Batteries and Energy Storage

NEW YORK BATTERY
AND ENERGY STORAGE
TECHNOLOGY CONSORTIUM

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New York Solar Summit
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Key Drivers for Storage

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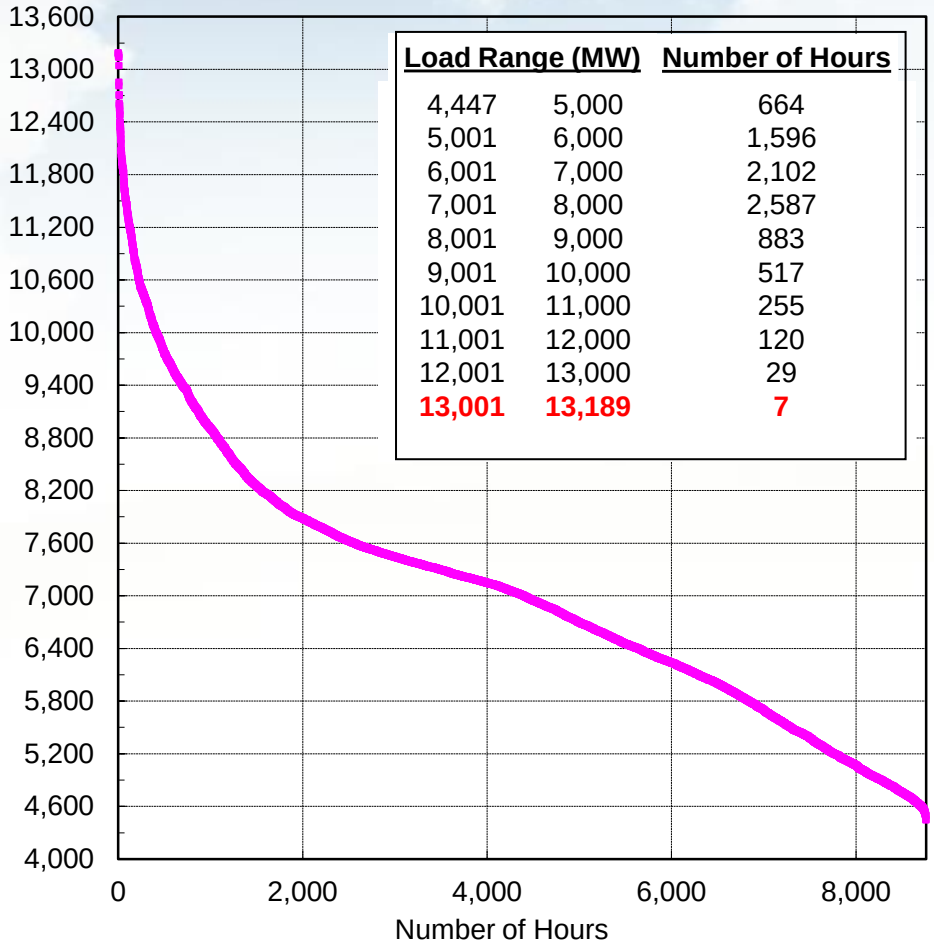
Capacity and peak load reduction

Resiliency

Renewables integration

Demand Curve

CECONY Service Area Load Duration Curve



Load Range (MW)		Number of Hours
4,447	5,000	664
5,001	6,000	1,596
6,001	7,000	2,102
7,001	8,000	2,587
8,001	9,000	883
9,001	10,000	517
10,001	11,000	255
11,001	12,000	120
12,001	13,000	29
13,001	**13,189**	**7**

