

# Energy Storage Technology

## NAS Battery Installation at AEP Substation



A Presentation to

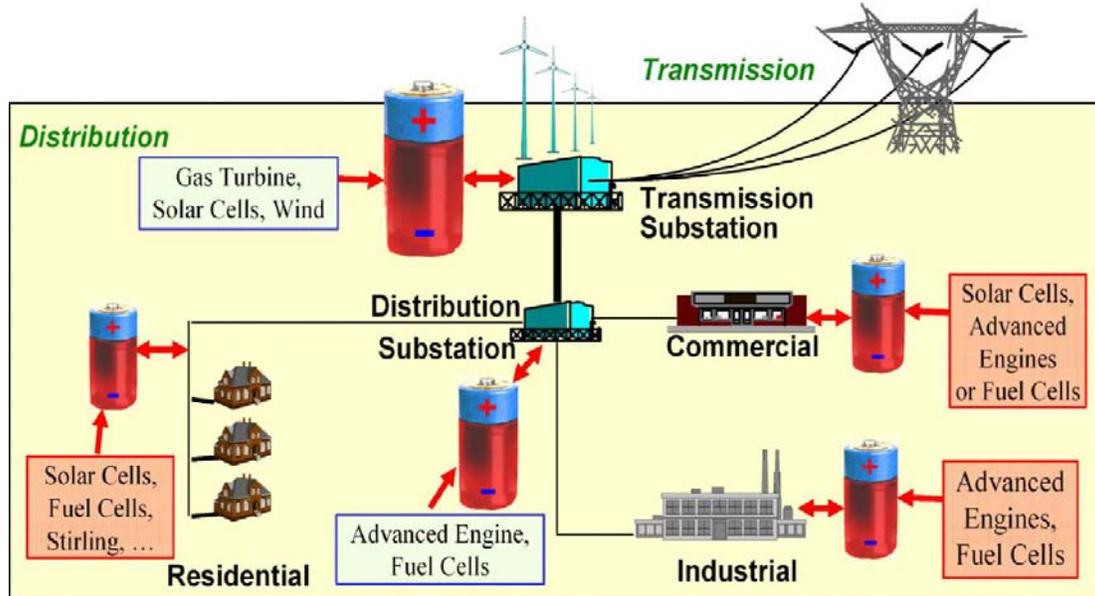
Modernizing the Grid - Midwest Regional Summit

