Energy Storage Association

# Policymaker viewpoints on grid services and grid transformation

## NERC/NAGF/ESIG Workshop

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September 18, 2019

www.energystorage.org

# Our Members

- manufacturers
- component suppliers
- system integrators
- developers
- independent generators
- electric utilities
- large end-users
- law, finance, consulting

## Technologies represented

- battery storage
- thermal storage
- mechanical storage
- power-to-gas storage


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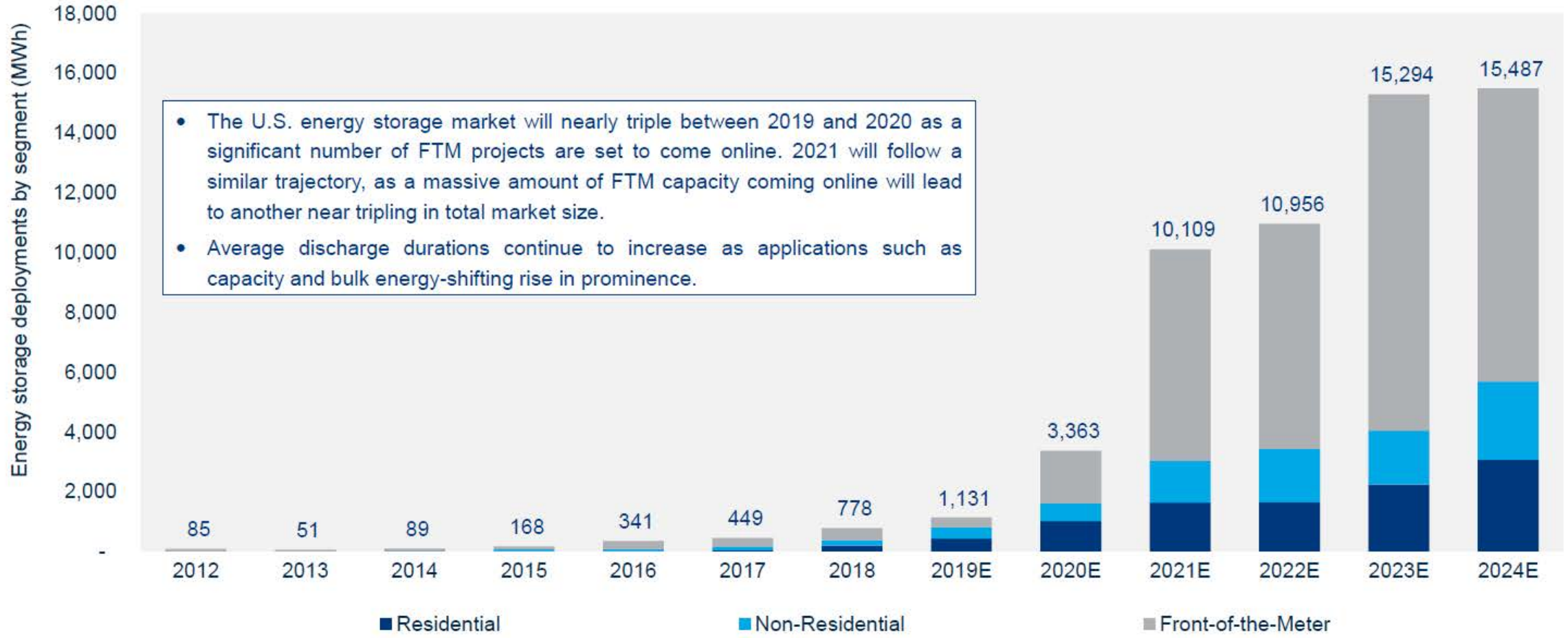
# U.S. market will reach 15.5 GWh in annual deployments by 2024

## 4-hour systems becoming the norm for front-of-the-meter systems; average BTM durations inch toward 3 hours

U.S. energy storage annual deployment forecast, 2012-2024E (MWh)

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# Capacity Qualification & Value of Storage

- Divergent approaches
  - ISO-NE: 2 hours (performance market)
  - MISO & SPP: 4 hours
  - PJM: 10 hours
  - NYISO: differing values by 2/4/6/8 hours + change in value after next 1 GW + quadrennial restudy
- Uniform “capacity value” in tension with heterogeneous resources
  - Storage has energy limitations
  - Generators have forced outage conditions
  - Renewables lack dispatchability
  - Demand resources are block-loaded