Source: Consolidated Edison

Generation and Transmission built to serve peak demand

High cost for few hours

Low system utilization

Energy Storage in Buildings

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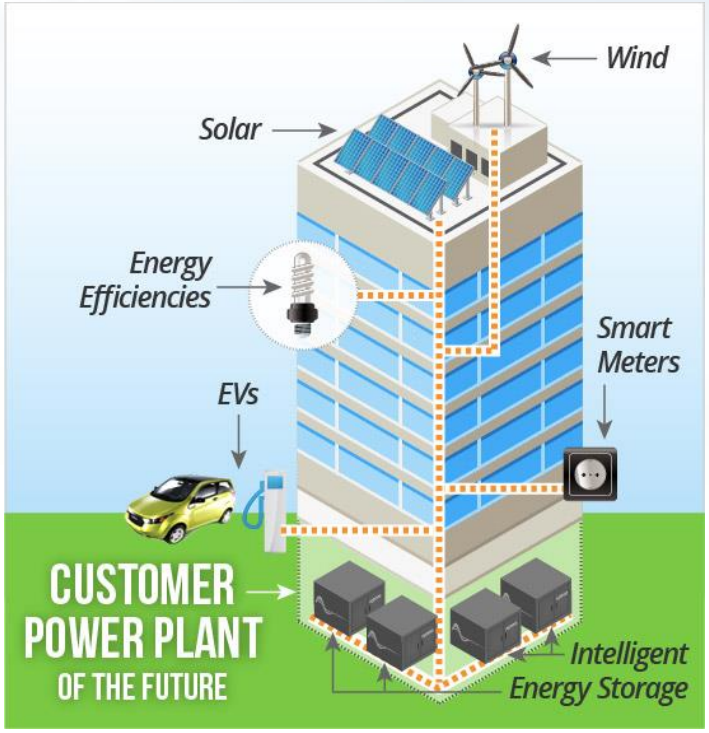
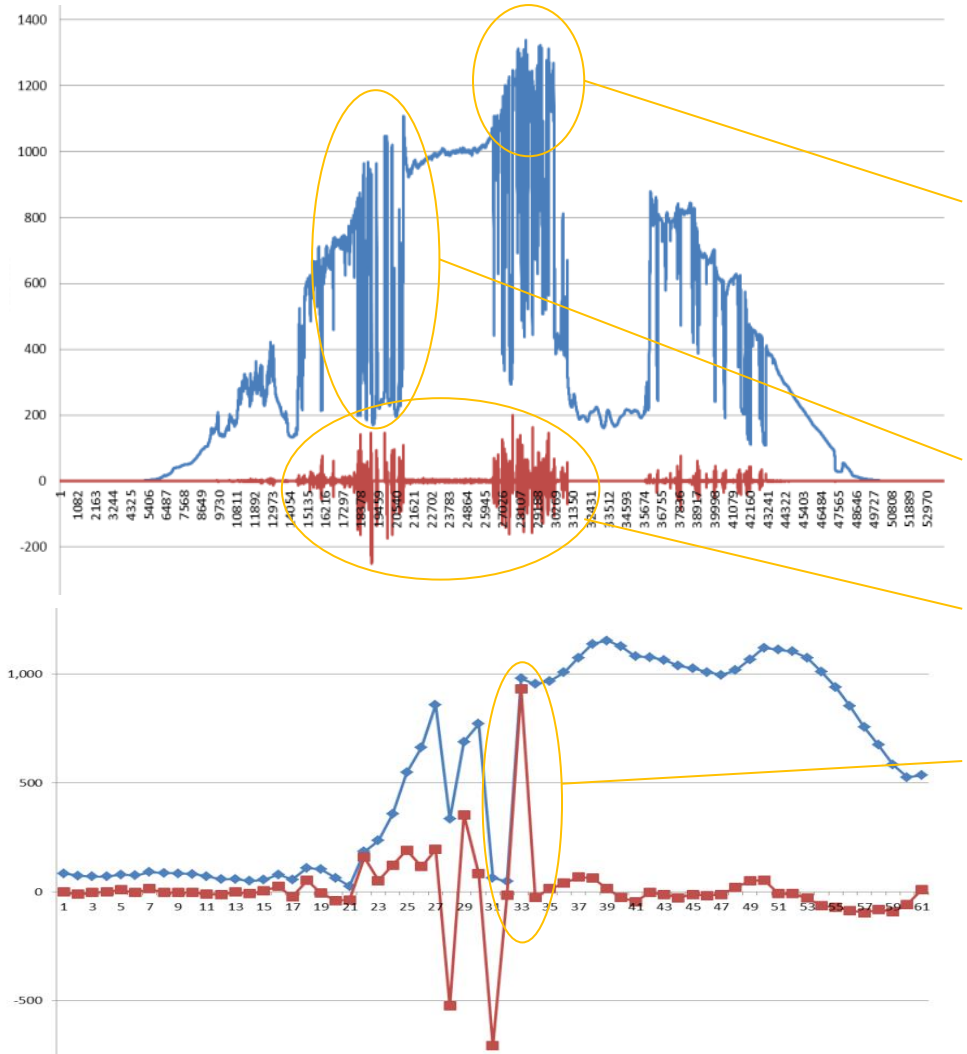
Benefits

