Webinar Instructions

This webinar is being recorded and will be available on www.energystorage.org.

All lines will be muted during the webinar.

To submit questions, please use the chat box on the left-hand side of your screen at any time throughout the presentation.
Antitrust Guidelines

All meetings and teleconferences of the Energy Storage Association are held in accordance with our antitrust guidelines. We ask that you abide by these guidelines during today’s webinar. The full guidelines are available in the Members Only area of the ESA website.
ESA Membership

ESA works to ACCELERATE markets, CONNECT members and EDUCATE all stakeholders.

Contact Richie O’Neill, Membership Director
r.oneill@energystorage.org
October 15-16
Bellevue, WA
Today’s Speakers

Emma Elgqvist
Engineer, Energy Optimization Modeling; National Renewable Energy Laboratory

Steve Casey
Manager, Strategic Planning; Eversource

Keith Martin
Co-head of Projects, United States; Norton Rose Fulbright
Energy Storage Economics 101

Emma Elgqvist, NREL

April, 2019
Why Storage Now?

Clean Energy Cost Trends

- Land-Based Wind -41%
- Distributed PV -54%
- Utility-Scale PV -64%
- Modeled Battery Costs -73%

Image credit: energy.gov/revolution-now

PV vs. Batteries

• PV is simple
  – Put it on the roof
  – The sun shines
  – Electricity is produced
  – Your utility bill is lowered

• Batteries are more complicated
  – Don’t generate electricity
  – Shifts energy from one time period to another
  – Put one in the basement or in a shed, nothing happens

• Batteries can usually only do one thing at a time
  – Cost of energy at the time it’s stored must be cheaper than cost of energy when it is used
  – To maximize return on investment, must determine what application battery should serve and when
## Range of Storage Use Cases

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Off Grid Microgrid</th>
<th>Grid Connected</th>
<th>Grid Connected with Microgrid</th>
<th>Coupled with large-scale RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Providing continuous power in lieu of utility</td>
<td>Lowering cost of utility purchases</td>
<td>Lowering cost of utility purchases Providing power during grid outage</td>
<td>Large-Scale distributed energy for economic diversification</td>
</tr>
<tr>
<td>Why/Where it works</td>
<td>• Remote sites with high fuel costs • Low grid reliability</td>
<td>• High demand charges • TOU rates • Ancillary service markets</td>
<td>• High demand charges • TOU rates • Ancillary service markets • Resilience requirements</td>
<td>• Deregulated market • Interested offtaker • Large land-availability</td>
</tr>
<tr>
<td>Primary Power Supply</td>
<td>DERs (typically including generators)</td>
<td>Grid + DERs</td>
<td>Grid + DERs</td>
<td>n/a (no onsite consumption)</td>
</tr>
<tr>
<td>Back-up</td>
<td>None</td>
<td>None</td>
<td>DERs</td>
<td>Typically none but could be possible</td>
</tr>
</tbody>
</table>
## Value Streams by Use Case

<table>
<thead>
<tr>
<th>Value Stream</th>
<th>Description</th>
<th>Off Grid</th>
<th>Grid Connected</th>
<th>Large Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Offset</td>
<td>Storage, in conjunction with RE, offsets fuel cost in off-grid remote locations</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Demand charge reduction</td>
<td>Use stored energy to reduce demand charges on utility bills</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Energy Arbitrage</td>
<td>Energy time-of-use shift (from on-peak to off-peak hours or selling during high cost and charging during low cost)</td>
<td></td>
<td>X, X</td>
<td></td>
</tr>
<tr>
<td>Demand response</td>
<td>Utility programs that pay customers to lower demand during system peaks</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Frequency regulation and capacity markets</td>
<td>Stabilize frequency on moment-to-moment basis or supply spinning, non-spinning reserves (ISO/RTO)</td>
<td></td>
<td>X, X</td>
<td></td>
</tr>
<tr>
<td>Voltage support</td>
<td>Insert or absorb reactive power to maintain voltage ranges on distribution or transmission system</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>T&amp;D Upgrade Deferral</td>
<td>Deferring the need for transmission or distribution system upgrades, e.g. via system peak shaving</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Resiliency / Back-up power</td>
<td>Using battery to sustain a critical load during grid outages</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Example of Demand Reduction and Energy Arbitrage

**Demand Reduction**

Setting peak for the month

**Energy Arbitrage**

Buy cheap, use high
Drivers for Grid-Connected RE + Storage Systems

- Storage Costs
- Incentives & Policies
- Utility Cost & Consumption
- Ancillary Services Markets
- Resilience Goals
Eversource Energy Storage
ESA Webinar

April 25, 2019
Eversource Overview

We Serve:
- 4 million electric, water, and gas customers
- Service territory in 3 states
- Roughly 48% of New England

We Deliver:
- Energy: 52 TWh/yr
- Gas: 101 bcf/yr
- Water: 131 M gal/day
- Rev: $8.45 B
- Net Income: $1.03 B

We Own & Operate:
- $23.6 B of assets
- 4,400 miles of transmission
- 58,000 miles of distribution
- 6,600 miles of gas pipeline
- 3,600 miles of water mains
- 70 MW of solar

Source: Eversource 2018 Annual Report and 10K
Energy Storage Key Value Factors

**Policy & Rules & Size**
- Targets, mandates, and incentives make a big difference in storage success.
- Need to understand the specific characteristics of the location to evaluate storage use cases properly.
- Current ISO-NE rules regarding asset registration limits the flexibility of how storage can be utilized.

