# American Electric Power
# *Community Energy Storage*

**Presentation to:**
**IEEE Power Engineering Society**
**Energy Storage – Super Session**

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Supervisor, AEP Grid Management Deployment

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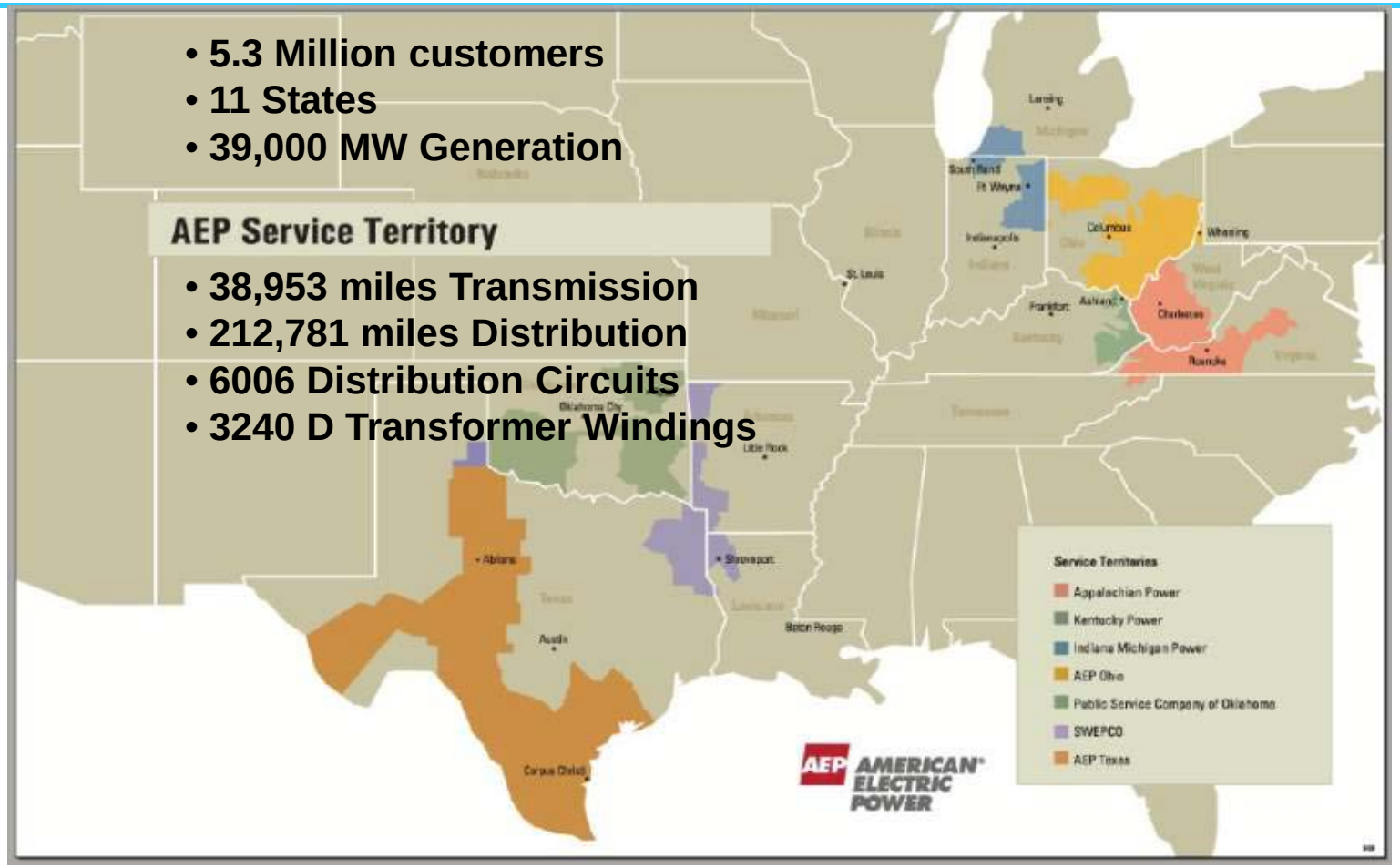
# AEP System Overview

