

NAS Battery Performance at Charleston, WV



A Presentation to

DOE Peer Review Program

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Partners



American Electric Power

- Owner & Operator of DESS
- Project Management
- Site Work
- Permits



NGK Insulators

- Manufacturer of NAS Battery System



S&C Electric Company

- PCS
- System Integration



DOE/Sandia

- Partial Sponsor

Overview- First MW-Scale NAS Application Outside Japan

1.2 MW, 7.2 MWh Distributed Energy Storage System in Chemical Station, North Charleston



Started Operation on June 26th, 2006

**AEP APPALACHIAN
POWER**
A unit of American Electric Power

NGK Insulators Ltd
S&C Electric Co.
DOE / SANDIA

Went into Contract with NGK and S&C
The Storage Unit Started Operation in

Sept 2005
June 2006

Distributed Energy Storage System (DESS) Project



Main Function

1.2 MW Peak Shaving

Justifications

- 1) Corporate Strategy**
- 2) Distribution Capital Deferral**
- 3) A Relatively Quick Solution**
- 4) Relocate-able to other Sites**

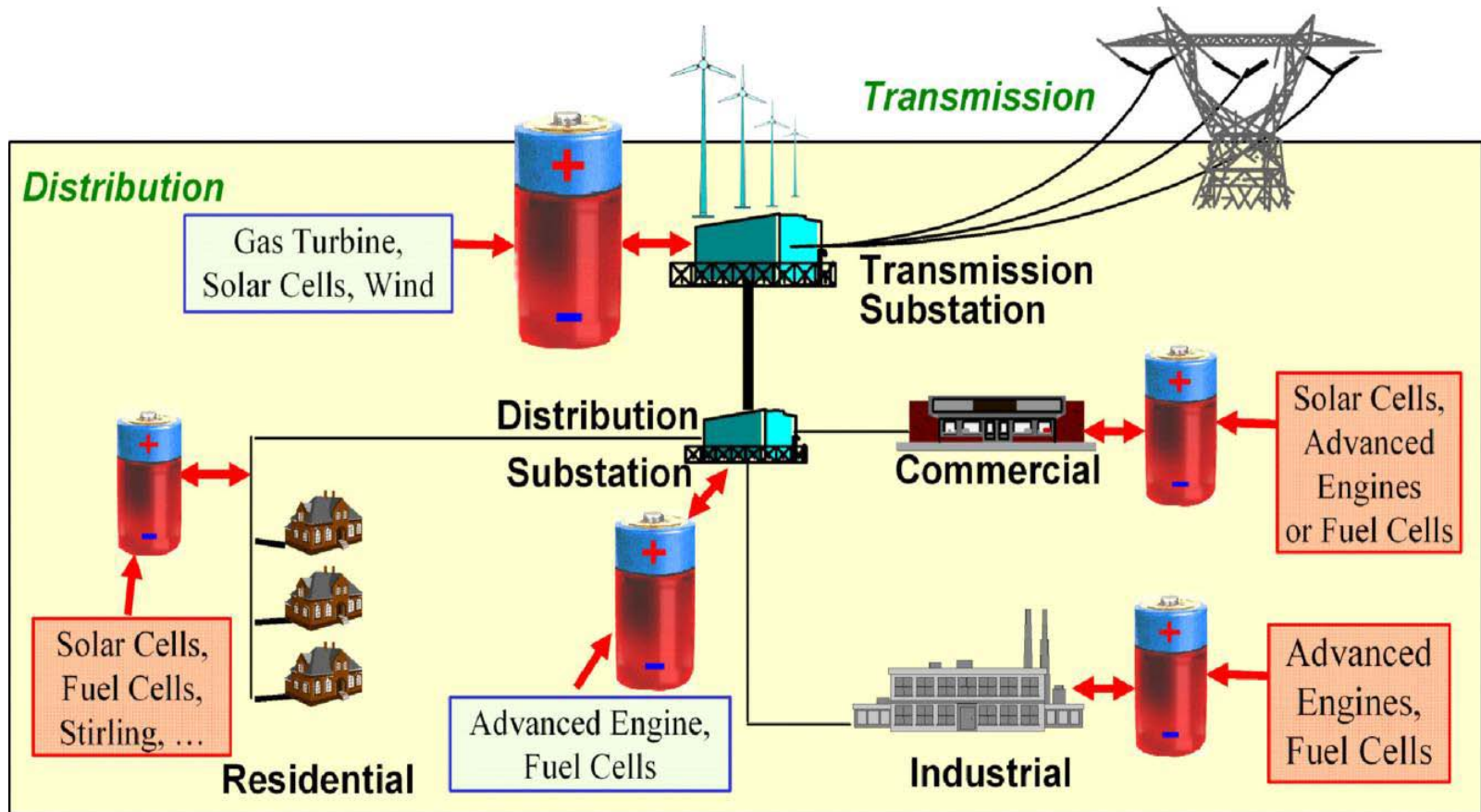
Total Cost

Under \$2,400 / kW, *Installed*

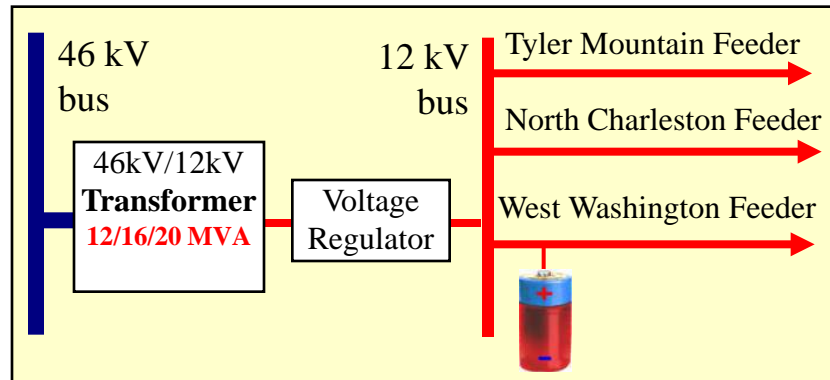
DOE Support

Covered Non-Repeat Expenses

AEP Outlook on Future Grid

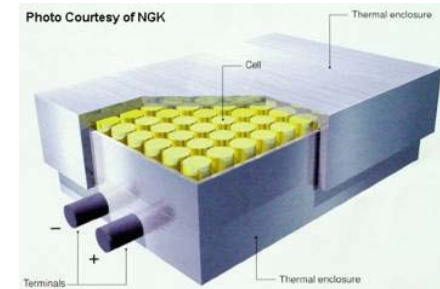
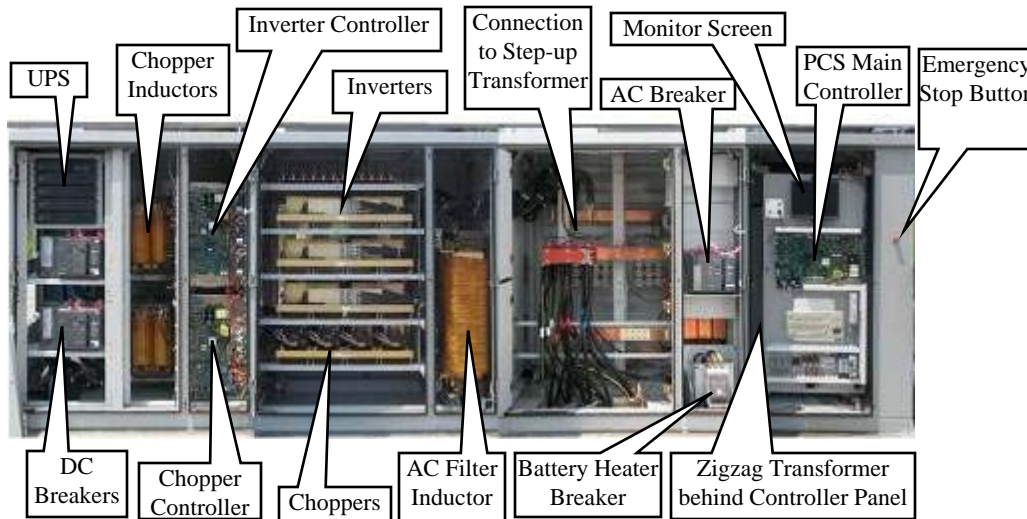


Charleston Site



1. Needed A Transformer Upgrade before Summer 2006
2. Internal Policy Required Building Another Substation with Feeders
3. Cost of New Substation was High (\$2 million)
4. Could not finish the upgrade in time for Summer Peak
5. Conventional Solution Is Not Relocate-able
6. A 1.2 MW, 7.2 MWh Relocate-able DESS was Authorized (< \$2.4 million)

