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NYS Energy Storage Roadmap

NYISO Environmental Advisory Council
Albany, New York

November 2, 2018

New York State's 2025 Storage Target

- **Deploy 1,500 megawatts** of energy storage by 2025
- Delivering roughly **$2 billion in gross benefits** to New York customers
- **Avoiding more than one million metric tons of CO_2 emissions**, on a path to even greater benefits as larger levels of intermittent renewables are deployed
- **Adding resiliency** to the electric system by reducing impact of outages; for illustrative purposes, 1,500 MW of storage is the equivalent electric demand of one-fifth of all NYS homes
- **Adding flexible resources** that allow intermittent renewables like solar and wind to be available when needed, especially during peak demand
- Growing the energy storage sector in New York to create **30,000 jobs by 2030**

Energy Storage Deployed

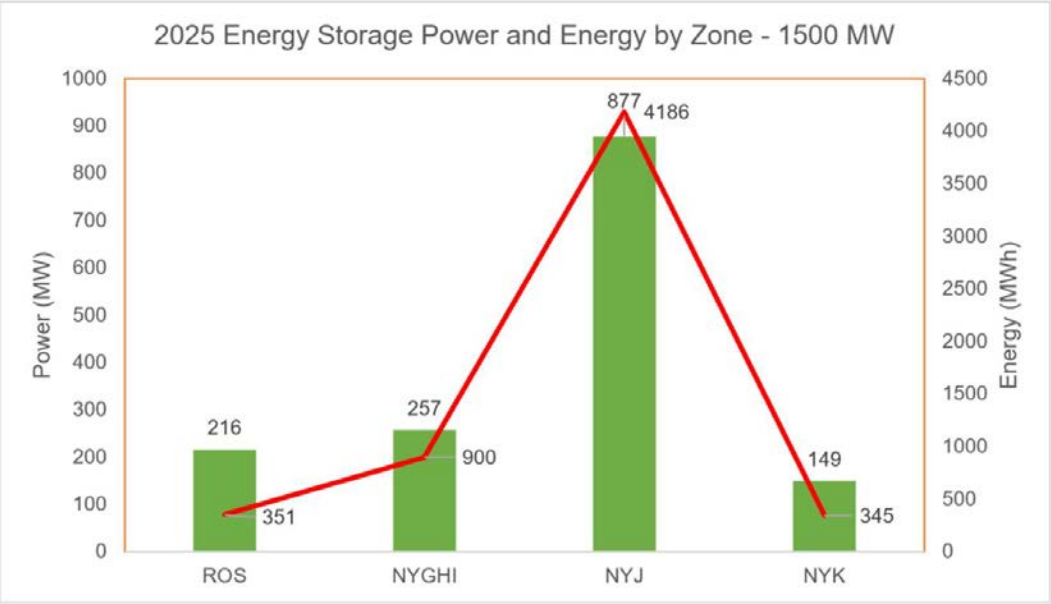
Today:

- Approximately 60 MW of advanced storage (batteries, flywheels, thermal)
- 1,400 MW pumped hydro

Additional storage to be added:

2025	2030
+1,500 MW advanced storage (technology agnostic)	PSC to establish target

Acelerex Modeling 1,500 MW Analysis for 2025



Energy Storage Buckets

Duration	MW	MWh
Long (6 hrs)	633	3,795
Medium Long (2-4hr)	242	970
Medium Short (1-2hr)	470	940
Short (30 mins)	155	78
Total	1,500	5,783

- Shown is the 1,500 MW storage target allocated by the model by zone
- This is not intended to show allocation of a target deployment by zone
- MW (power rating) is the green bar and MWh (duration) is the red line.