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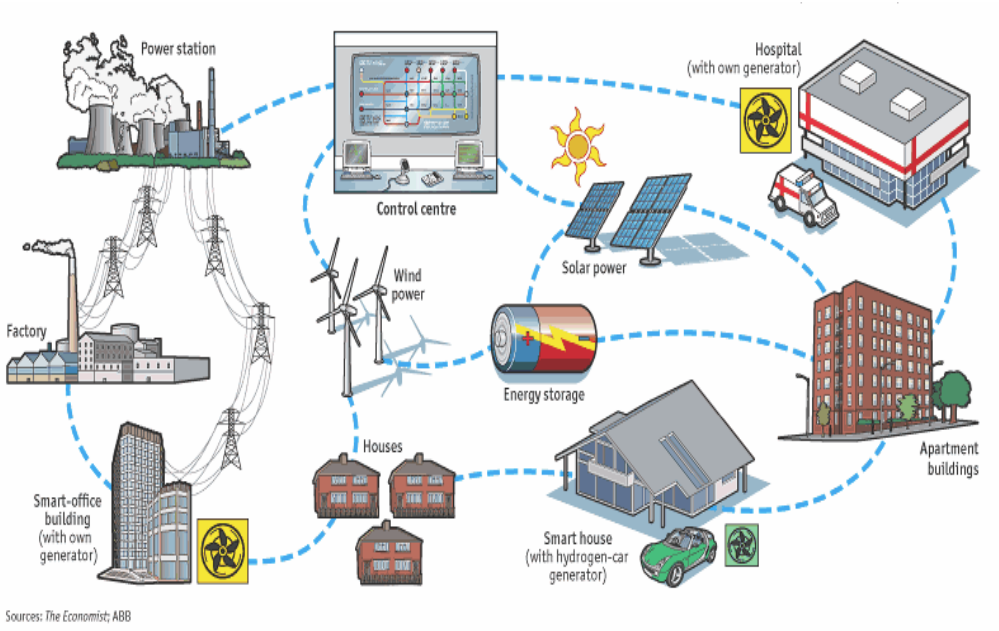
# Distribution System Operational Strategy

Transforming from single source distribution circuits to an interconnected grid with multiple sources, real time visualization, resiliency, automation, and control.

- Equipment sensors that provide real time condition/status
- Two way communication amongst devices with central control center visibility and automated outage recovery
- Two way power flow support – easy integration of distributed generation
- Digital meters with remote service switch
- Dynamic voltage and customer load control
- Integrated back office systems to provide remote and automated data collection, analysis, visualization and action



# Energy Storage At AEP

- The Next Step -


AEP Ohio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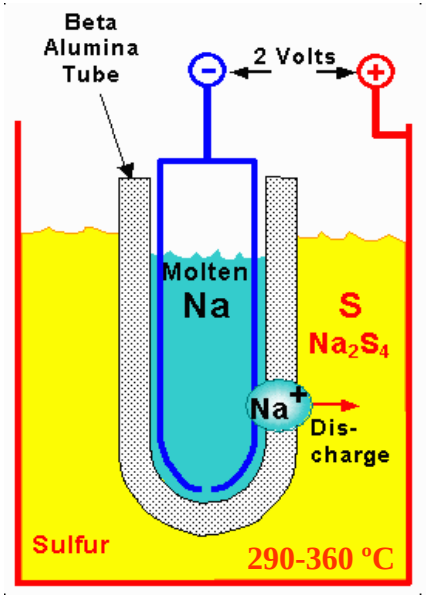
# AEP's (NaS) Battery Application


1 MW, 7.2 MWh installed in Chemical Station (Charleston, WV - 2006)
- Deferred substation upgrades

Three installations in 2008 (2 MW Each)
- Peak Shaving
- Demonstrate "Islanding"
- Storage of intermittent renewables
- Sub-transmission support

*AEP selected Sodium Sulfur (NaS) technology*

- Proven technology in Japan (TEPCO)
- 1-10 MW, 4-8 hour storage systems
- NaS strengths:
  - *Commercial record over 1MW (over 100 installations)*
  - *Cost*
  - *Compactness*
  - *Modularity & Ability to be relocated*