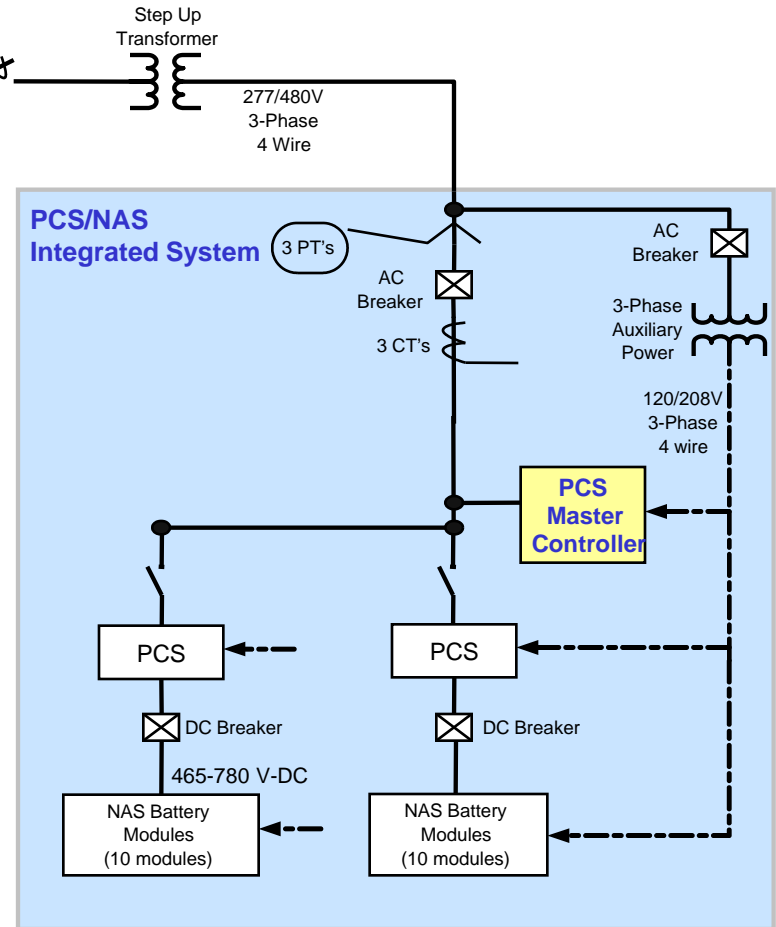
Installation of DESS Parts



DESS Sketch and Connection to Grid

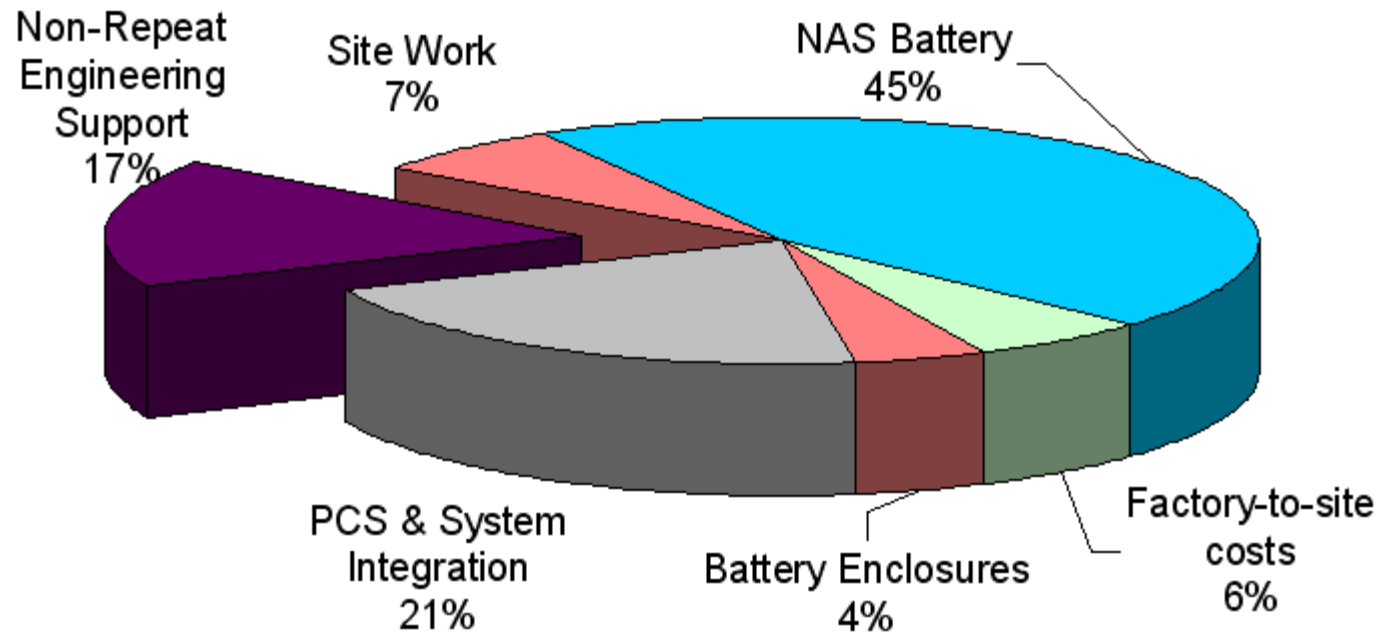


Primary
Distribution
System



DESS Cost – DOE/Sandia Role in Removing the Initial Deployment Hurdles

