

# Energy Storage and Microgrids: a few Case Histories.

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# Metlakatla, AK: Island System with Hydro

Hydro: 4.9 MW *Due to frequent brownouts:*  
Load following Diesel: 3.3 MW

*Increasing fuel costs (\$400K/yr) prompted GNB/GE/DOE-Sandia study*

Retrofit L/A Storage: 1.0 MW (GNB, Exide)

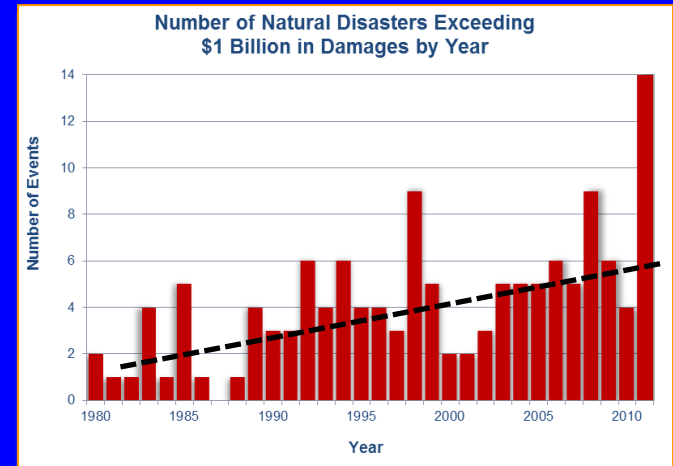
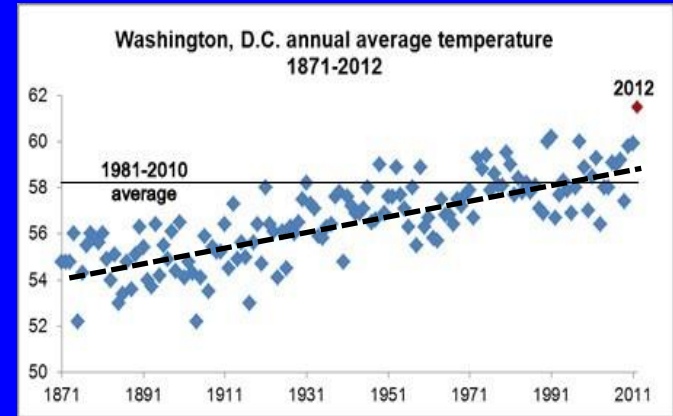
Operating Costs \$K	w/o BESS	with BESS
Fuel Oil	4,864	184
Island Delivery	2,039	78
Diesel Maintenance	1,100	400
Replacement	N/A	682
Diesel Operation during Maintenance	N/A	21
<b>Total 1997-2008</b>	<b>8,003</b>	<b>1,364</b>



1MW / 1.4MWh Feb. 1997

# Energy Storage for Resilience

Every \$1 on protection measurements  
Can prevent \$4 in repairs after a storm!



Trends indicate the situation  
will get worse not better!!

# Vermont Public Service Dept. – DOE - Green Mountain Power

Joint Solicitation issued by VPS/OE  
Rutland, VT

4MW / 3.4MWh of storage  
Integrated with 2MW PV  
Integrator: Dynapower

Groundbreaking: Aug. 12, 2014  
Ribboncutting: Sep. 15, 2015

Storage: Ancillary grid services, demand charge reduction  
PV: Green power for the grid. Situated on Brown Field area

System can be islanded to provide emergency power for a resilient microgrid serving a highschool / emergency center.

Project referenced as model in VT Energy Strategic Plan!



# How to make the Microgrid Pay for itself:

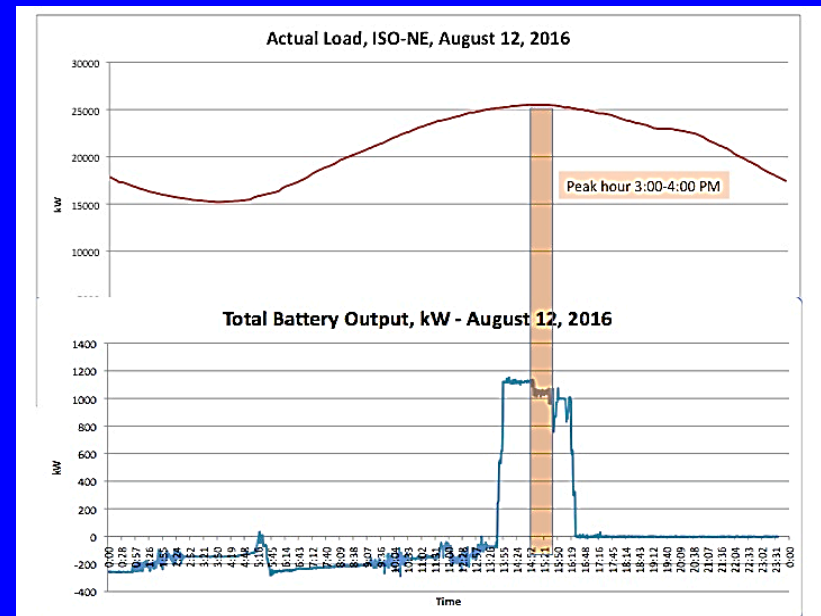
## Regional Network Service (RNS):