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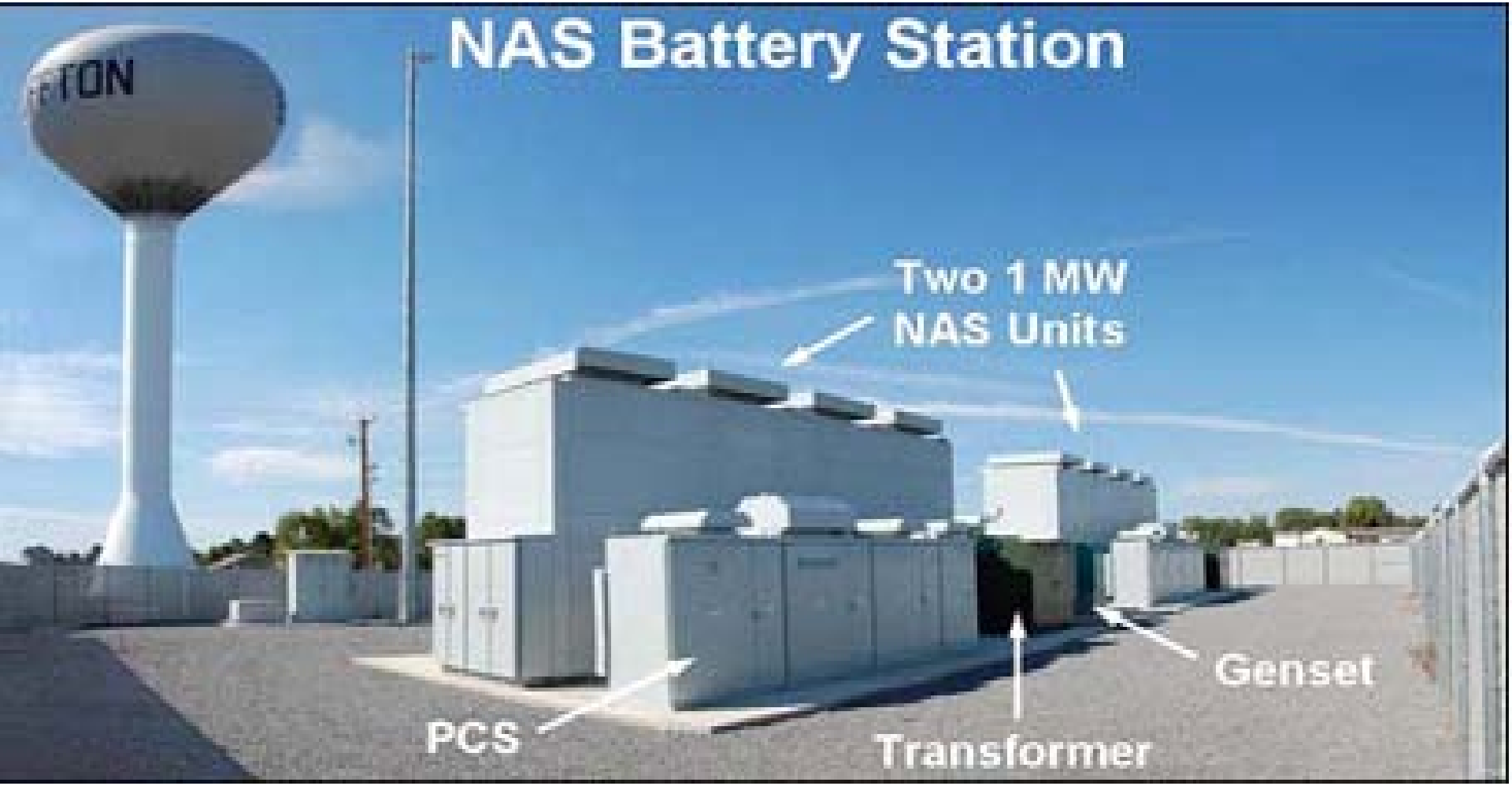
# Bluffton, OH – 2 MW with Islanding