November 2006

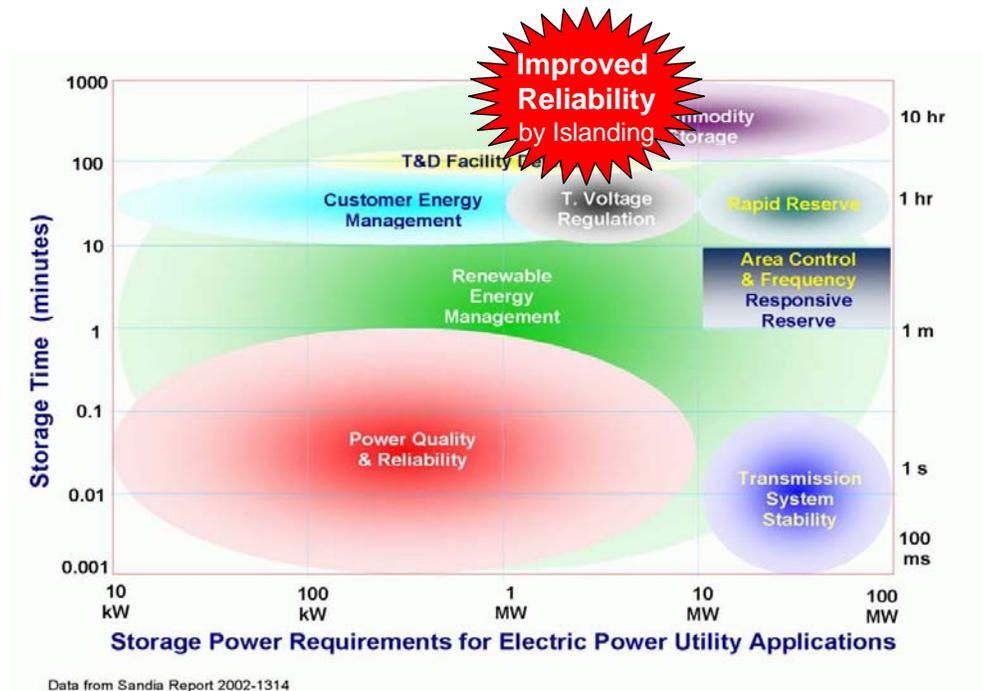
Ali Nourai

American Electric Power

## A Future Grid Possibility



## Utility Applications of Energy Storage



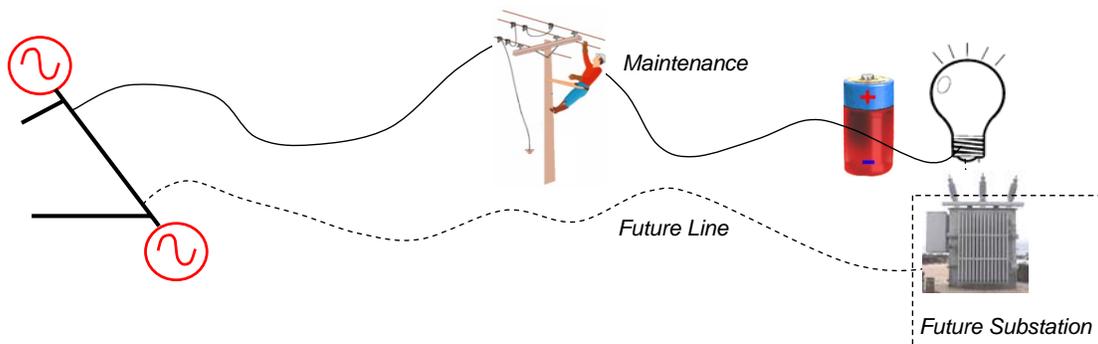
## AEP's Interest in Energy Storage

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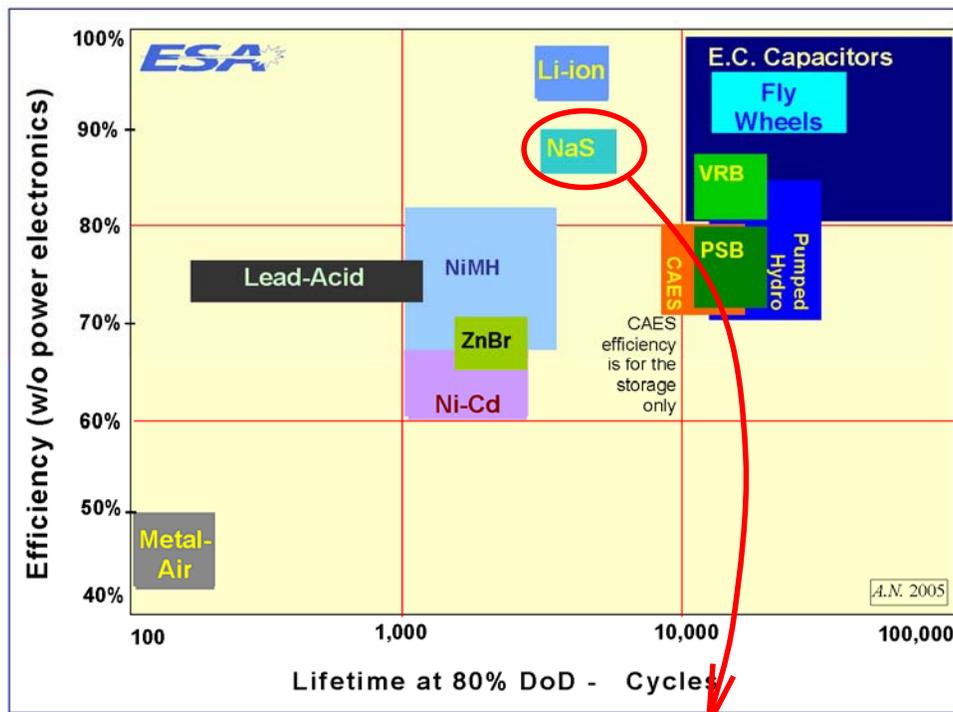
A quick solution to Reliability and Capital Deferral:

