FERC/NERC/Regional Entity Inquiry

Federal Energy Regulatory Commission | Washington D.C.

Order No. 841
Electric Storage Participation in Markets Operated by RTOs and ISOs

Anuj Kapadia
Office of Electric Reliability
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Disclaimer

The views expressed herein are mine, and do not necessarily reflect the views of the Commission, individual Commissioners, Commission staff, or individual Commission staff members

Agenda

- Wholesale Market Participation – Order No. 841
- Overview of Electric Storage Resources

NOPR on Electric Storage Participation in the Organized Wholesale Electric Markets: Primary Reforms

In response to the information received in AD16-20-000, the Commission issued NOPR in November 2016 proposing to require each RTO/ISO to revise its tariff to:

(1) establish a participation model consisting of market rules that, recognizing the physical and operational characteristics of electric storage resources, accommodates their participation in the organized wholesale electric markets and

(2) allow distributed energy resource (DER) aggregators, including electric storage resources, to participate directly in the organized wholesale electric markets.

Order No. 841 – Electric Storage Participation in the Organized Wholesale Electric Markets

The Commission required that RTOs/ISOs establish a participation model consisting of market rules that ensure:

- **Electric storage resources are eligible to provide all capacity, energy, and ancillary services they are technically capable of providing.**
- Electric storage resources are able to be dispatched and set the wholesale market clearing price as both a wholesale seller and wholesale buyer.
- RTO/ISO tariffs establish a minimum size requirement for electric storage resources not to exceed 100 kW.
- Electric storage resources be able to pay the wholesale price for charging energy that they resell back into the wholesale markets.

Timeline

- February 2018: Order 841 was issued
- December 2018: RTO's/ISO's filed their compliance filings
- May 2019: Order 841-A was issued
- December 2019: Order 841 Implementation date
- Commission is in the process of reviewing compliance filings and will provide direction back to RTO's/ISO's

OVERVIEW OF ELECTRIC STORAGE RESOURCES

What are electric storage resources?

- Electric Storage Resources have bidirectional electric energy and storage capabilities, and are characterized by both their power capacity (MW) and energy capacity (MWh).
- Order No. 841 definition: "a resource capable of receiving electric energy from the grid and storing it for later injection of electric energy back to the grid."
- Due to the requirement that the resource be capable of injecting electric energy, this definition includes technologies such as batteries, flywheels, compressed air, and pumped-hydro
  - Does not include thermal storage technologies (e.g. ice and hot water) that only modify load.

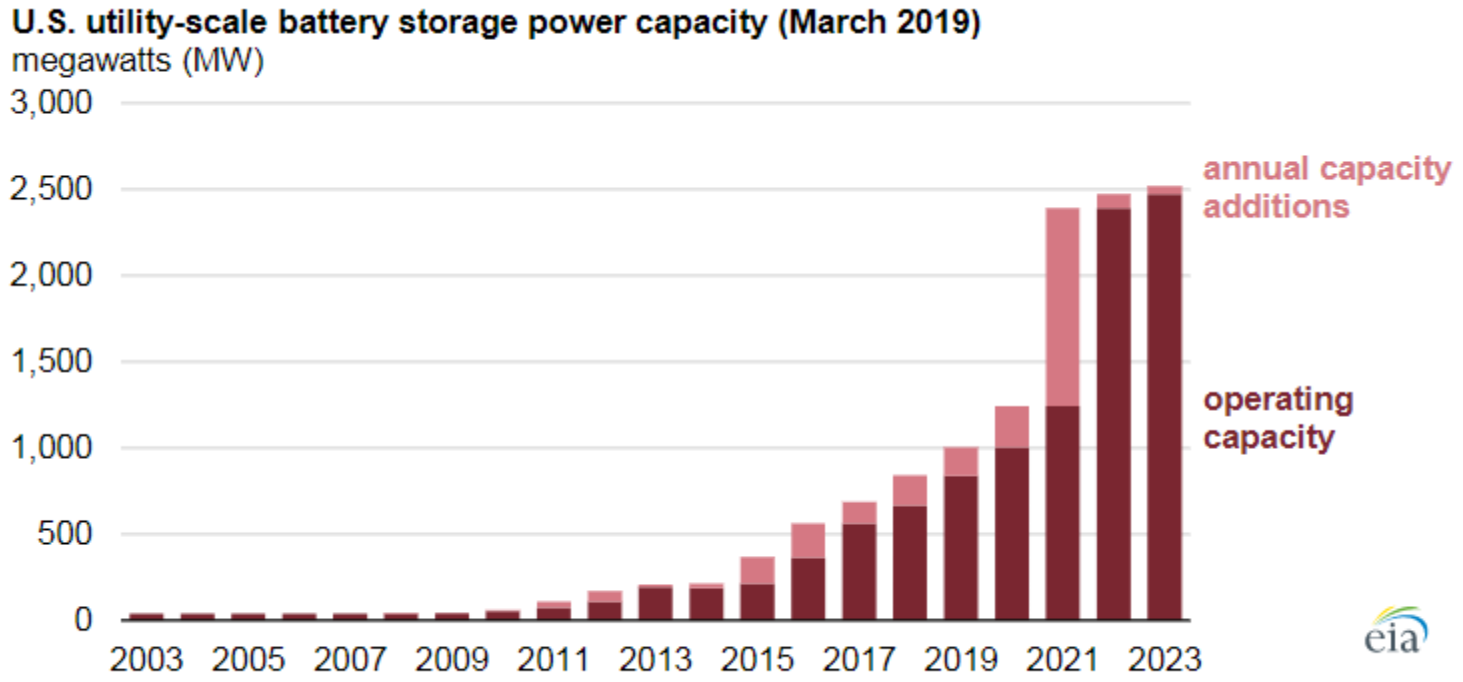
Examples of Electric Storage Technologies