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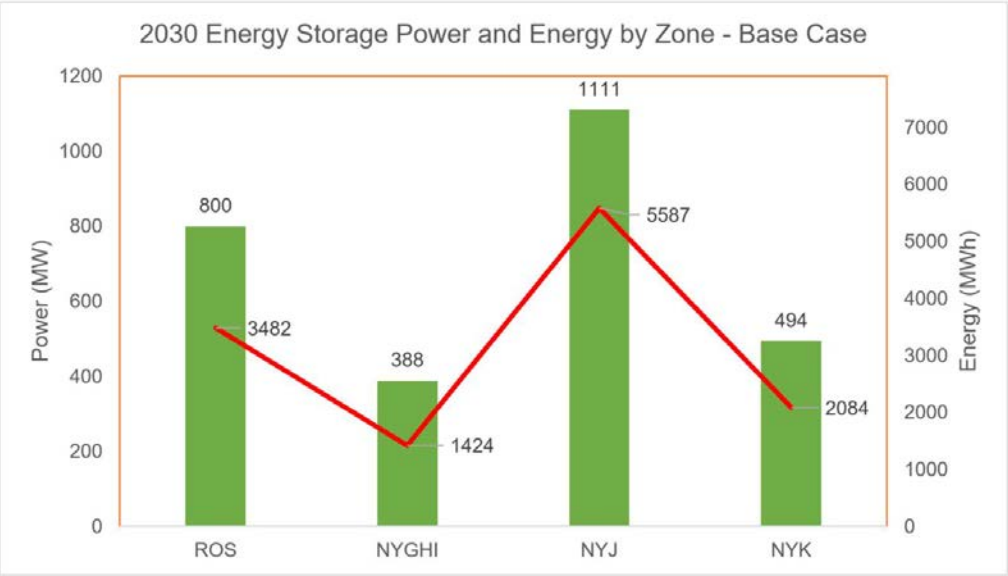
Acelerex Modeling Base Case Results for 2030



Energy Storage Buckets

Duration	MW	MWh
Long (6 hrs)	1,447	8,682
Medium Long (4 hrs)	714	2,856
Medium Short (2 hrs)	467	934
Short (30 mins)	154	77
Total	2,795	12,557

By 2030, nearly 2,800 MW of storage is deployed by the model; 80% of the deployments between 2025 and 2030 occur outside New York City.

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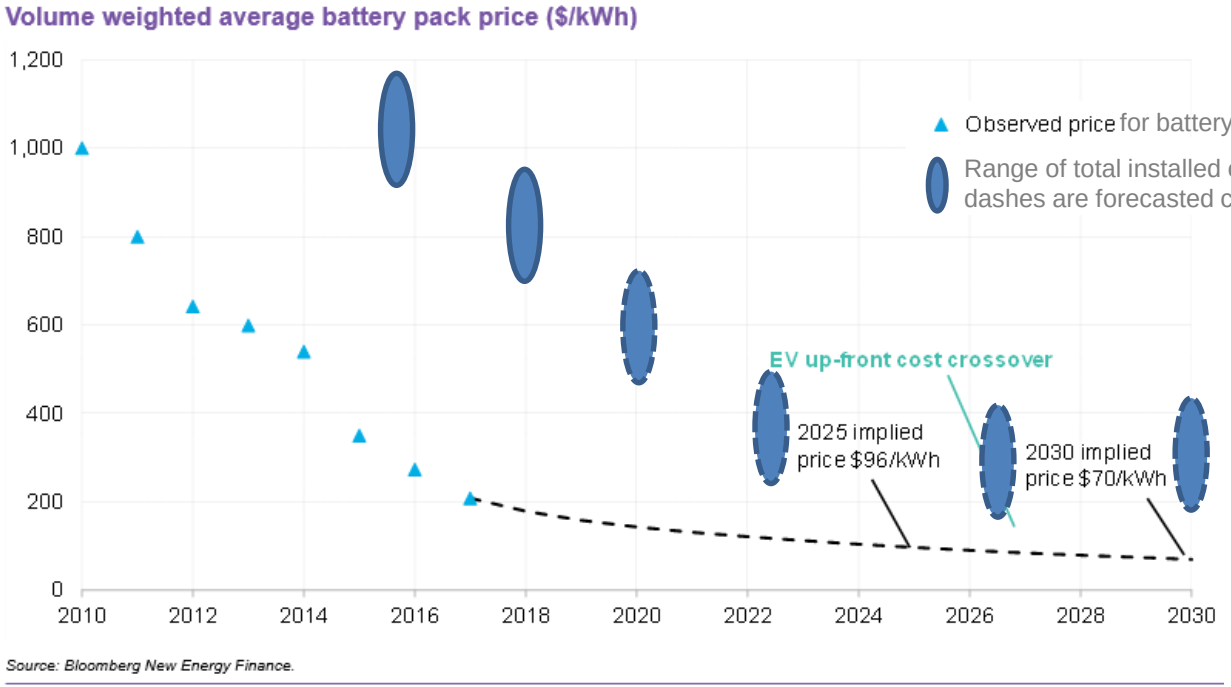
Cost declines are documented
Li-ion battery pack and installed costs



