

# Energy Storage: Borrowing Time - Distribution Upgrade Deferral

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2005

Technology in Search  
of a Business Case

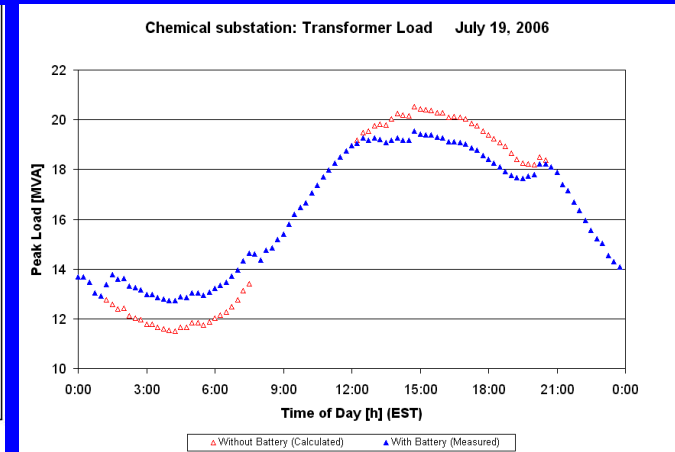


Charleston, WV Appalachian Power Substation

## AEP / DOE PROJECT

1.2 MW / 6hr NaS Battery for Substation Support:

- First Commercial Application in US.
- Provides Backup during Peak Load
- Defers Upgrade by 5 to 6 Years
- Reduces Transformer Heat up
- Potential Arbitrage Benefits 10K/month



Generic Design funded by DOE

S&C Power Conditioning System developed with DOE Funding (R&D 100)

Commissioned July 20, 2006

# Three 2 MW NaS Battery Installations for APS Substation Support, 2009



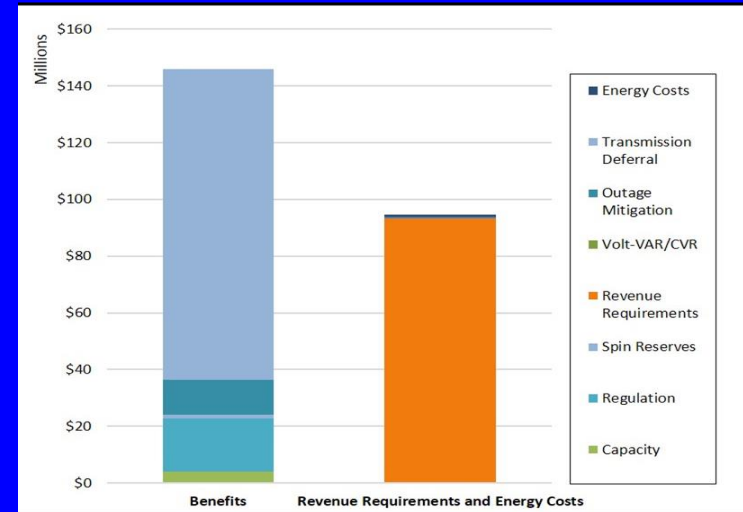
Ten Years Later  
with Less Expensive Technology  
Better Analytics,  
and Better Understanding  
of Storage Business Cases ...

# Nantucket Island, MA

## National Grid, PNNL/DOE



71 MW Submarine Cables



Analytics: Balducci et al. PNNL

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

*Ribbon Cutting: Oct. 8, 2019. Return on Investment: 1.55*  
*\$110 million Deferral Value + \$36 million Operational Benefits*



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.

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



Energy Storage  
should be in  
the Toolbox of every Utility!