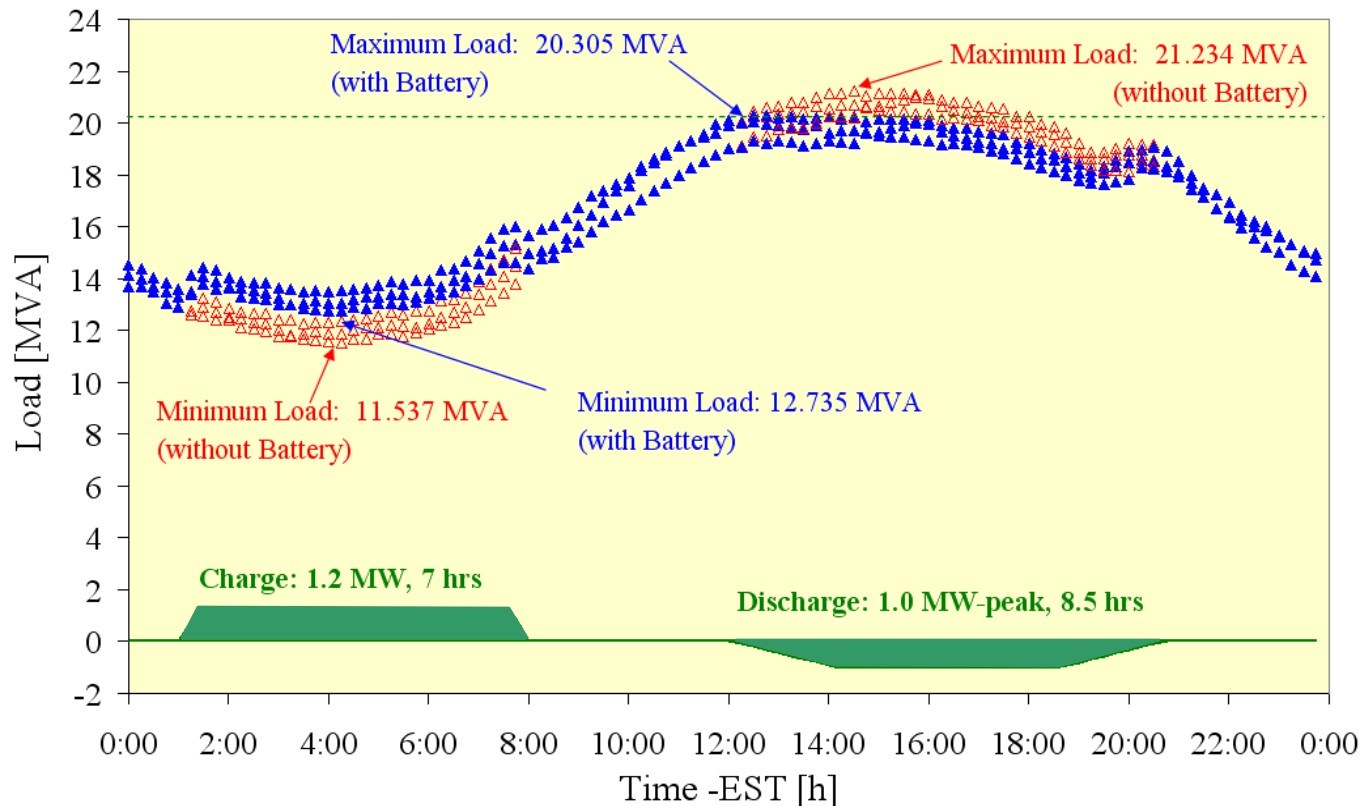
Cost Components



Immediate Benefits – Reduced Peak Load

Three Highest Peak Days

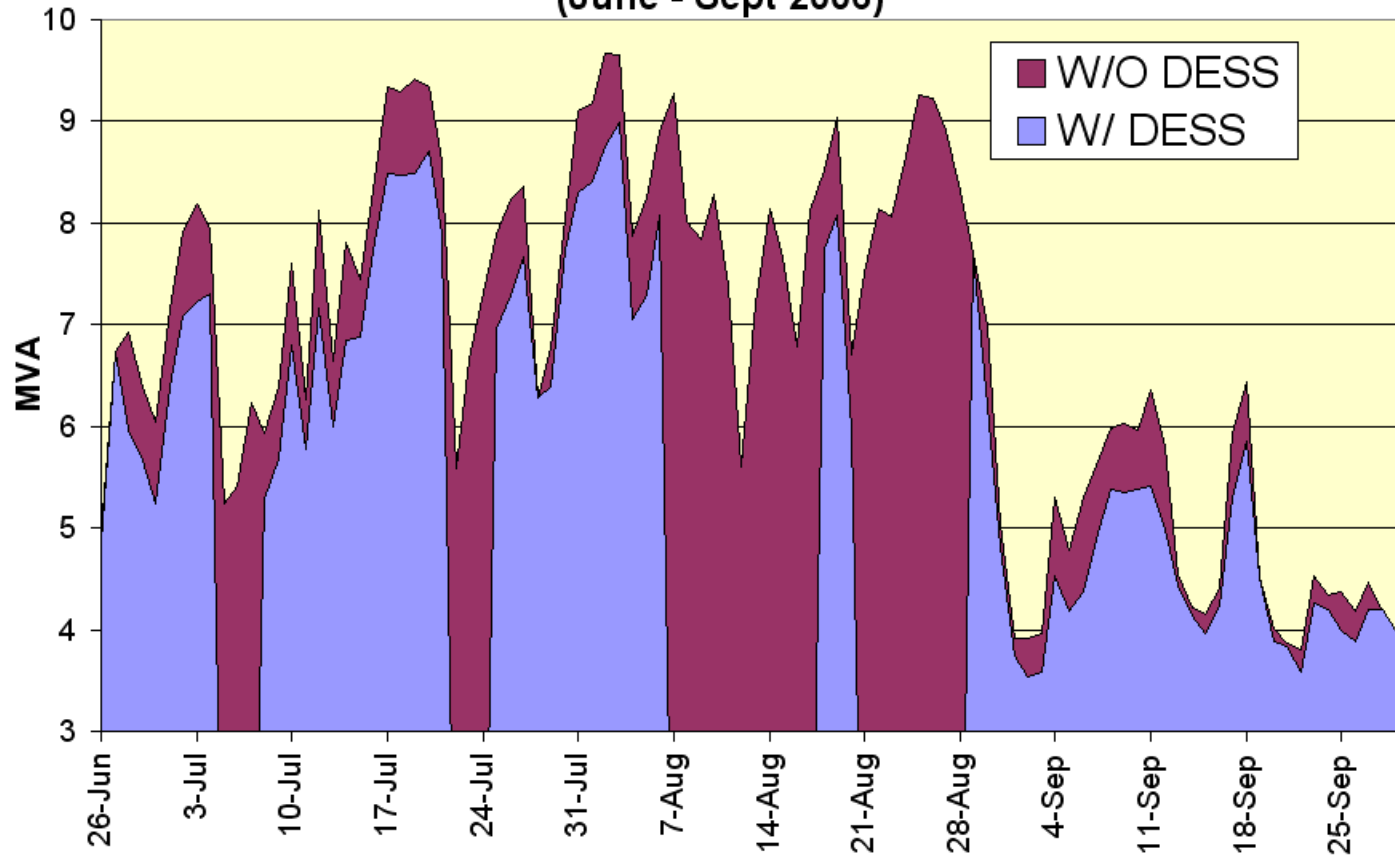
Chemical Substation: Transformer Load
Three Worst Days of Summer (7/19, 8/2, and 8/3/2006)