} Different reliability contribution profiles → relative capacity contributions, which may change with supply mix



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# Recent Findings on Capacity Value of Storage

## Analysis of PJM (Current) by Astrape Consulting

*Figure 2. Capacity Value of Storage in PJM Under Varying Durations and Penetrations*

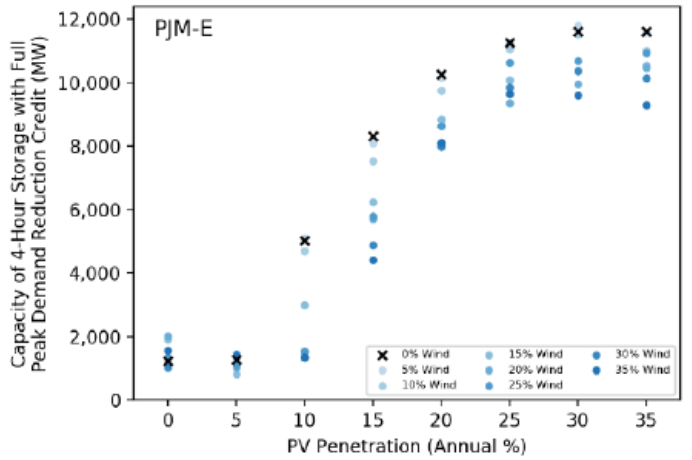
| Duration (Hours) | Penetration (MW) | Capacity Displaced (MW) | Capacity Value (%) |
|---|---|---|---|
| 2 | 1,000 | 1,000 | 100.00 |
| 2 | 2,000 | 2,000 | 100.00 |
| 4 | 1,000 | 1,000 | 100.00 |
| 4 | 2,000 | 2,000 | 100.00 |
| 4 | 4,000 | 3,996 | 99.90 |
| 4 | 8,000 | 7,648 | 95.60 |
| 6 | 1,000 | 1,000 | 100.00 |
| 6 | 2,000 | 2,000 | 100.00 |
| 6 | 4,000 | 4,000 | 100.00 |
| 6 | 8,000 | 8,000 | 100.00 |
| 6 | 10,000 | 9,789 | 97.89 |
| 6 | 12,000 | 11,200 | 93.33 |

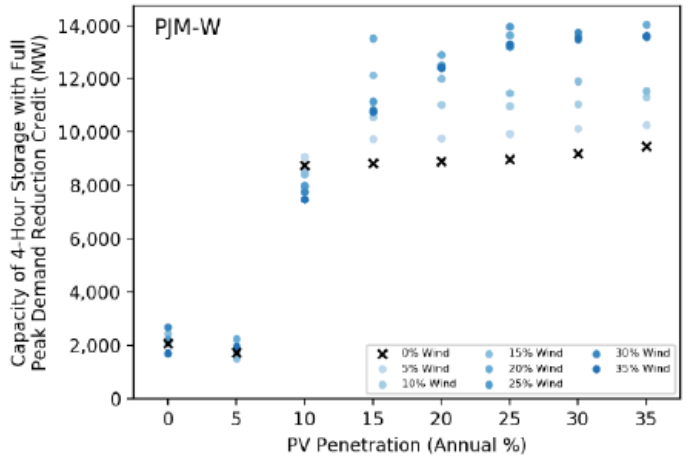
## NYISO Tariff Filing

| Durations (hours) | Less than 1000 MW | At and Above 1000 MW |
|---|---|---|
| 2 | 45% | 37.5% |
| 4 | 90% | 75% |
| 6 | 100% | 90% |
| 8 | 100% | 100% |

## Analysis of PJM Futures by NREL

*Figure 3. Capacity Value of 4-Hour Storage in PJM-East and PJM-West Under Varying Levels of Renewable Energy (Source: NREL)*

