Overview and Update on Energy Storage in New York

NY BES+ NEW YORK BATTERY AND ENERGY STORAGE TECHNOLOGY CONSORTIUM

William Acker
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Poughkeepsie, NY
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NY-BEST Mission

To catalyze and grow the energy storage industry and establish New York State as a global leader.

We do this by:

1. *Communicating information and facilitating connections*
2. *Accelerating commercialization*
3. *Educating policymakers and stakeholders*
4. *Promoting New York's intellectual and manufacturing capabilities and providing access to markets*

Why Energy Storage

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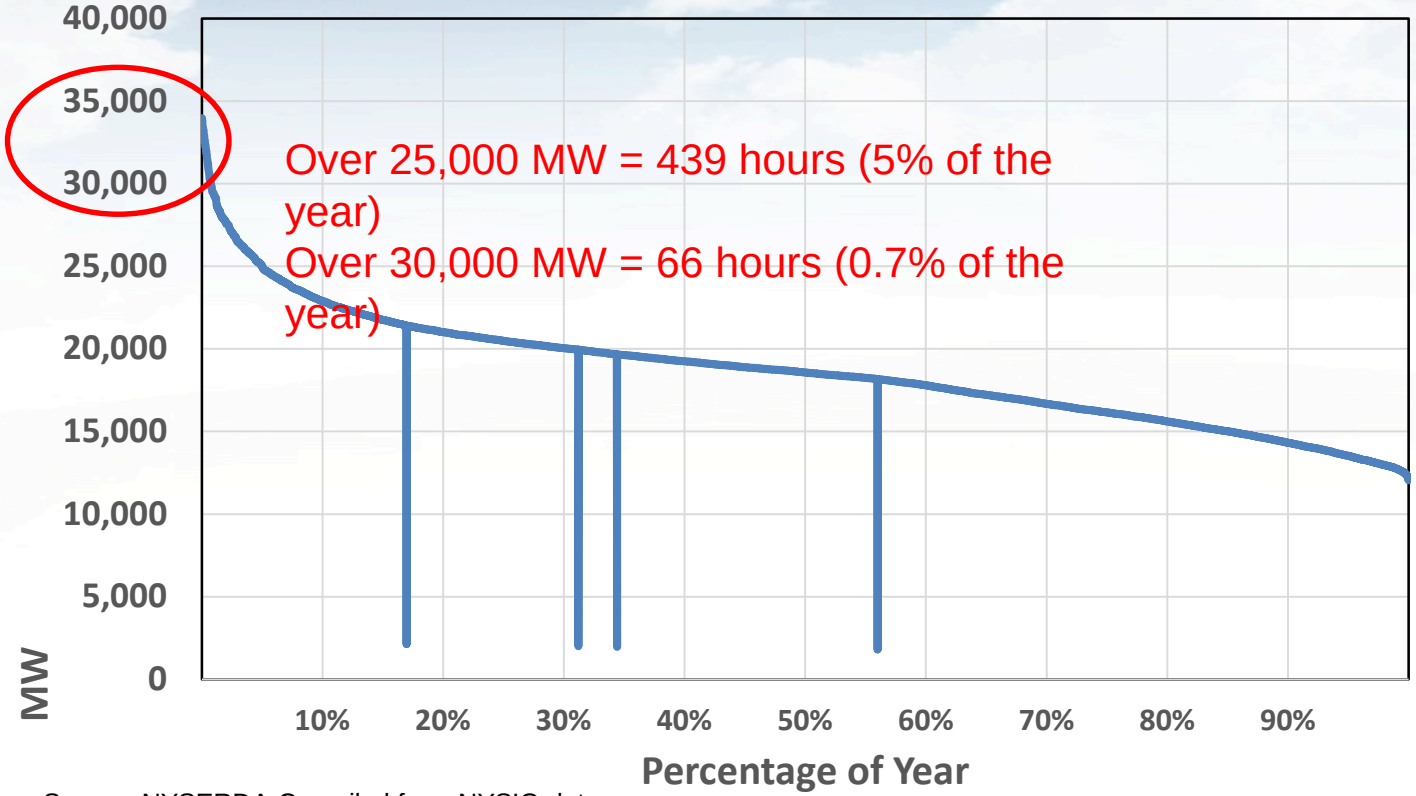
Key Drivers