**Costs**
- Cost reductions expected to continue in a significant way, making storage more viable in the future.
- Use cases designed for power versus energy drive cost profile – energy focused equals higher costs.

**Technology**
- Technology improvements are expected to continue.
- Lithium-ion is best technology now, but others will emerge in the future for different use cases.

**Experience**
- Control of the energy storage is the most critical aspect of creating value.
- Demonstration projects to gain knowledge is needed for successful projects.
Favorable Regulatory Environment
- MA 1,000 MWh storage target & Clean Peaks law
- CT law mandates EDC storage pilots
- On-going grid mod proceedings in CT and NH

Storage High Level Business Case
Can be used for traditional investment deferral/avoidance and peak shaving to reduce costs for customers:

- Traditional Investment Deferral/Avoidance
  - Less traditional rate base
- Avoidance of Regional Network Service
  - Reduces transmission costs
- Avoidance of Forward Capacity Market
  - Reduces supply costs

Benefit/Cost Ratio > 1.0

There are Multiple Use Cases and Benefits for Energy Storage
- Traditional investment deferral/avoidance
- Reliability and resiliency
- Peak management
- Power quality
- Renewables integration
- GHG reductions
There are 11,000 customers downstream of the Wellfleet substation from Wellfleet to Provincetown.

They are served by a single line (Circuit 96) with no redundancy that runs along Route 6.

In the last 5 years, these customers have had 15 major outage events, representing 45,123 customer outage hours.

This is among the worst performing circuits in our entire service territory across all three states.

Adding a redundant line to improve reliability would require construction through 13 miles of the Cape Cod National Seashore.
Specifics of the Outer Cape Community Battery Project

Technology:
A lithium ion battery, capable of providing a minimum 1.5 to 3 hours of back up power at peak and up to 10 hours in non-peak conditions.

Appearance:
The battery will be housed in a Cape-Style building on about half an acre in Provincetown.

Impact:
Improve reliability in Provincetown, North Truro, Truro, and Wellfleet by over 50%.

Avoid the need to build 13 miles of distribution line through the Cape Cod National Seashore area.

Assist in peak management in times of high loads.

Cost:
Approved by MA DPU for $40M

Outer Cape Battery Size

25 MW / 38 MWH

• The power rating of the battery - the maximum it can charge or discharge at one time.

• The energy - how much it can store and deliver if batteries are fully charged.
The island is served by **four 23kV submarine cables** from Falmouth.

In the event of a cable failure or other contingency, the island is served by **five 2.5MW diesel peakers**, owned by GenOn.

Five percent projected load growth over the next decade means that **additional reliability resources** will be required.

The island will have nearly **5 MW of solar**. System impact studies showed the potential for undesirable voltage-related impacts.

The Town of Oak Bluffs wants to **reduce the Island’s carbon footprint** wherever possible.
Specifics on **Phase One** of the Martha’s Vineyard Community Battery Project

**Technology:**
A lithium ion battery capable of demonstrating reduction of alliance on 2 of the 5 diesel peakers.

**Appearance:**
The battery will be housed in a Cape-Style building on approximate 1/3 an acre behind the Eversource Service Station in Oak Bluffs.

**Impact:**
Allows for the reduced dependence on 2 diesel fired peakers owned by GenOn.
Enhances reliability for all Martha’s Vineyard customers.
Supports installation of distributed solar.
Helps Martha’s Vineyard achieve its energy goals.

**Cost:**
Approved by MA DPU for $15M

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**MV Battery Size**
4.9 MW / 20 MWH

**Phase Two Concept and Next Steps:**
- Phase Two would consist of a second 10MW / 64 MWH battery adjacent to Phase One.
- Phase Two would enable reduction of reliance on all 5 diesel peakers.
- Phase Two development expected to start as Phase One is approaching in-service.
Financing Issues

Keith Martin
keith.martin@nortonrosefulbright.com
There are two ways to look at project finance. One is that borrowing a large amount of money to build a project requires locking down costs and locking in a revenue stream. Banks focus on the net amount a project will have to pay debt service after covering costs. Another way to think about project finance is it is an exercise in risk allocation.

DSCR

technology risk
The market is not yet at the point of financing projects like it might finance a local McDonald's franchise on the basis of projected hamburger sales. While storage projects have the potential to generate up to 13 different revenue streams, only a few are common today.

upside revenue
Storage works best currently if it can be considered part of a new solar project or an existing wind farm on which a Treasury cash grant was paid. The IRS has issued three private letter rulings on when tax credits can be claimed on storage. The storage must be considered part of the generating equipment rather than a transmission asset.

- knob on a motor
- 75% cliff
The IRS is working on investment tax credit regulations, but these are unlikely to be issued until next year. A bill to allow tax credits for standalone storage is gradually gathering support. Of the three tax proposals of greatest interest to the power industry, this probably has the best chance of moving if any new tax proposals move this year.
Financing Issues

Keith Martin
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Questions can be submitted through the chat box in your browser.
Thank you

Please submit ideas for future webinars to education@energystorage.org