Energy Storage Association

Storage 101: Project Economics

April 25, 2019

www.energystorage.org

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.

Energy Storage Association

Antitrust Guidelines

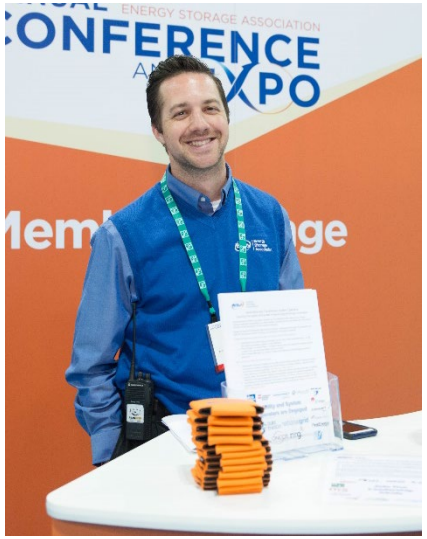
All meetings and teleconferences of the Energy Storage Association are held in accordance with our antitrust guidelines. We ask that you abide by these guidelines during today's webinar. The full guidelines are available in the Members Only area of the ESA website.

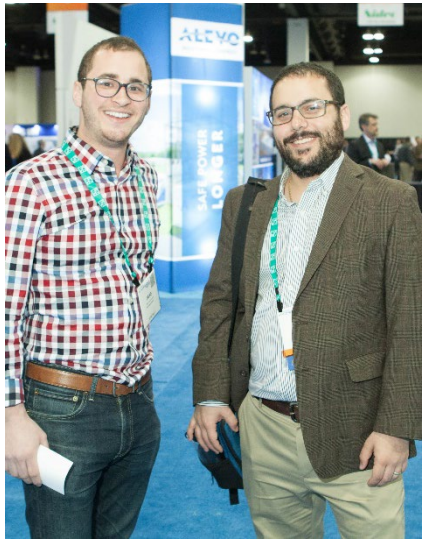
Energy Storage Association

ESA Membership

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

Contact **Richie O'Neill**, Membership Director
r.oneill@energystorage.org





Energy Storage Association

THE ESA

STORAGE EXCHANGE

Powered by EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Alabama 110 MW Compressed Air Energy Storage Plant

October 15-16
Bellevue, WA

ESA Energy Storage Association

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 Association

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Energy Storage Economics 101

Emma Elgqvist, NREL

April, 2019

Why Storage Now?

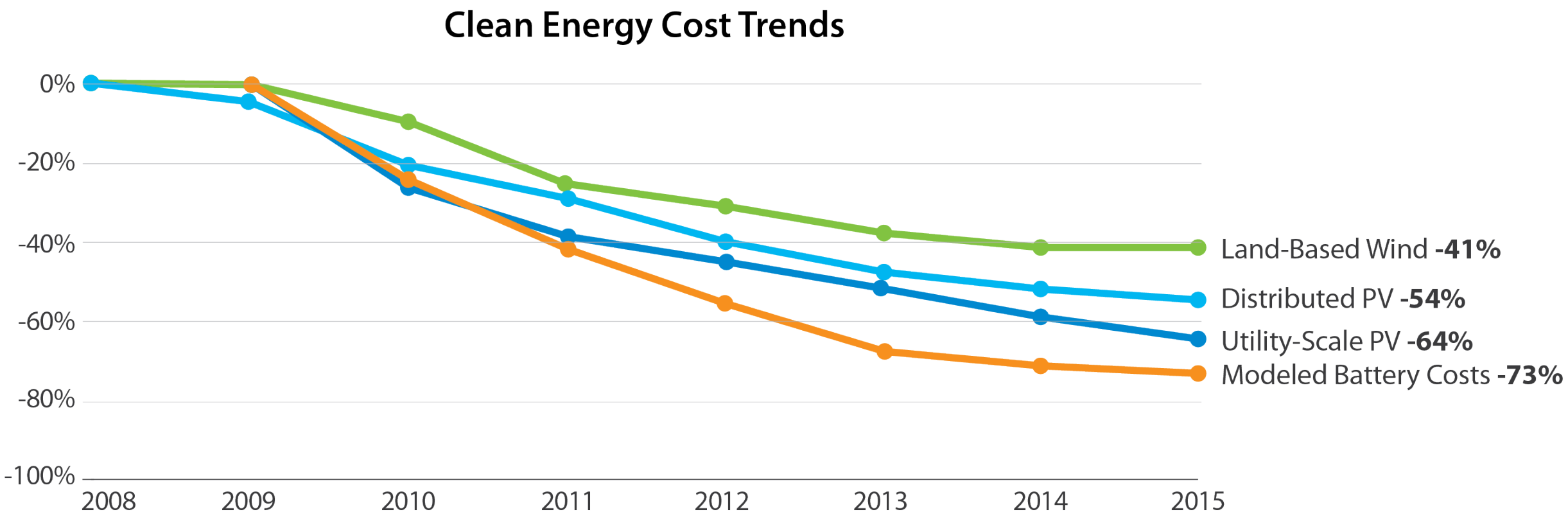


Image credit: energy.gov/revolution-now

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, *Revolution Now – Accelerating Clean Energy Deployment.* DOE/EE-1478, September 2016. https://energy.gov/eere/downloads/revolutionnow-2016-update.