Payments for using transmission lines depend on **monthly peak** load.

## Forward capacity market (FCM):

Payments for regional capacity reserves to cover load excursions depend on the **yearly peak** day/hour identified by ISO-NE,

In addition, there are financial benefits from frequency regulation and arbitrage.



Capturing the yearly peak,  
\$200,000 from PV and storage!

# QuESt a Tool for Valuation– Sandia/DOE

## (Deregulated Utilities)



- QuESt: An open source Python tool for Energy Storage evaluation
- QuESt Valuation: Stacking services in an electricity market
- QuESt BTM: Bill reduction for time-of-use/net metering customers
- QuESt: Data Manager: Data Acquisition

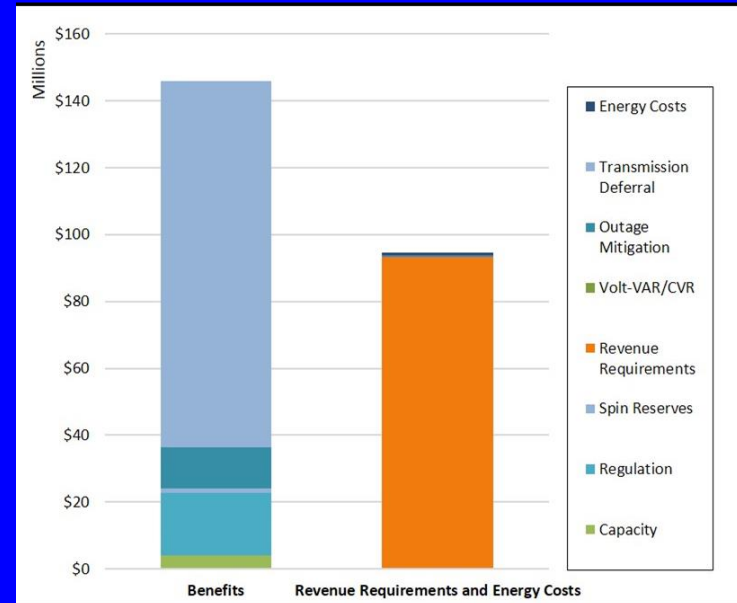
[Sandia.gov/ess-ssl/tools/quest](http://Sandia.gov/ess-ssl/tools/quest)

[PNNL: availabletechnologies.pnnl.gov/technology.asp?id=413](http://PNNL:availabletechnologies.pnnl.gov/technology.asp?id=413)

# Nantucket – National Grid, Tesla, PNNL/DOE



71 MW Submarine Cables



Analytics: Balducci et al. PNNL

*\$110 million Deferral Value + \$36 million Operational Benefits*

Installation: 6MW/8hr Storage + 6-10 MW Generator to yield required 91MW Peaking Capacity



PNNL evaluated technical and financial benefits of energy storage:

- Financial benefits of ES
- Technical impact on distribution system
- Control strategies to maximize financial benefits while achieving resiliency goals.

**Ribbon Cutting: Oct. 8, 2019. Return on Investment: 1.55**

In addition to transmission deferral, other potential economic benefits could include:

- ISO-NE demand response program participation
- ISO-NE ancillary service markets
- ISO-NE forward capacity and reserve markets
- Energy arbitrage, Outage mitigation





Extreme heat causes more deaths  
than any other natural disaster.

Studies show that temperatures  
in less affluent neighborhoods of cities  
may be 15-20 deg F higher than  
in tree shaded suburbs.

Outages, electricity prices,  
and natural disasters  
affect the poor disproportionately!

DOE Initiative ES4SE:  
Energy Storage for Social Equity

15 communities to be selected  
to receive detailed Technical Assistance

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5 communities will be chosen  
to partner in constructing  
an energy storage facility.

<https://www.pnnl.gov/projects/energy-storage-social-equity>

Being prepared for Climate Disasters  
Everywhere and  
Assuring Energy Equity  
for Urban, Rural, and Tribal  
Disadvantaged Communities  
should be High Priorities for the U.S.