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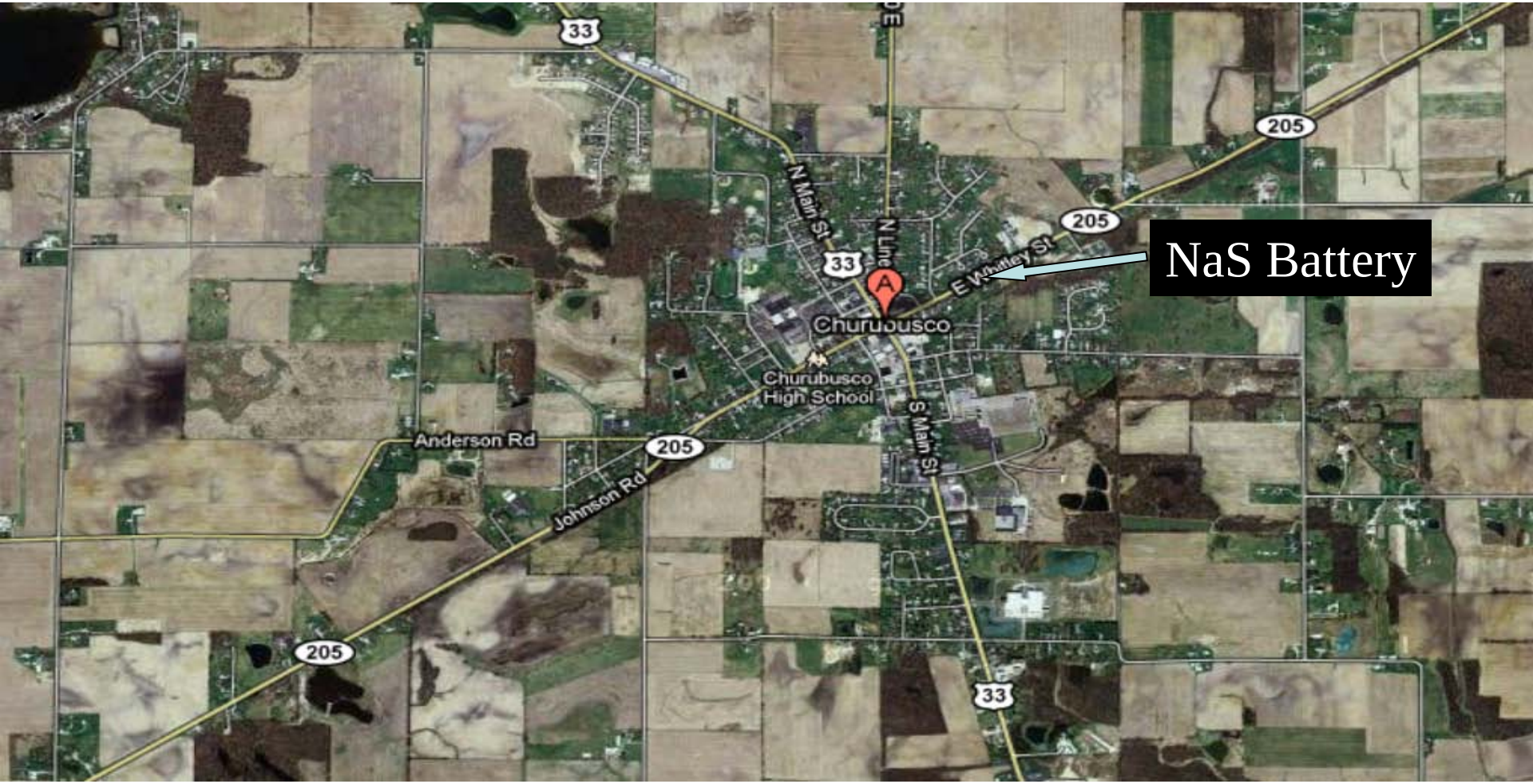
# Churubusco, IN with Islanding

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# The Concept of Community Energy Storage

- ***CES*** uses distributed resources to offer >> flexibility @ << cost than ***bulk*** storage as battery volumes increase
- CES fits with the Grid's emerging need for ***Distributed Intelligence AND Speed***
- Storage at the load offers unique benefits that bulk storage can't match
  - Direct integration with PHEV batteries to act as a buffer for load mgmt (PHEV charging)
  - Direct integration with customer owned renewable resources
  - Demand Control thru contractual integration with HAN