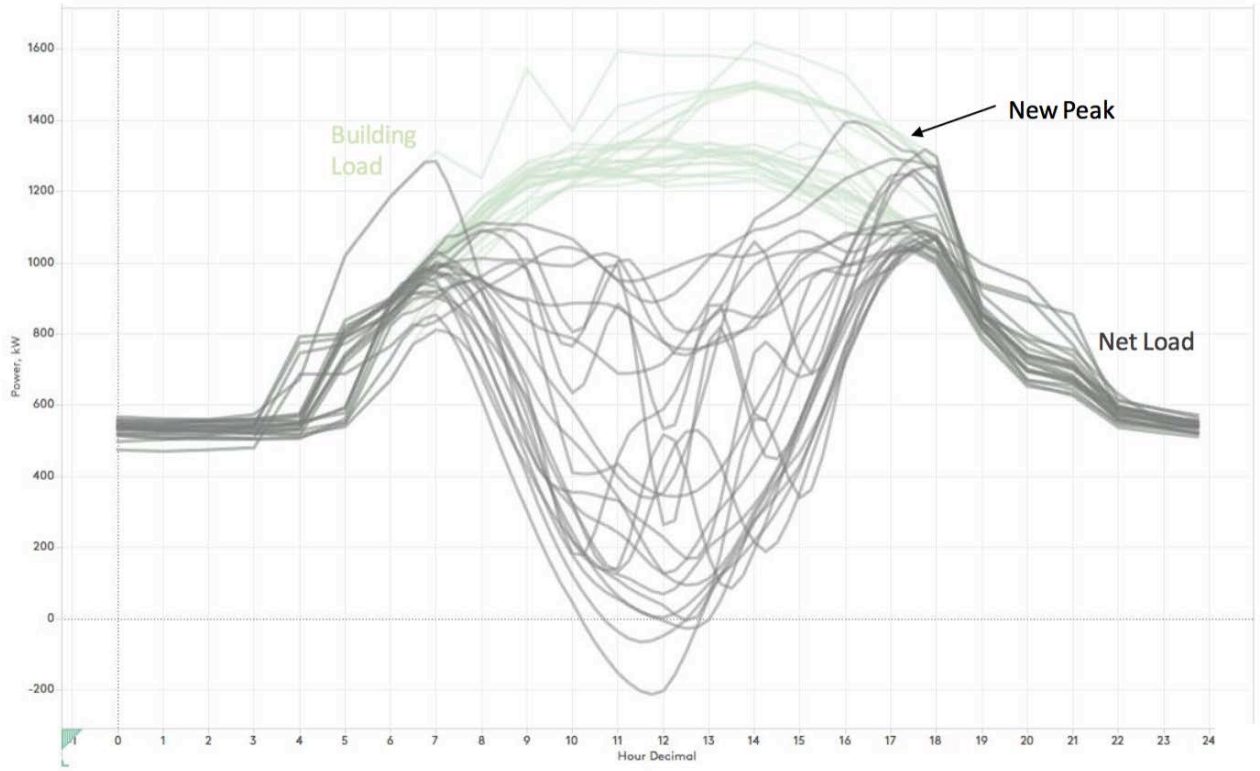
- Improving the efficiency and capacity factor (utilization) of the electric grid
- Integrating an increasing amount of renewable energy
- Enhancing the reliability and resilience of the electric grid

2013 NYS Load Duration Curve



Source: NYSERDA Compiled from NYSIO data

Solar Variability



Building Net Load Weekdays in October

Source: Advanced Microgrid Solutions

Hurricane Sandy

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Source: Bloomberg Businessweek

Types of Energy Storage

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Electrochemical

Battery (many types)
Capacitors
Fuel Cells (power to gas)

Mechanical

Pumped hydro
Compressed air
Flywheels

Thermal

Ice
Molten Salt

Range in Scale and interconnection

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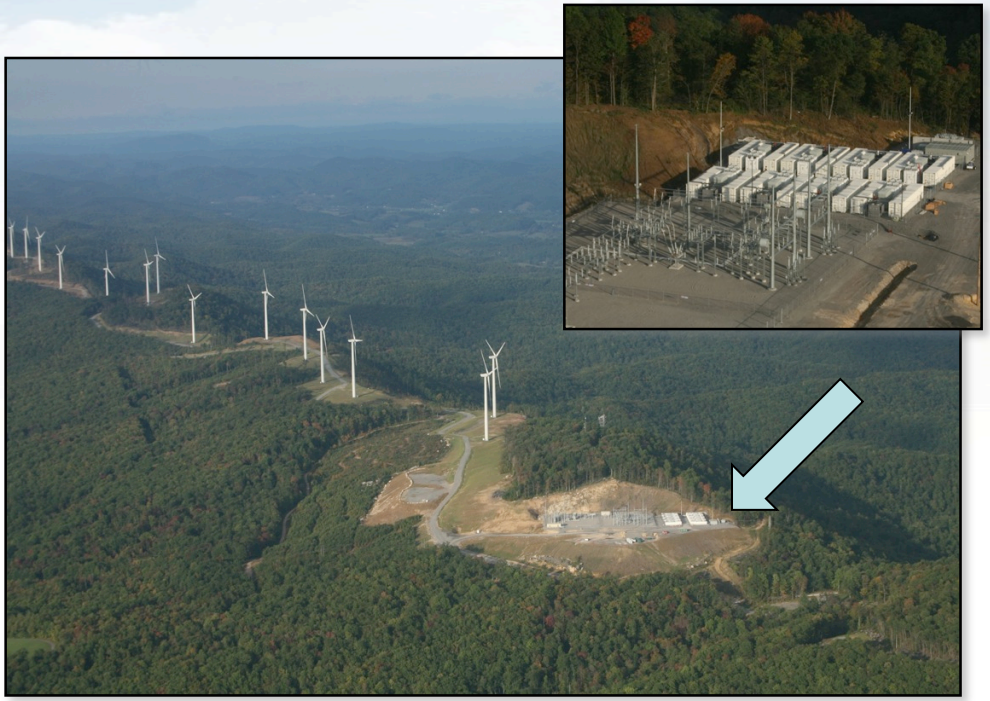