- Provide local emergency backup
- Increase Resiliency of the grid
- Provide benefits year-round
- Manage demand charges
- Increase efficiency
- Reduce investment/assets needed for peak conditions
- Facilitate renewable energy integration



Source: Demand Energy

The Variability of the Solar Energy Resource

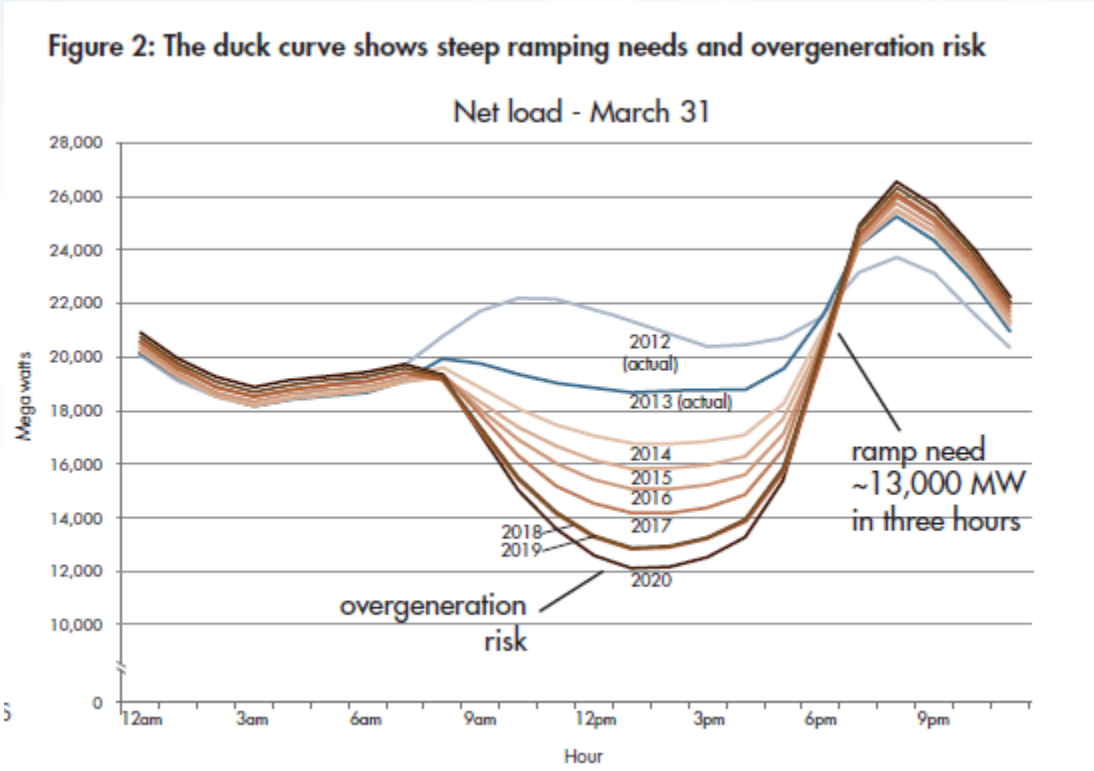


- Rapid fluctuation due to cloud movement
- Radiation is changing rapidly between 200 and 1000 Watt/m^2
- Ramps stay in the range of 200 Watt/m^2 per second
- Ramps of up to 1000 Watt/m^2 per second are possible but rare