1. Provide contingency power to single-source loads
2. Maintain service during system repairs
3. Defer Investment in large increments of capital



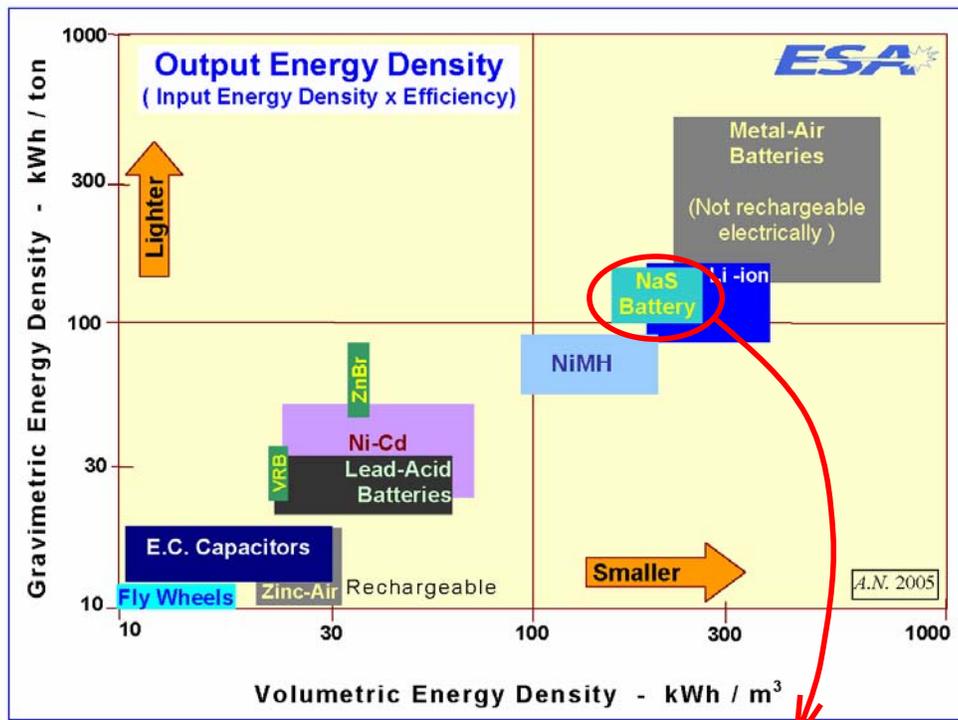
## Battery Options - Efficiency & Cycle Life

[NaS = Sodium Sulfur Battery]