Immediate Benefits – Reduced Peak Loads

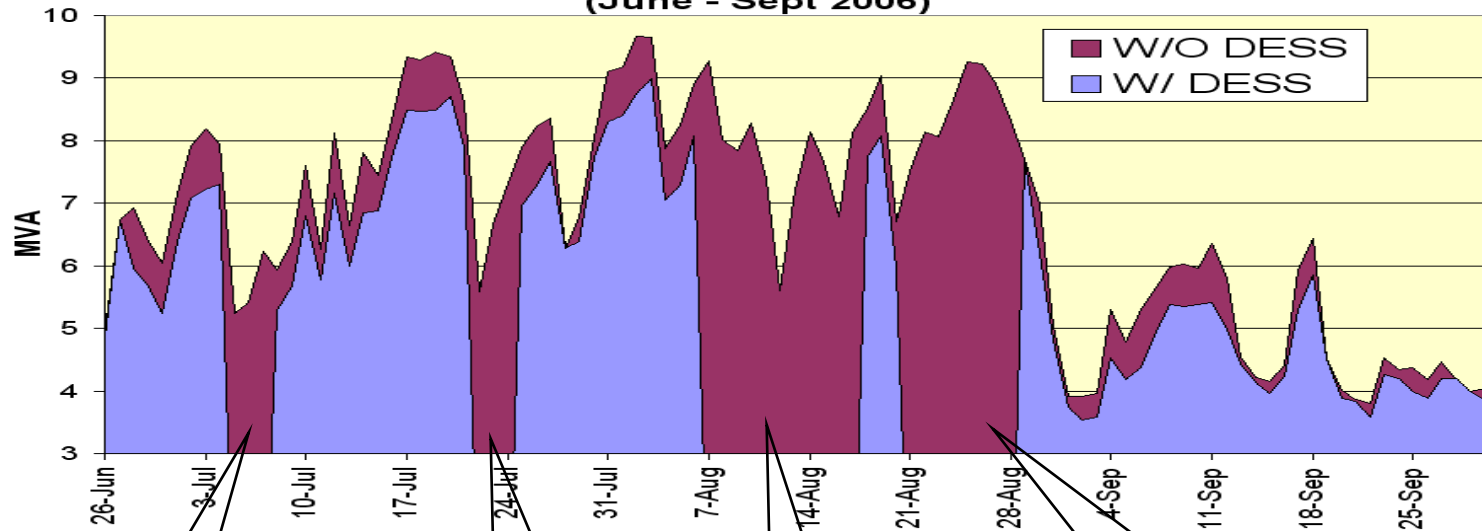


**FEEDER LOAD - Daily Afternoon Peaks
(June - Sept 2006)**



DESS Down Times - Unscheduled

FEEDER LOAD - Daily Afternoon Peaks
(June - Sept 2006)