Solid State Batteries - a range of electrochemical storage solutions, including advanced chemistry batteries and capacitors
Flow Batteries - batteries where the energy is stored directly in the electrolyte solution for longer cycle life, and quick response times
Flywheels - mechanical devices that harness rotational energy to deliver instantaneous electricity
Compressed Air Energy Storage - utilizing compressed air to create a potent energy reserve
Pumped Hydro-Power (open and closed loop) - creating large-scale reservoirs of energy with water
Advanced Rail Energy Storage - electric traction drive shuttle-trains, operating on closed rail lines that are angled uphill such that the mass of the train becomes the storage medium

Examples of Electric Storage Projects – Currently Underway

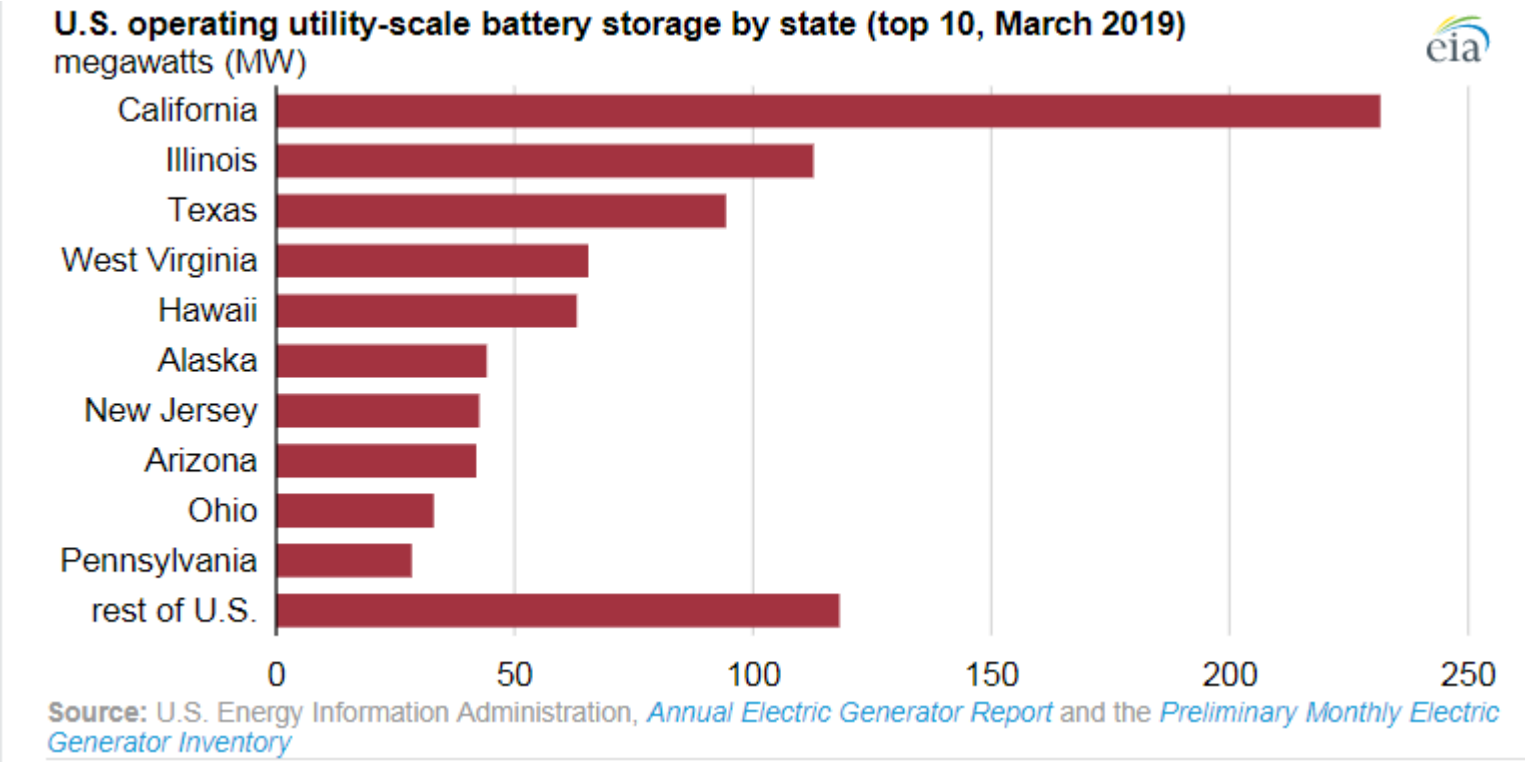
- Aliso Canyon capacity projects- to solve constraints on the grid due to gas leakage- three projects totaling to 70 MW/280 MWh
- PG&E replacing 3 gas plants with 568 MW/ 2,270 MWh energy storage
- SoCal Edison Long Beach Generation Enhancement- paired with a combined cycle gas-fired plant (100 MW/400 MWh)
- New Pumped Hydro Project in Arizona- 2,000 MW