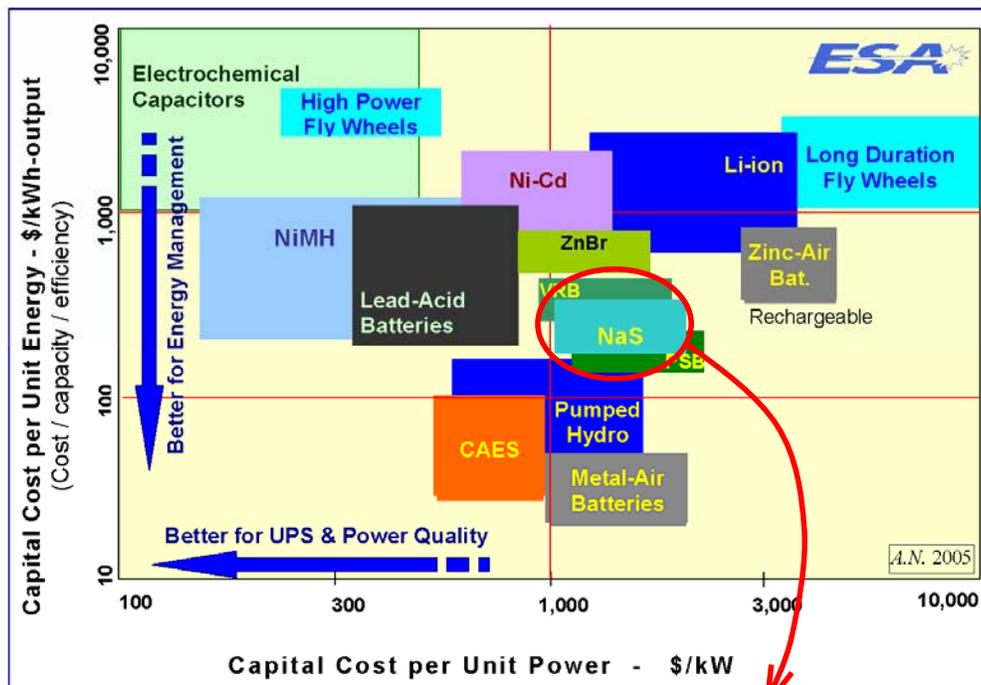
*NAS has High Efficiency and Long Cycle Life*

## Battery Options - Compactness



*NAS is the Most Compact in large-scale applications*

## Battery Options - Cost Comparison



*NAS has Lowest \$/kWh for Distributed Storage*

## The First 1.2 MW, 7.2 MWh NAS Battery in AEP

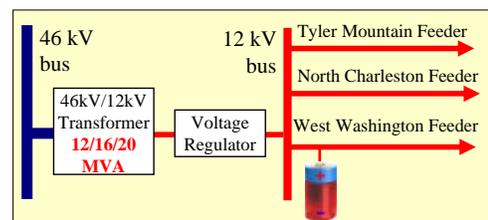
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## Overview of AEP's 1.2 MW Energy Storage System