Source: Bloomberg New Energy Finance.

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Primary Use Cases Examined by Market Segment

Customer-Sited: customer retail bill management and demand response

Distribution System: VDER compensation, non-wires alternatives (NWAs) including wholesale market participation, PV paired with storage

Bulk System: wholesale market services including energy arbitrage, capacity, spinning reserves and frequency regulation, energy arbitrage, large scale renewables paired with storage.

Project modeling was completed for a number of commercial and industrial customer load profiles, several utility territories and NYISO zones

Roadmap Recommendations

- Retail rate actions and load relief programs
- Direct procurement through Non-Wires Alternatives, Large Scale Renewable RECs, and NYS leading by example
- Market acceleration incentive
- Address soft costs
- Wholesale market actions and dual market participation
- Accountability

Environmental Recommendations

- Differentiate E value within VDER value stack to reflect carbon intensity
- Procure storage that can meet local peaking needs
- Energy storage pairing with Large Scale Renewables under NYSERDA's REC procurements
- Local contingency planning for downstate peaker fleet units that would be subject to proposed DEC NOx regulations

Market Acceleration Incentive

- Approximately $350 million recommended statewide from existing sources of funds
- Align with uncompensated system benefits and declining storage costs
- Establish critical foundations for a self-sustaining market without direct incentives
- Declining MW block for customer sited and competitive procurement for distribution/bulk, in partnership with utilities

Roadmap Wholesale Recommendations

- Enable full storage participation in capacity and ancillary services markets
- Accelerate “dual market participation”
- Examine treatment when paired with bulk renewables
- Enable storage compensation as a transmission asset
- Aggregation requirements
- Expand integrated T&D planning to include storage

Dual Market Participation Examples

Utility non-wire alternative

- Size: multiple MWs, 2-6 hour duration
- Distribution services: load pocket relief during summer
- Wholesale services such as: capacity, 10 minute spin, frequency reg

Community solar + storage

- Size: 2-5 MW, 2-4 hour duration
- Distribution services: distribution relief, summer capacity (VDER tariff)
- Wholesale services such as: winter capacity, 10 minute spin, frequency reg

Customer-sited storage

- Size: kW to MW, 2-4 hour duration
- Distribution services: demand response
- Wholesale services beyond demand response such as 10 minute spin, frequency reg
- Aggregation of smaller systems for dispatch purposes

Path Forward

1Q18

- Governor Andrew M. Cuomo announces 1,500 MW storage target
- Acelerex Energy Storage Study completed

2Q18

- Stakeholder engagement
- NYS Energy Storage Roadmap released for formal public input

3Q18

- Technical conferences held
- Formal public comments on Roadmap

4Q18

- PSC establishes 2030 energy storage goal and deployment mechanisms and programs (Public Service Law Section 74).
- Incentive implementation design

1Q19

- Anticipate compliance filings submitted to DPS for market acceleration incentives implementation
- Implementation of market acceleration incentives begins

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