Batteries

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Many types

- Lead Acid
- Advanced Lead Acid
- Sodium
- Lithium-ion
- Flow Batteries
- Air Electrodes
- Many others

Li ion Chemistries

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Chemistry	Energy Density	Power Density	Max C-Rate
Lithium Iron Phosphate ($LiFePO_4$)	Low 50-130 Wh/kg	High > 1000 W/kg	> 20
Lithium Manganese Oxide (LMO)	Moderate 100-180 Wh/kg	Moderate 160-720 W/kg	8
Lithium Nickel Cobalt Manganese (NCM or NMC)	Moderate 130-170 Wh/kg	Good 480-800 W/kg	10
Lithium Cobal Oxide $LiCoO_2$ (LCO)	Moderate 40-200 Wh/kg	Moderate 130-380 W/kg	4
Lithium Titanate (LTO)	Low 40-90 Wh/kg	High 700-1300 W/kg	10
Ultracapacitors	Very Low ~1-10 Wh/kg	Very High ~10,000 W/kg	100

Quiz

Li ion battery cells cost about $1000/kWh in 2010

Today they cost about:

A) $150/kWh
B) $300/kWh
C) $600/kWh
D) $1000/kWh
E) $1250/kWh
F) $1500/kWh

NY State Goals

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Greenhouse Gas: 40% reduction by 2030

Greenhouse Gas: 80% reduction by 2050

Renewable Energy: 50% by 2030

Building Energy Consumption: 23% decrease by 2030

Electric Vehicles: 800,000 by 2025

Governor Cuomo's Storage Goals

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- Launching an initiative to deploy 1,500 megawatts of energy storage by 2025
- Employ 30,000 New Yorkers to establish New York as a home for this rapidly expanding clean tech industry
- Develop Target for 2030 to support 50% renewable goal

Energy Storage Roadmap

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Developed by NYSERDA consistent with legislation

- Analytical Modeling to develop target
- Policy, Regulatory, and Programmatic actions to achieve goal

Initial Market Activity

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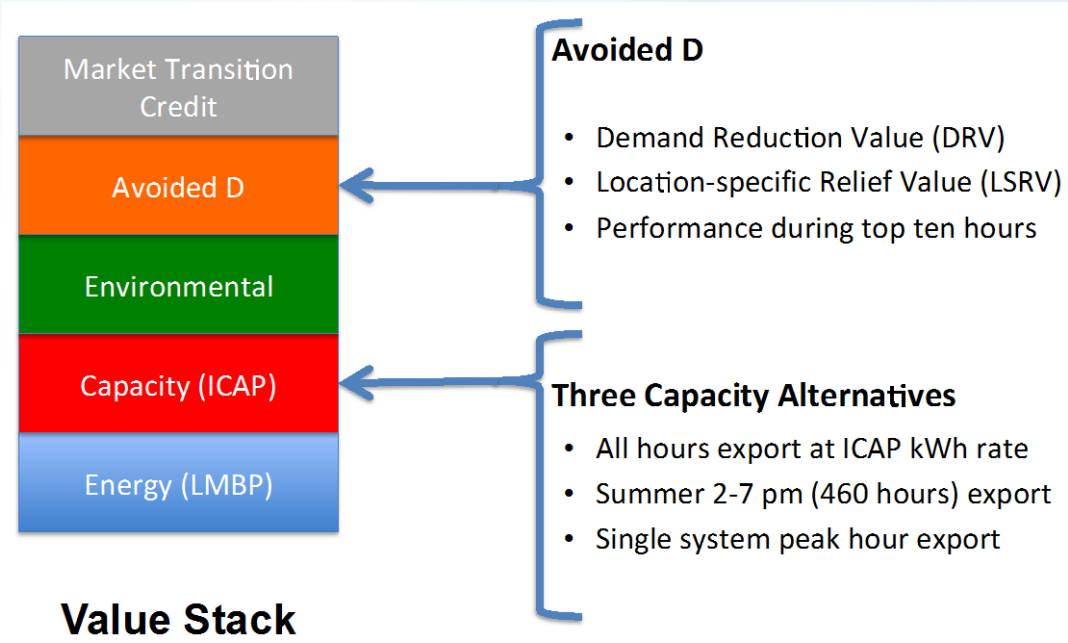
Driven primarily by utility load reduction