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

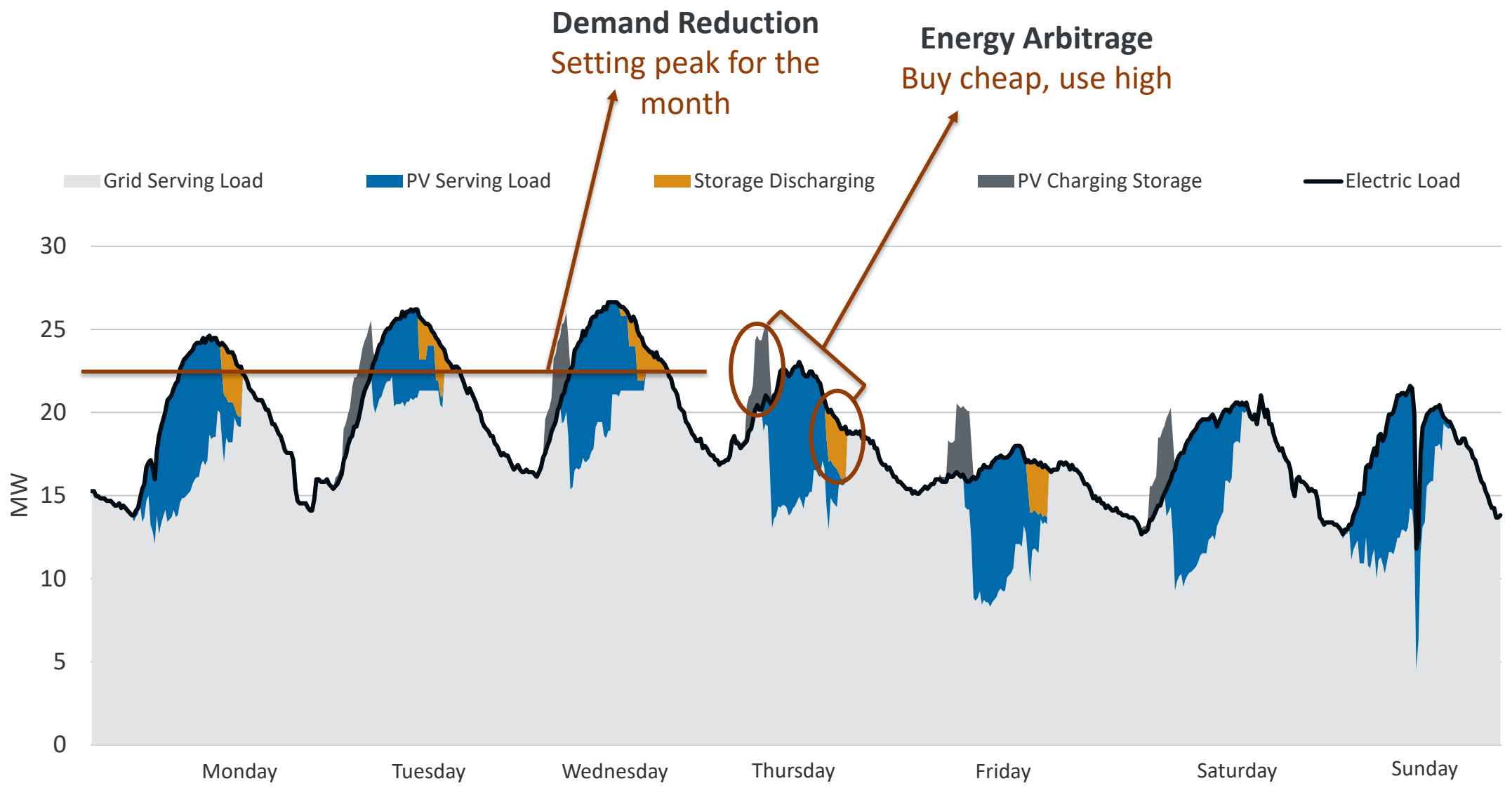
Range of Storage Use Cases

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

Value Streams by Use Case

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

Example of Demand Reduction and Energy Arbitrage



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

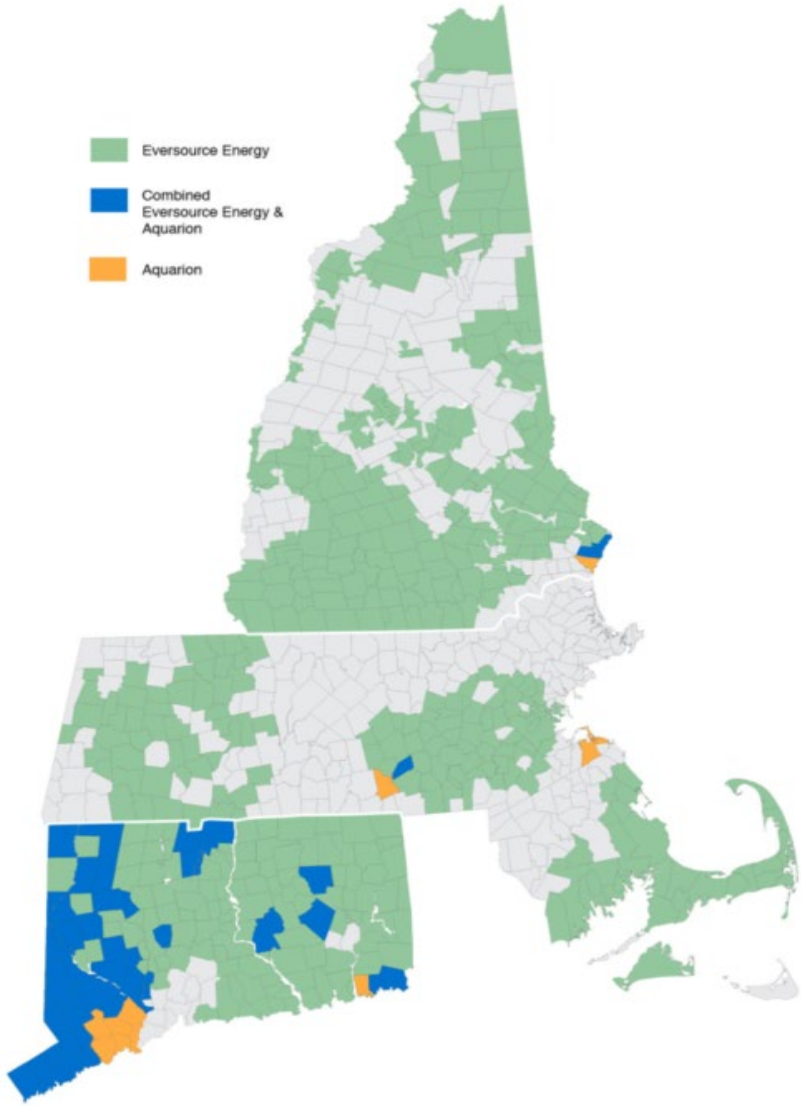
We Deliver:

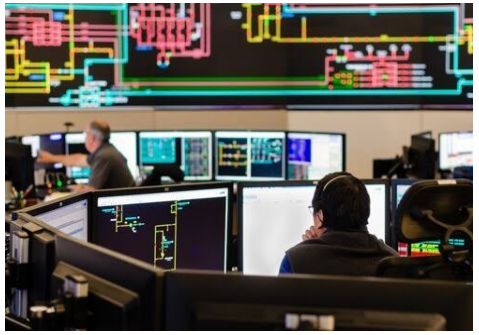
- Energy: 52 TWh/yr
- Gas: 101 bcf/yr
- Water: 131 M gal/day
- Rev: $8.45 B
- Net Income: $1.03 B

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

Critical to its technical and economic viability

Need to understand the specific characteristics of the location to evaluate storage use cases properly

Targets, mandates, and incentives make a big difference in storage success

Current ISO-NE rules regarding asset registration limits the flexibility of how storage can be utilized

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 improvements are expected to continue

Lithium-ion is best technology now, but others will emerge in the future for different use cases

Control of the energy storage is the most critical aspect of creating value

Demonstration projects to gain knowledge is needed for successful projects

Eversource Energy Storage Overview

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

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

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*)