Data source: NREL, Airportdata, 2010, Evaluation BEW, DNV KEMA

California Duck Curve

1.325 GW of storage target for 2020



Source: CAISO

Storage Technologies

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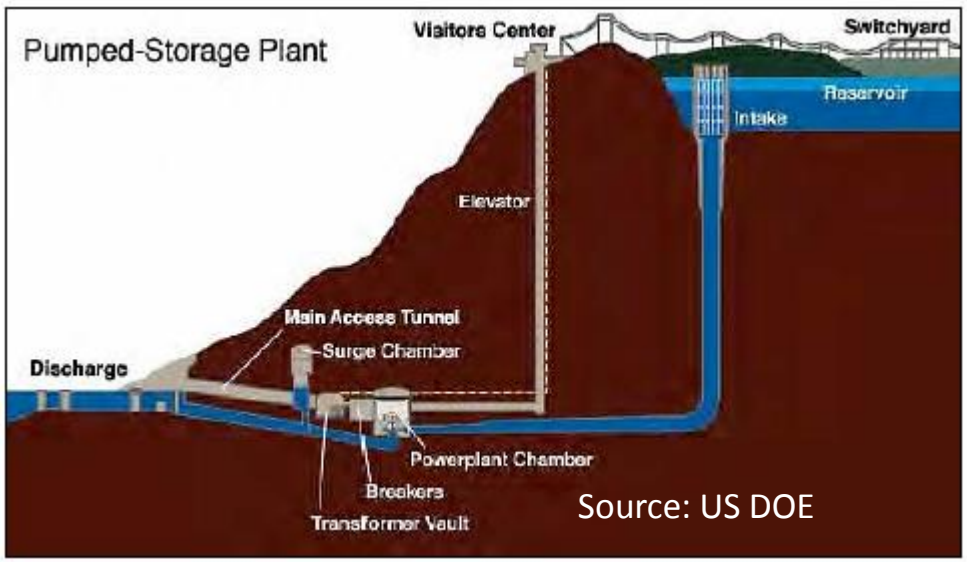
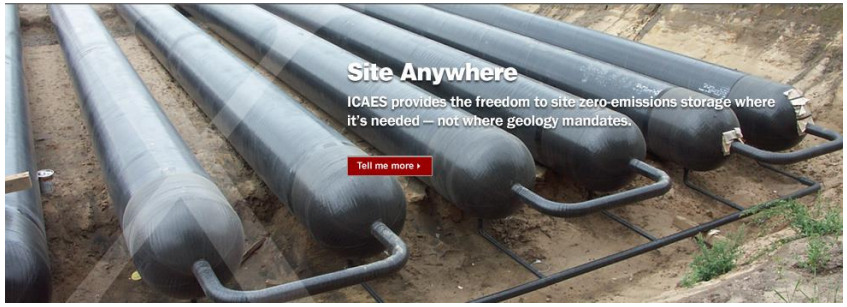


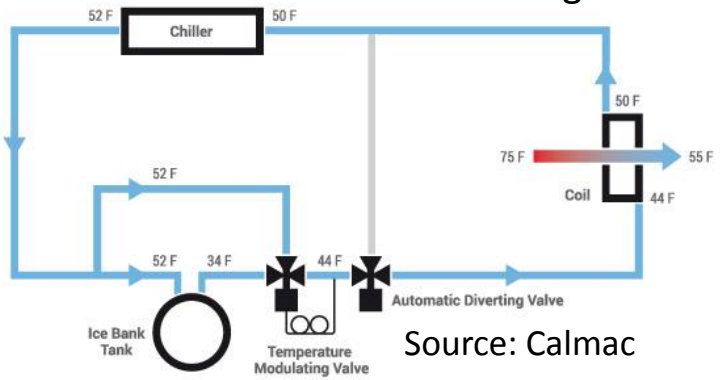
Source: US DOE

Compressed Air



Source: SustainX

Thermal Storage



Source: Calmac

Batteries

Many types

- Lead Acid
- Advanced Lead Acid
- Sodium
- Lithium (different cathodes)
- Flow Batteries
- Air Electrodes
- Many others