Down 2 Days
Main Impeller
Malfunction.
It was Replaced

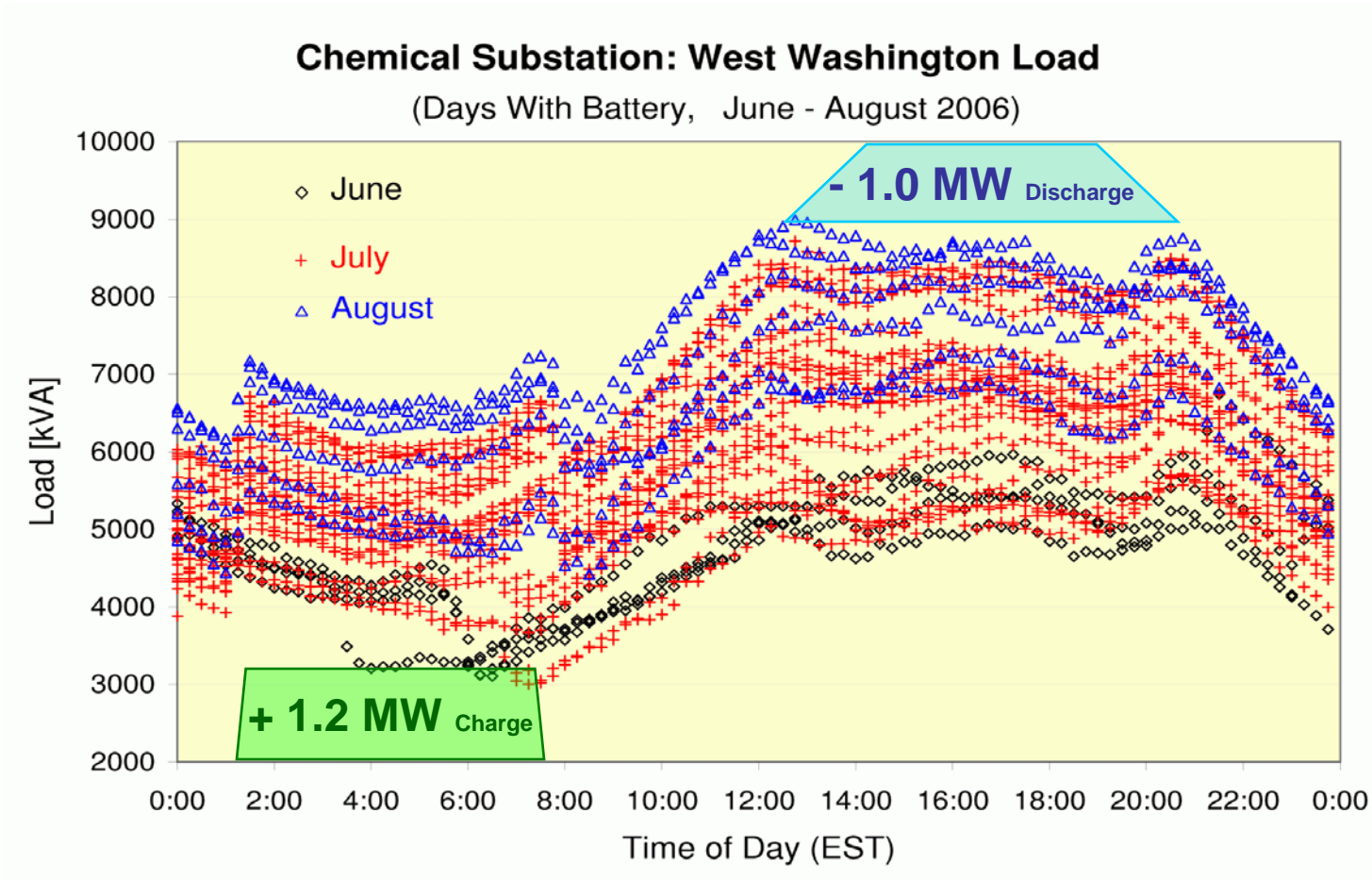
Down 3 Days
Ethernet
communication
software glitch.
System reconfigured
to be more tolerant.

Down 8 Days
Recall of an
element used on
the Control
Board
Replaced the
board

Down 5 Days
Intermittent activity caused by
change in metering of pulse-
like battery heater load
Removed the heater load from
the metering & control
circuits