Utility Scale Battery Storage Capacity – Cumulative

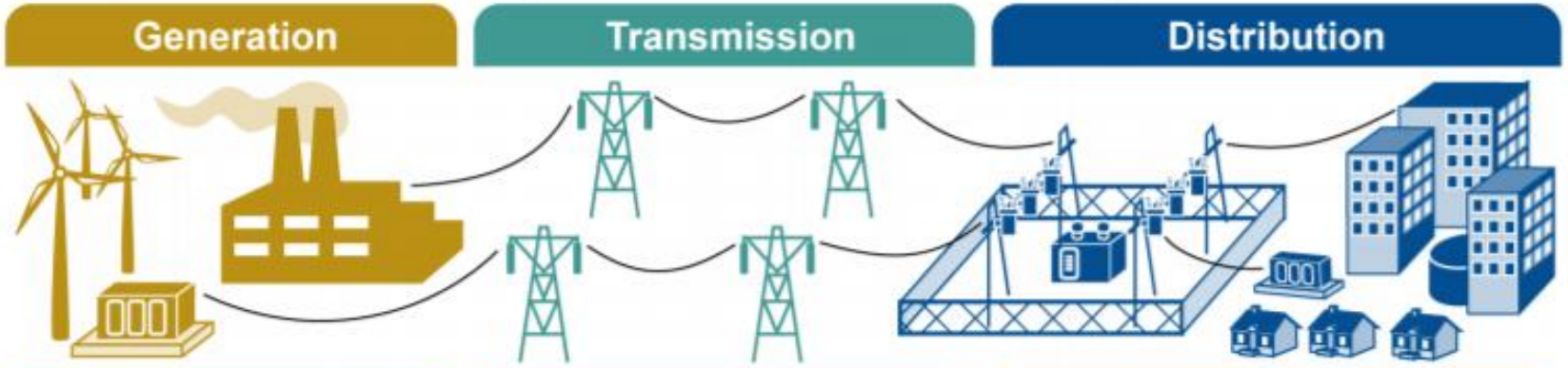


Source: U.S. Energy Information Administration, *Annual Electric Generator Report* and the *Preliminary Monthly Electric Generator Inventory*

Operating Battery Storage by State



Potential Storage Applications



Source: GAO illustration based on studies and documents. | GAO-18-402

Drivers of Electric Storage Development

- Federal and state policy
- Convergence of industry innovation
- Declining costs (batteries and renewables)
- Creation of a resilient and flexible grid
- Increasing customer demand
- Improved control software and capabilities

Questions?