Cost reduction

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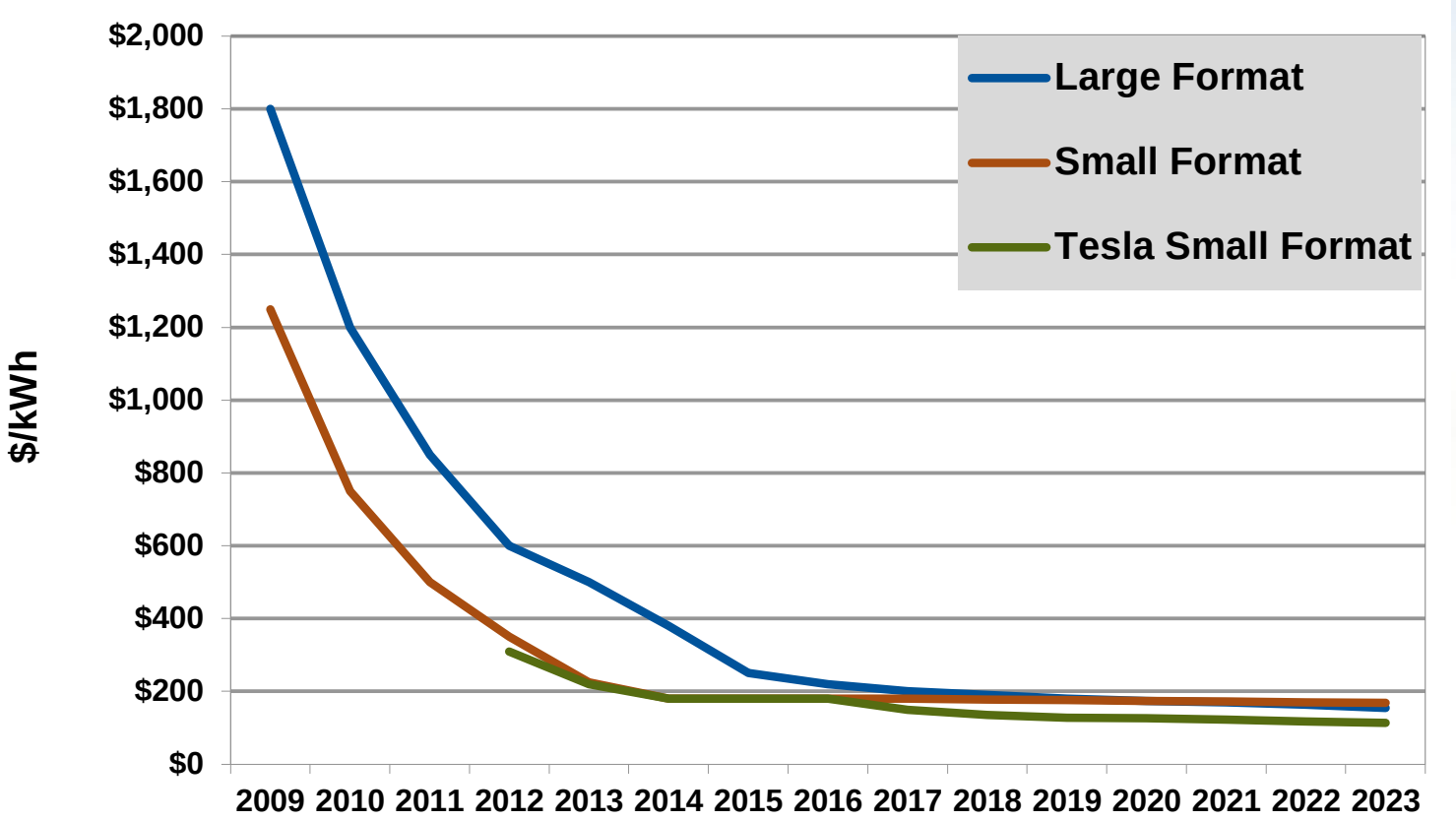
Historical and Forecast Lowest-Point Pricing for Li-ion Batteries by Form Factor, 2009-2023



Source: Navigant Research, Sam Jaffe presentation at NY-BEST Conference Sept. 2014

