan in 2019.

7. Finance and incentivize energy storage for customers and utilities. Incentives can enable customers to use storage to manage their electric load and store renewable energy. Incentives in the form of rebates, grants, and tax credits can provide a bridge to scalable deployment of storage. These incentives can also be designed to decline as the value of storage becomes more readily monetized, and/or as the cost of storage decreases. Policymakers can allow utilities that provide storage incentives to customers to also recover the costs of installing smart meters. This would enable dynamic and time-varying energy management from multiple distributed battery systems while also better aligning customer and system costs. Financing energy storage installations for commercial customers can help reduce their demand charges. Policymakers might start first with a policy that provides grants to pilot projects, and/or that targets existing solar system owners. Financial incentives should be designed to ensure that the state meets other goals, including emissions and peak demand reductions and equitable access to clean energy.

8. Clear data access policies that allow third parties to provide energy management services based on signals from the utility can greatly increase the value of efforts to monetize the value stream offered by energy storage. State policy should include measures to protect customer data while also encouraging the use of this information to facilitate additional improvements to grid management and customer services. To address this, policymakers can develop legislation or rules that clarify who owns the energy data associated with customer energy usage; protect customer privacy; outline the process for allowing direct access to data by third parties; and promote access to the highest resolution of data possible. For example, states could establish customer access to energy data through the Green Button program.

9. Consider taking advantage of the "direct pay" option available to state and local governments for energy storage investment tax credits (ITC) available in the Inflation Reduction Act (IRA). The direct pay option allows states (or other qualified entities without tax obligations) to be directly refunded a 30% ITC from the federal government after the project is online. The IRA also allows for up to 70% in bonus credits for projects including domestic production of storage systems, low-moderate income projects, or projects located in energy communities.

## Example State Programs:

According to the Pacific Northwest National Laboratory (PNNL), 10 states have set energy storage procurement targets and 17 states offer financial incentives for storage.

- California's Self-Generation Incentive Program (SGIP):
  https://www.cpuc.ca.gov/sgip/

- Connecticut's Energy Storage Solutions Program:
  https://energystoragect.com/

- Colorado's Senate Bill 18-009 "Allow Electric Utility Customers Install Energy Storage Equipment":
  https://www.aeltracker.org/bill-details/16311/colorado-2018-sb009

- Solar Massachusetts Renewable Target (SMART) Program:
  https://www.mass.gov/info-details/solar-massachusetts-renewable-target-smart-program

- Maryland's Energy Storage Income Tax Credit:
  https://energy.maryland.gov/business/Pages/EnergyStorage.aspx

- New York State Energy Research and Development Authority (NYSERDA) Energy Storage Program:
  https://www.nyserda.ny.gov/All-Programs/Energy-Storage-Program

- NYSERDA's Energy Storage Workforce Development Plan:
  New York State Energy Research and Development Authority

## More Information:

- Energy Storage Association: Energy Storage Goals, Targets, Mandates: What's the Difference?:
  https://energystorage.org/energy-storage-goals-targets-and-mandates-whats-the-difference/

- 2020 Grid Energy Storage Technology Cost and Performance Assessment:
  https://www.pnnl.gov/sites/default/files/media/file/Final%20-%20ESGC%20Cost%20Performance%20Report%2012-11-2020.pdf

- Solar+Storage for Low- and Moderate-Income Communities: A Guide for States and Municipalities:
  https://www.cesa.org/resource-library/resource/solar-storage-for-low-and-moderate-income-communities-a-guide-for-states-and-municipalities/

- PNNL: Energy Storage for Social Equity Initiative:
  https://www.pnnl.gov/projects/energy-storage-social-equity-initiative

- National Renewable Energy Laboratory (NREL): Storage Futures Study – The Four Phases of Storage Deployment:
  http://www.nrel.gov/docs/fy16osti/64764.pdf

- NREL: The Potential for Battery Energy Storage to Provide Peaking Capacity in the United States:
  https://www.nrel.gov/docs/fy19osti/74184.pdf

- NREL: Declining Renewable Costs Drive Focus on Energy Storage:
  https://www.nrel.gov/news/features/2020/declining-renewable-costs-drive-focus-on-energy-storage.html

- NREL: Check the Storage Stack: Comparing Behind-the-Meter Energy Storage State Policy Stacks in the United States: https://www.nrel.gov/docs/fy22osti/83045.pdf

- PNNL: Energy Storage in Integrated Resource Plans:
  https://energystorage.pnnl.gov/pdf/PNNL-28627.pdf

- U.S. DOE: Energy Storage Systems Program:
  http://www.sandia.gov/ess/

- U.S. DOE: Global Energy Storage Database:
  https://sandia.gov/ess-ssl/gesdb/public/

- U.S. DOE, Office of Electricity: Energy Storage:
  https://energy.gov/oe/services/technology-development/energy-storage

- U.S. Energy Information Administration 2020: Battery Storage in the United States – An Update on Market Trends: https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage.pdf