- Utility programs
- NWS and REV demo projects
- Demand Charge reduction

VDER Value Stack and Storage

Potential Additional value from Storage

1. Increase value of exported energy
   ① Avoided D value (top ten hours)
   ② Capacity value
2. Arbitrage Export (VDER tariff) with self consumption (customer utility tariff)
3. Traditional BTM benefits of storage such as demand charge reduction and ICAP tag reduction



Value Stack

NYSERDA funding

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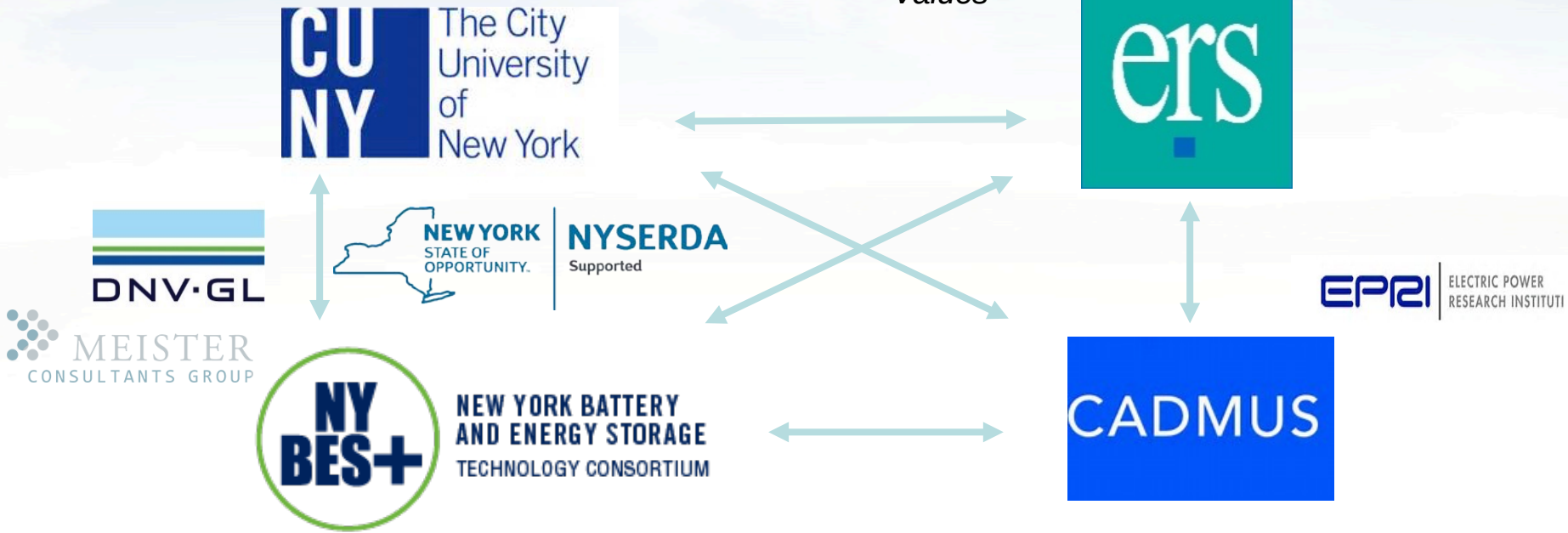
- PON 3585 – Product Development
- PON 3541 – Pilot projects
- $200 million commitment from Green Bank

NYSERDA Energy Storage Program

I. *Create a team to reduce soft costs by 25% in 3 years and 33%+ in 5 years*

II. *Release PON 3541: Demonstrating Distributed Energy Storage for 'Stacking' Customer and Grid Values*



https://www.nyserda.ny.gov/All-Programs/Programs/Energy-Storage-Program

Other Actions and Resources

Permitting Guidance

Fact sheet and Energy Storage Guide

Technical Assistance

Resources:

- NY-BEST Soft Cost Resources: https://www.ny-best.org/resource/energy-storage-soft-costs-resources
- New York REV Connect Website: https://nyrevconnect.com/non-wires-alternatives/
- NYSERDA Energy Storage Program: https://www.nyserda.ny.gov/All-Programs/Programs/Energy-Storage-Program

Thank You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