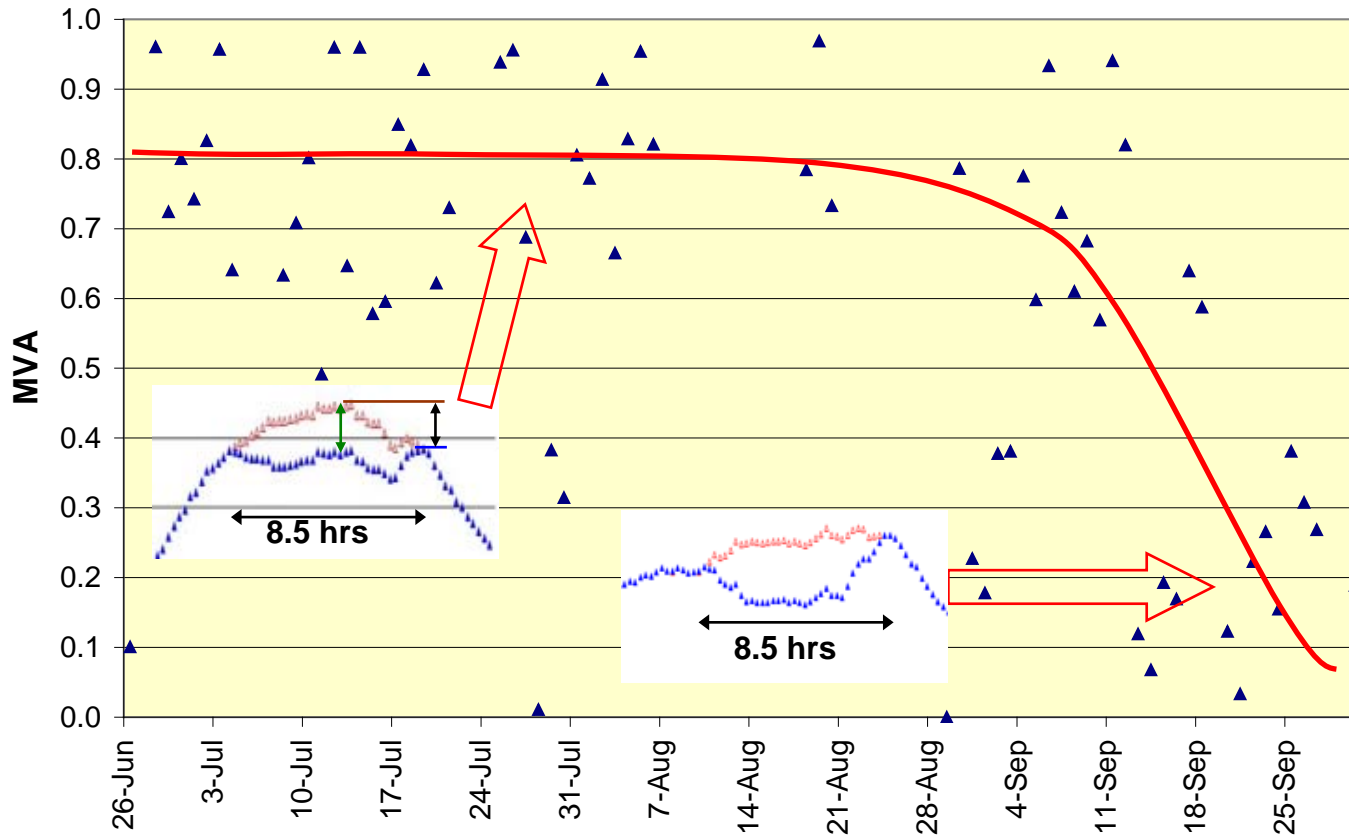
Immediate Benefits – Load Shape

Three Worst Months

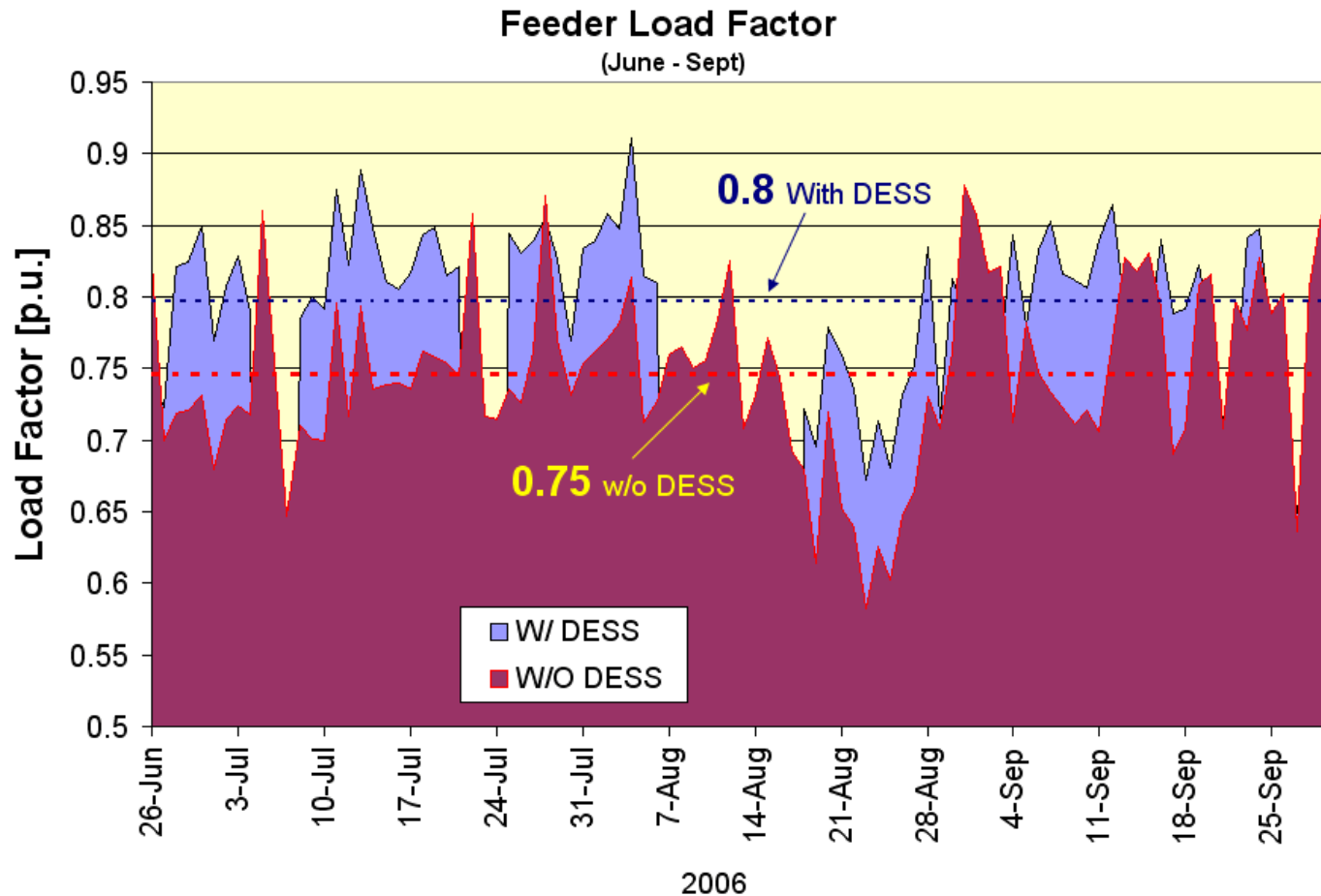


Effective Peak Load Reduction – Less than 1MVA

Actual Reduction in the Feeder Load due to a 1.0 MW Discharge
(June - Sept, 2006)