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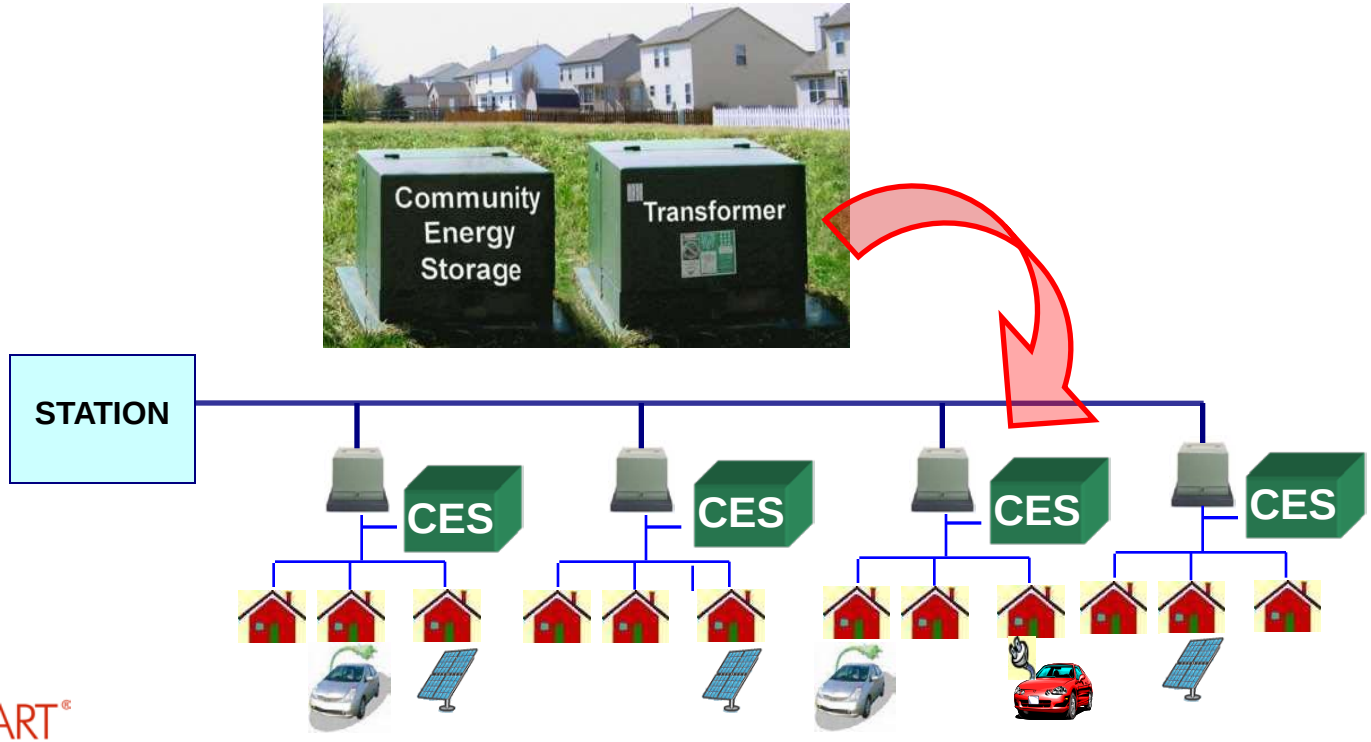
# Community Energy Storage (CES)

CES is a distributed fleet of small energy storage units connected to the secondary of transformers serving a few houses or small commercial loads.

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# CES Specifications

| Key Parameters | Value |
|---|---|
| Power (active and reactive) | 25 kVA / 25 kW |
| Energy | 25 kWH future 75 kWh |
| Voltage | 240 / 120V AC |
| Battery – Similar to PHEV | Li-Ion |
| Round trip efficiency | > 85% |


AEP Specifications for CES are “OPEN SOURCE” for Public Use and Feedback. During 2009 EPRI hosted free, open webcasts to solicit industry wide input.