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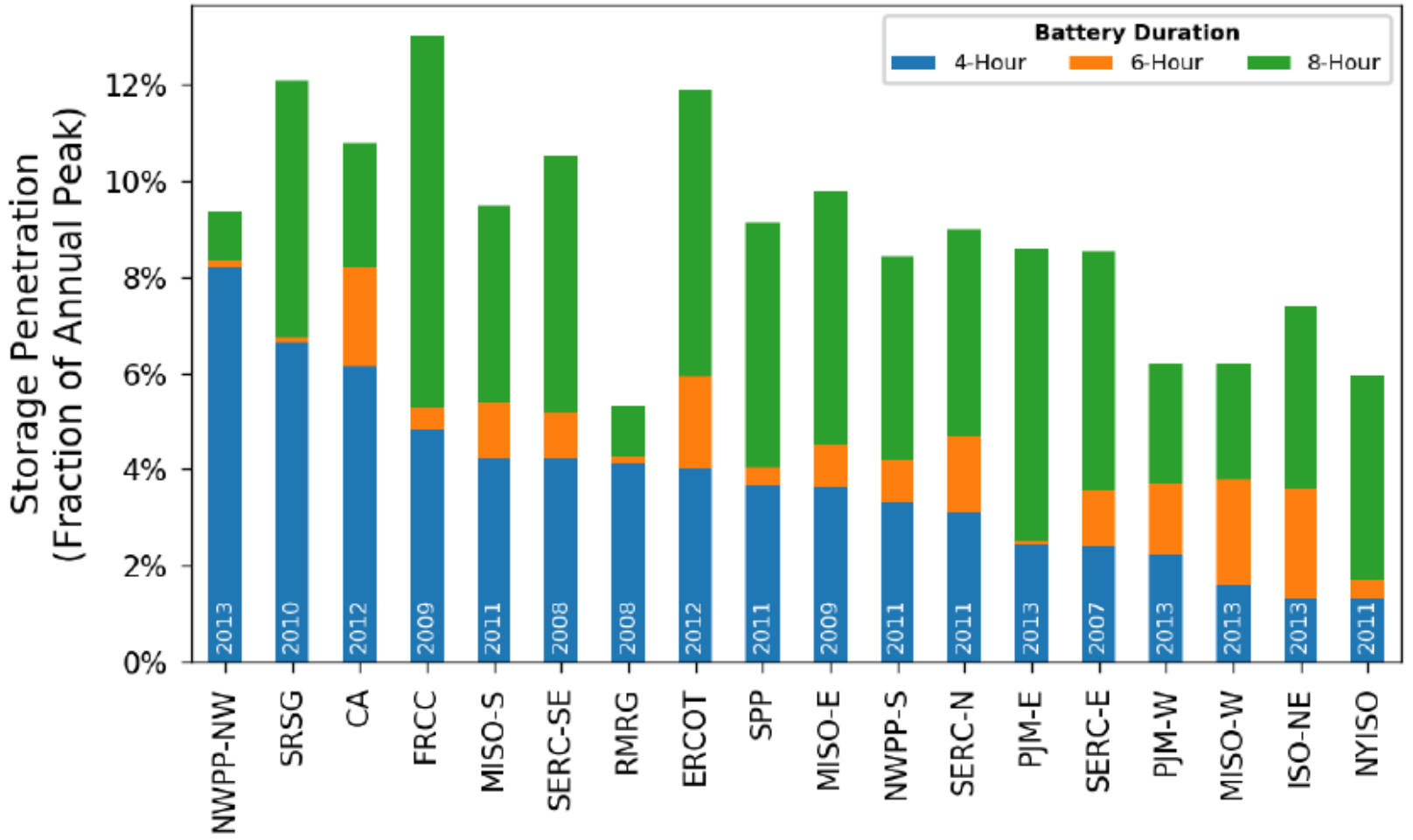
# The Potential for Battery Energy Storage to Provide Peaking Capacity in the United States

Denholm et al., 2019

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# Commitment & Optimization and Storage