Market Projection

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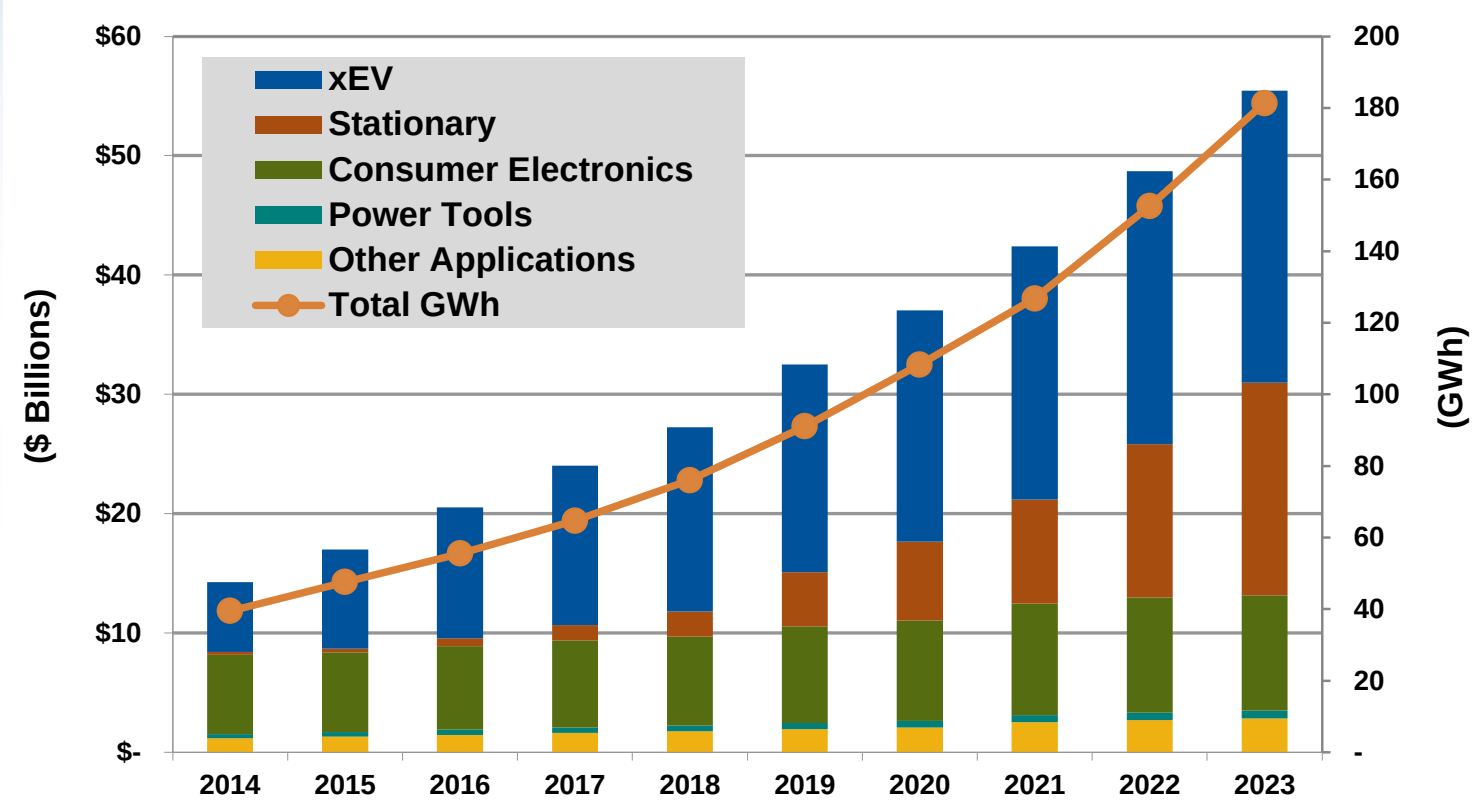
Advanced Batteries Revenue by Application, World Markets: 2014-2023



Source: Navigant Research, Sam Jaffe presentation at NY-BEST Conference Sept. 2014