**www.aeptechcenter.com/ces**

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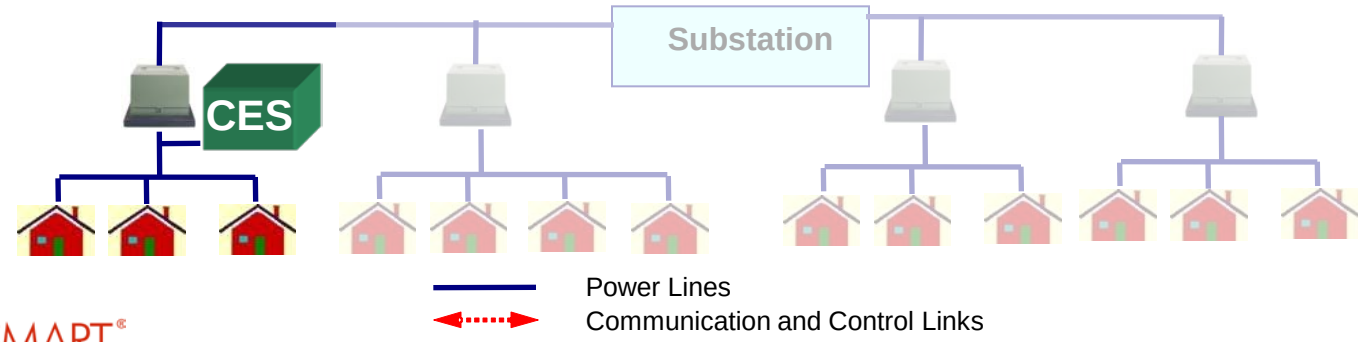
# CES – Virtual Station Scale Storage

## Local Benefits:

1) **Backup power**
2) **Flicker Mitigation**
3) **Renewable Integration**

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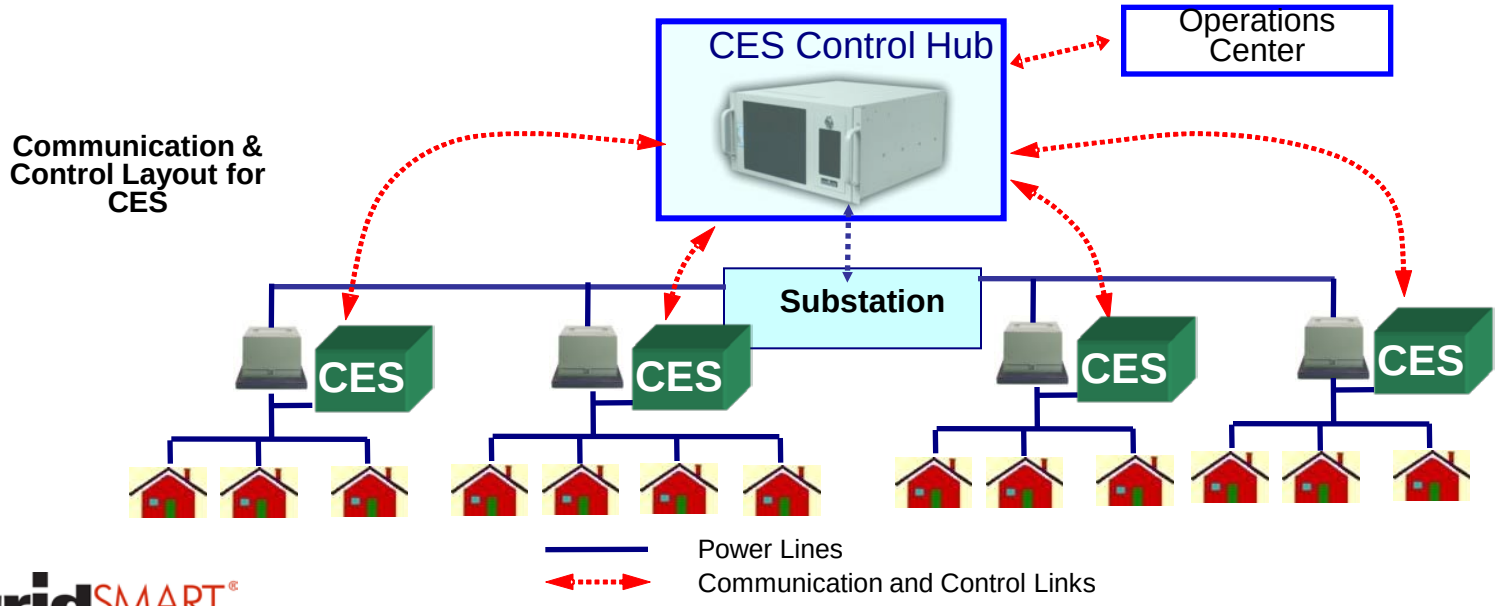
# CES – Virtual Station Scale Storage