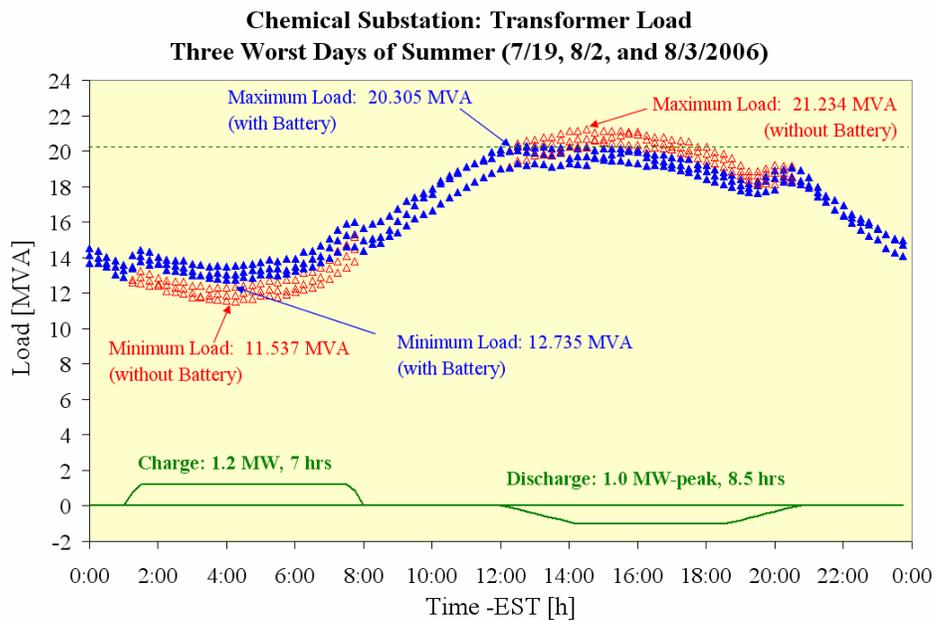


- Charleston, WV
- 1.2 MW, 7.2 MWh
- Operational since June 26th 2006



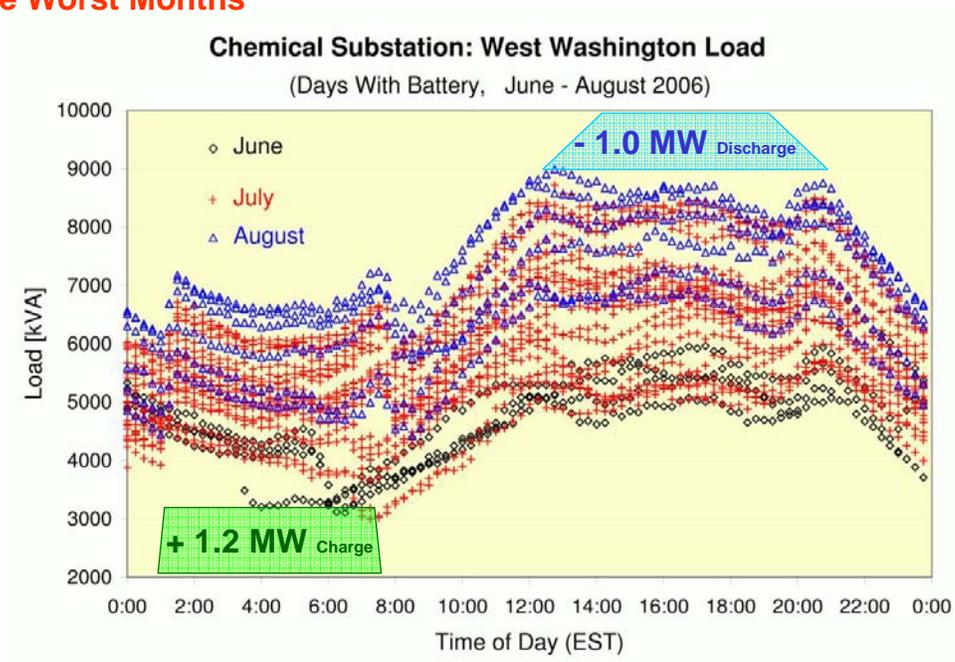
## Sample of Peak Shaving

### Three Highest Peak Days of 2006



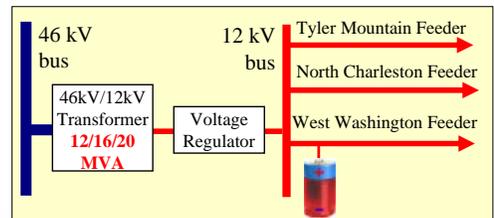
## Immediate Benefits – Load Shape

### Three Worst Months

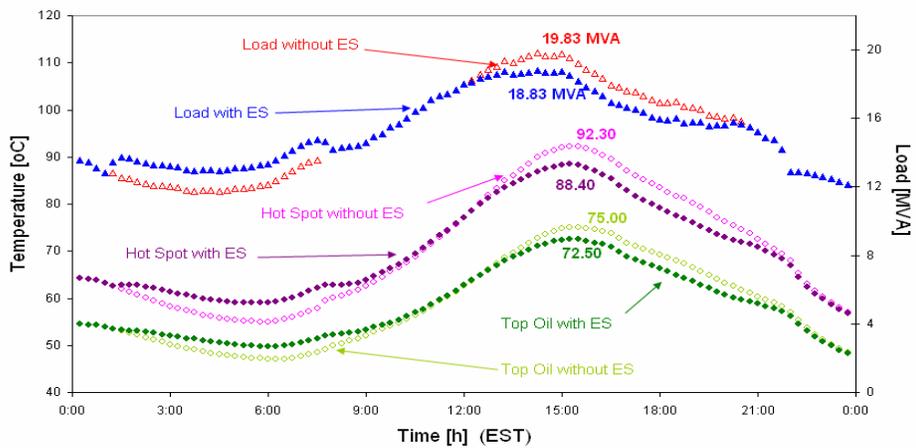


Load Factor Improved from an average of 0.75 to 0.80

# Impact on Transformer temperature



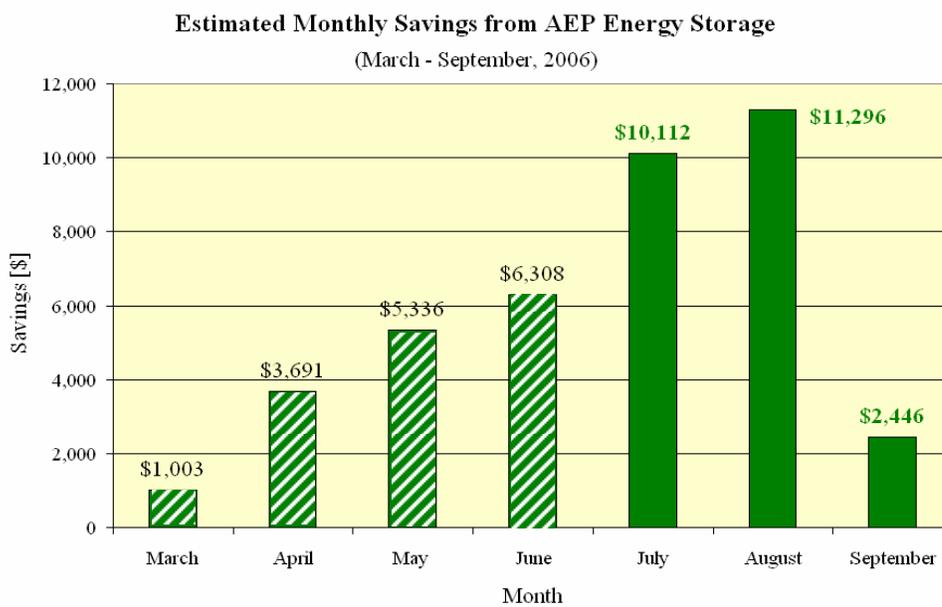
**Transformer Load, Hot Spot and Top Oil Temperature  
Chemical Substation - July 21, 2006**



\*Based on measured/calculated load and measured ambient temperature, Hot Spot and Top Oil temperature are calculated by using PTLoad 6.1, EPRI software.

## Energy Savings in the PJM Market

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***\$24,000 in the First Three Months***