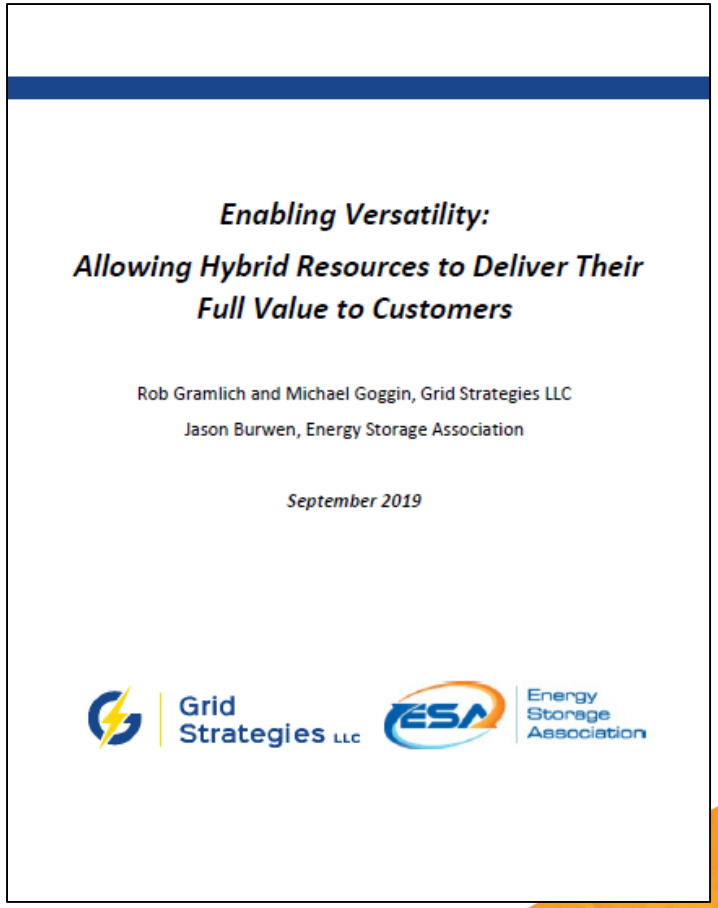
- RTOs vary in approaches, but each raises issues
  - PJM & ISO-NE both do not implement state of charge as a bidding parameter, lack means to optimize in DA even if implemented → potential for infeasible schedule
  - NYISO requires ISO-management of state of charge for storage in capacity market pursuant to DA schedule, lack of make-whole payments → potential for dispatch that harms economics
- Tension between flexibility/lack of commitment needed for battery storage and markets built on commitment logic
  - Energy markets → RT participation and self-scheduling generally ideal, do not need DA optimization
  - Capacity markets → generally require offer obligations, need DA optimization
    - MISO limits offer obligations to hours coincident with peak
- Storage with transition times (e.g., pumped hydro, compressed air) may need DA optimization
  - Longer-duration storage may seek multi-day optimization

# Market Mitigation and Storage

- Concerns over unclear or onerous market mitigation emerging
  - NYISO proposes buyer-side mitigation rules be extended to <2 MW storage
    - Tension with storage sited precisely to resolve a T&D constraint
  - Questions over cost-offer development in SPP, PJM
    - Management of limited energy → opportunity cost in addition to “fuel” cost and O&M cost
- Tension between strategies for de-rating / management of limited energy and mitigation logic of physical withholding
  - Compounded for dual participation storage meeting end-user and/or distribution system needs
  - ERCOT NPRR 915 allows units <10 MW to make bids for energy only in intervals desired

# Hybrid Storage + Generation Model

- Unclear how Order 841 will be applied to hybrid resources
  - ESA seeks a technical conference or notice of inquiry at FERC
- Several classes of issues merit discussion
  - Interconnection
  - Market participation
  - Capacity valuation
- ESA + GridStrategies have released *Enabling Versatility: Allowing Hybrid Resources to Deliver Their Full Value to Customers*
  - Summarizes main issues and potential remedies—jumping off point for reforms



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# Order 841 Starting Other Conversations

- Market products & designs to take advantage of storage flexibility
  - Fast frequency control
    - ERCOT to implement first US market for fast frequency response
  - Load/supply-shift product (as opposed to arbitrage
  - Improved energy price formation for flexibility
- Interconnection updates
  - Study methods that account for intended use (i.e., not charging on peak)
- Storage-as-transmission
  - Regulatory framework for “interconnection,” RTO/ISO control, cost recovery, interactions with generation
    - Nov 5-6 FERC workshop may include discussion
  - Transmission planning methods and data

# State-RTO Interactions on Storage

- State actions to drive storage will influence RTOs
  - Deployment targets
  - Incentive programs
  - Utility programs
    - Energy efficiency
    - Non-wires alternatives
  - Clean Peak Standard
- RTO rules will affect state policy goals
  - 100% renewables/clean energy goals
  - Deployment targets
- After Order 841, storage is will be a central site for coordination between states & RTOs
  - Accounting for charging energy
  - Wholesale interconnection
  - Distribution access tariffs
  - Multiple-use (wholesale vs retail) framework



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# Thank you!

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