Building/Urban Installations

Green Charge Networks, NYC
100 kW lithium-ion system for demand charge management

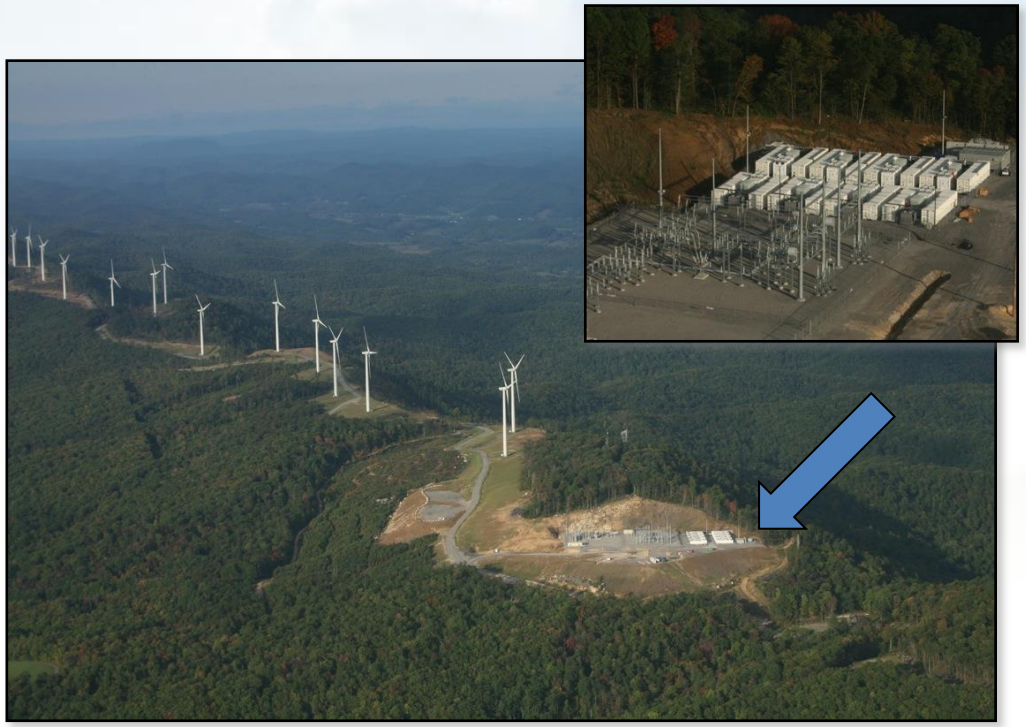
Calmac Manufacturing, NYC
Ice storage system for permanent peak reduction

Demand Energy, NYC
225kW lead acid storage system for energy management & backup

Stem, San Francisco
15kW lithium ion system for energy management & backup

Electric Grid Examples

Beacon Power, Stephentown, NY
20 MW Flywheels



AES Laurel Mountain WV
64 MW lithium-ion storage

New York City Transit
Off-peak electric storage for a bus refueling station, using a sodium-sulfur battery system

Codes, Standards, and Siting

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Navigating and Streamlining

- Battery System (UN 38.3, UL 1973, IEC 62133,
- Electrical Interface (UL 1741, IEEE 1547)
- Building & Electrical Codes (Alternative materials)
- Fire Codes (Fire safety testing)

About NY-BEST

NEW YORK BATTERY AND ENERGY STORAGE TECHNOLOGY CONSORTIUM

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

We do this by:

1. *serving as a center for communication, education and interaction amongst stakeholders;*
2. *leveraging New York's world-class intellectual and manufacturing capabilities and market leadership;*
3. *supporting and accelerating the commercialization process from research and development to products and widespread deployment; and*
4. *advocating for policies that promote the energy storage industry.*

140+ Member Organizations

BEST Test and Commercialization Resources

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- Cell Testing
- Module and System Test
- Environmental
- Battery Prototyping
- Operated by DNV GL and RIT

A Module Test Station and Walk-in Environmental System Test Stations

Panoramic View of the Battery Prototyping Equipment in the Dry Room

Discussion

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