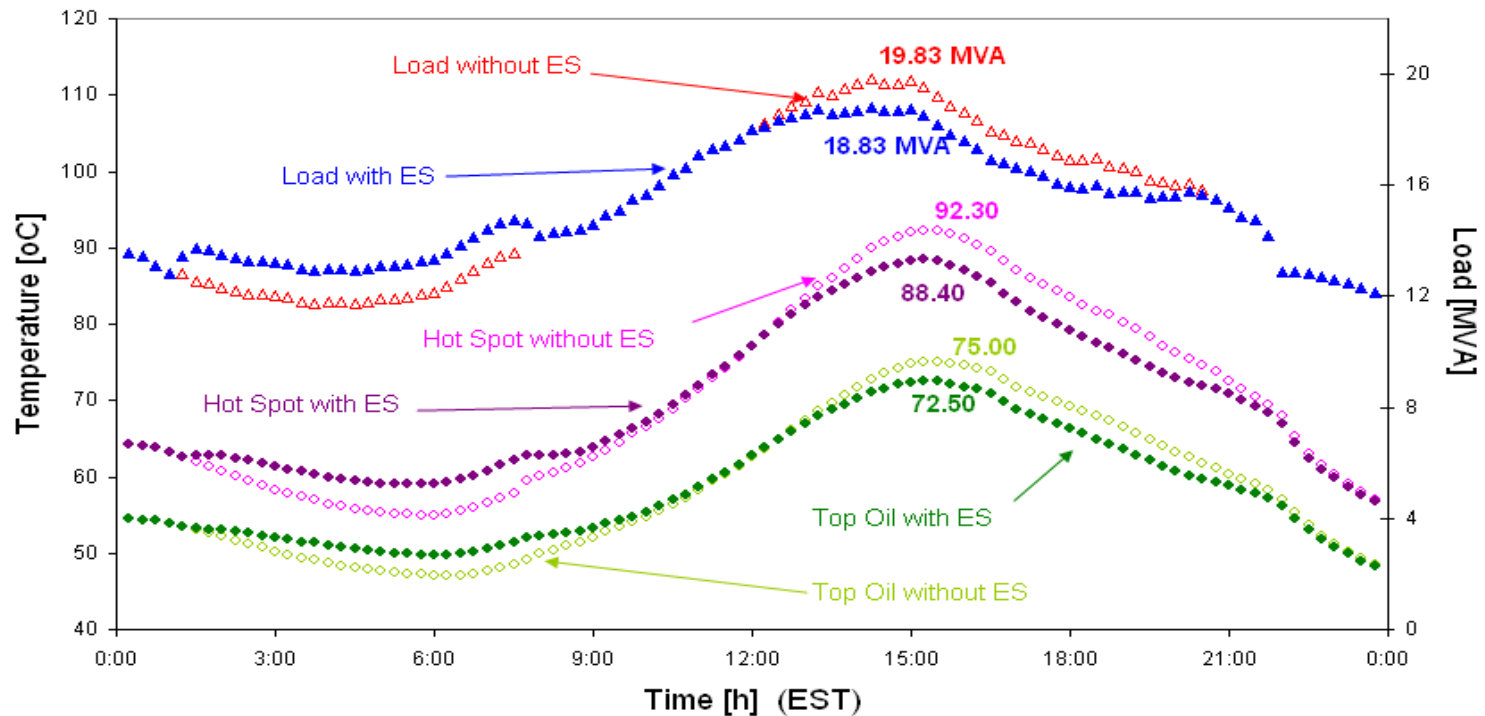
Immediate Benefit – Load factor Improvement