## Conclusions

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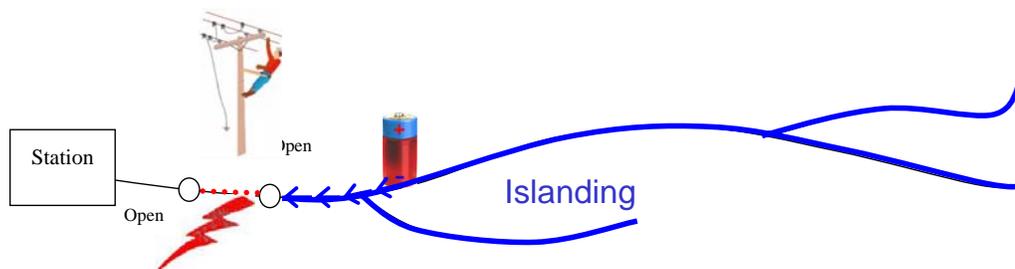
- 1MW NAS Battery Storage was Installed and Operational in Just 9 Months
- The Battery Helps Shave Transformer Peak Loads for 8.5 hours a day
- It Reduces Transformer Temperature by several degrees C
- Improves the Feeder's Load Factor from 0.75 to 0.80, in average
- Potentially provided a PJM Market Energy Value of \$24,000 in 3 months
- Helps AEP build more Confidence on this Energy Storage Technology

## Going Forward – Battery Applications to Reduce Outage Time

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DESS may be an effective way to address the **Reliability Issues** associated with the aging utility infrastructure

In many cases, deployment of DESS would be much quicker than using conventional solutions



*No One Left in the Dark*