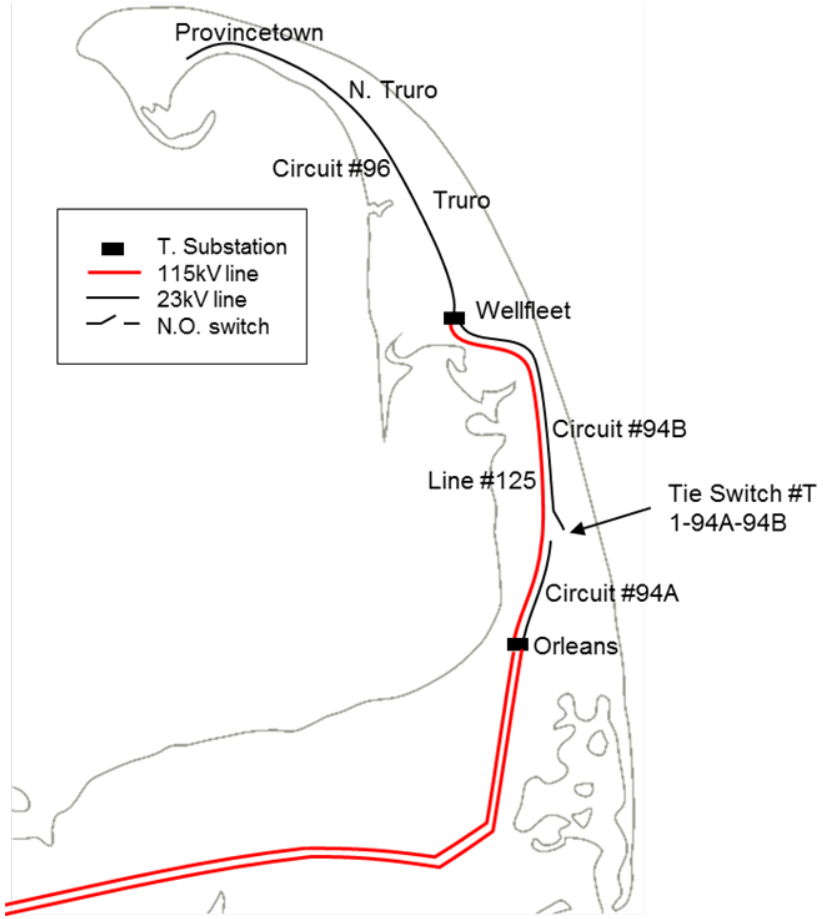
+

Avoidance of Forward Capacity Market (*Reduces supply costs*)

=

Benefit/Cost Ratio > 1.0

Snapshot of the Outer Cape Today



- 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

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.

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%.

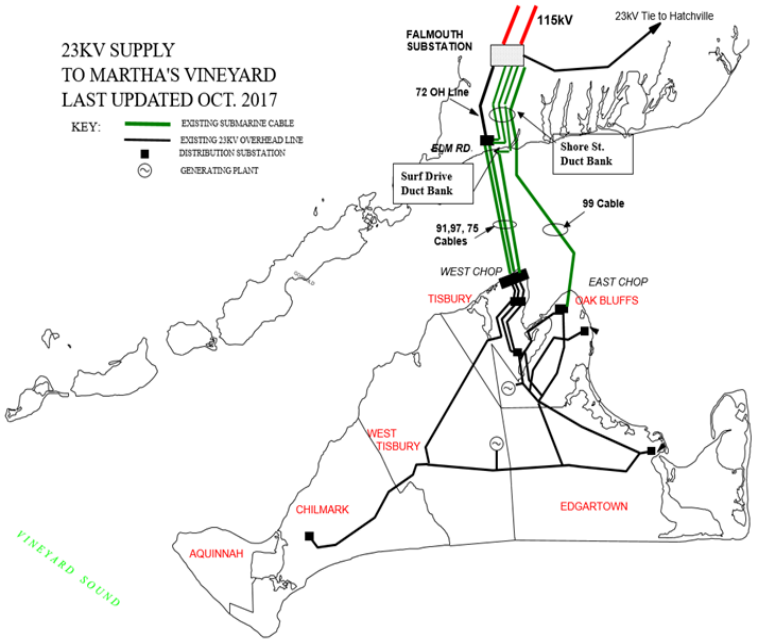
Avoid the need to build 13 miles of distribution line through the Cape Cod National Seashore area.

Assist in peak management in times of high loads.

Cost:

Approved by MA DPU for $40M

Snapshot of Martha's Vineyard Today



GenOn's 7.5 MW of diesel peakers located next to the ES service station in Oak Bluffs. These, along with 5 MW in West Tisbury, provide back up in the event of a cable failure or other contingency.

- 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

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.

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

Financing Issues

Keith Martin
keith.martin@nortonrosefulbright.com

NORTON ROSE FULBRIGHT

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 is 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
keith.martin@nortonrosefulbright.com

NORTON ROSE FULBRIGHT

Q & A

Questions can be submitted through the chat box in your browser.

Energy Storage Association

THE ESA

STORAGE EXCHANGE

Powered by EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Alabama 110 MW Compressed Air Energy Storage Plant

October 15-16
Bellevue, WA

ESA Energy Storage Association

Thank you

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

Energy Storage Association