Immediate Tangible Benefits of the First AEP DESS

Transformer Temperature Control

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

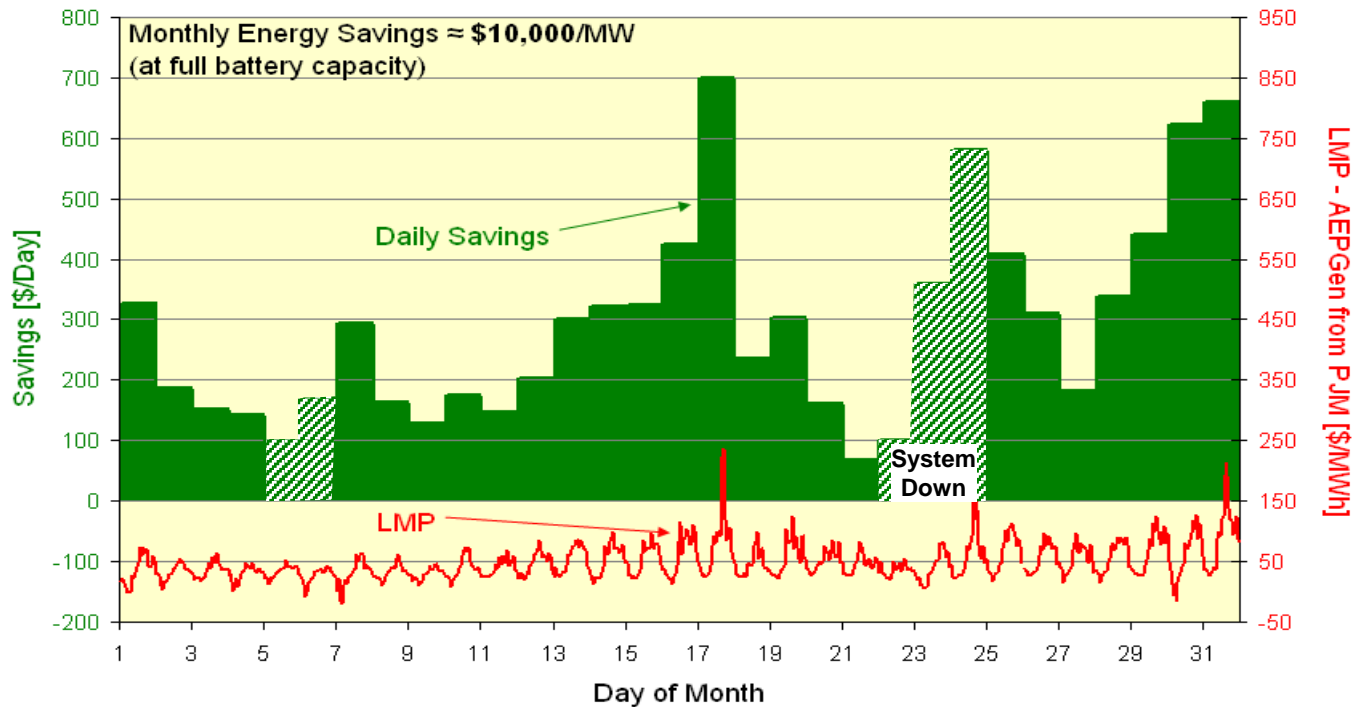


*Based on measured/calculated load and measured ambient temperature, Hot Spot and Top Oil temperature are calculated by using PTLoad 6.1, EPRI software.

Energy Savings in the PJM Market

Daily Energy Savings from AEP Energy Storage

(July 2006)

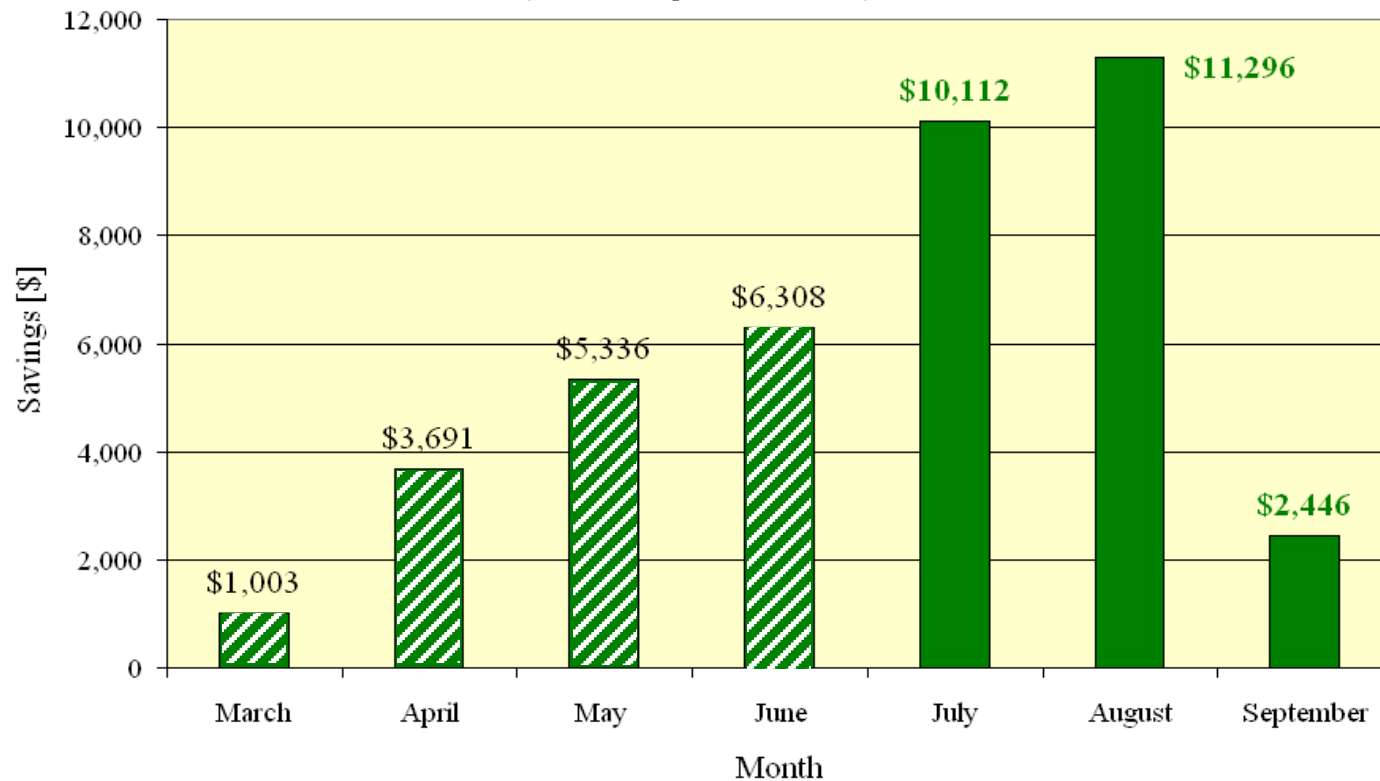


DESS was not put on the Market but made other generators more available

Energy Savings in the PJM Market

Estimated Monthly Savings from AEP Energy Storage

(March - September, 2006)



Conclusions



- WAS Installed and Operational in Just 9 Months
- Helped Shave Transformer Peak Loads for 8.5 hours a day
- Kept Transformer temperature down by several degrees C
- Improved 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
- Up and running 85% of days during its first three months
- Helps AEP build more Confidence on this Energy Storage Technology

Going Forward *- On this Project*

1. Have already changed the DESS schedule to a **Double-Discharge** profile for winter load
2. Continue to provide **Performance Data** and its analysis to DOE/Sandia until October 2007

Going Forward *- Next Project*



Work with DOE/Sandia for using DESS to improve Electric Service Reliability

- DESS may be an effective way to address **reliability issues** associated with the aging utility infrastructure
- In many cases, deployment of DESS would be much quicker than using conventional solutions