## Local Benefits:

1) Backup power
2) Flicker Mitigation
3) Renewable Integration

## Grid Benefits:

4) Load Leveling at substation
5) Power Factor Correction
6) Ancillary services

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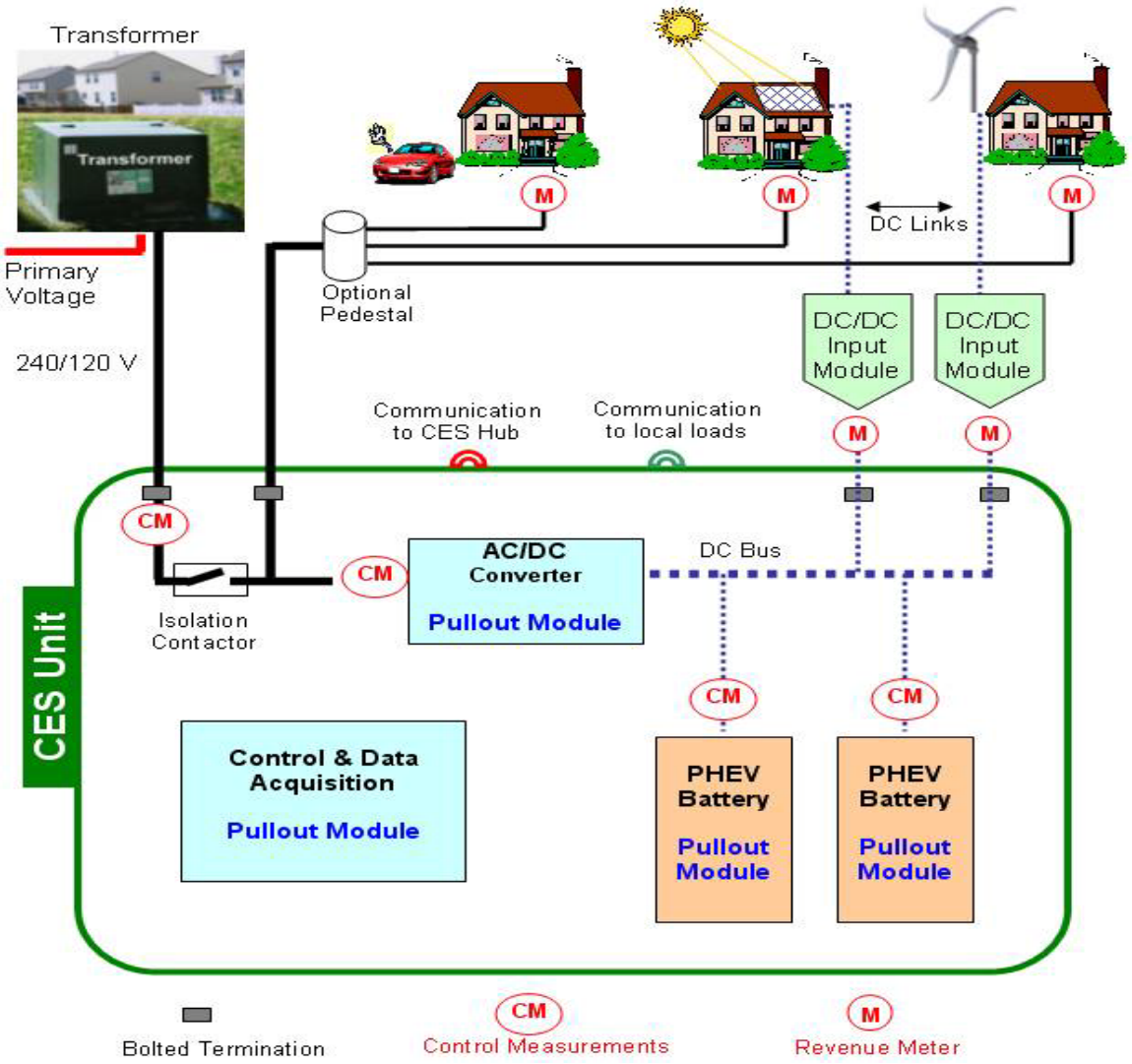
# CES Layout

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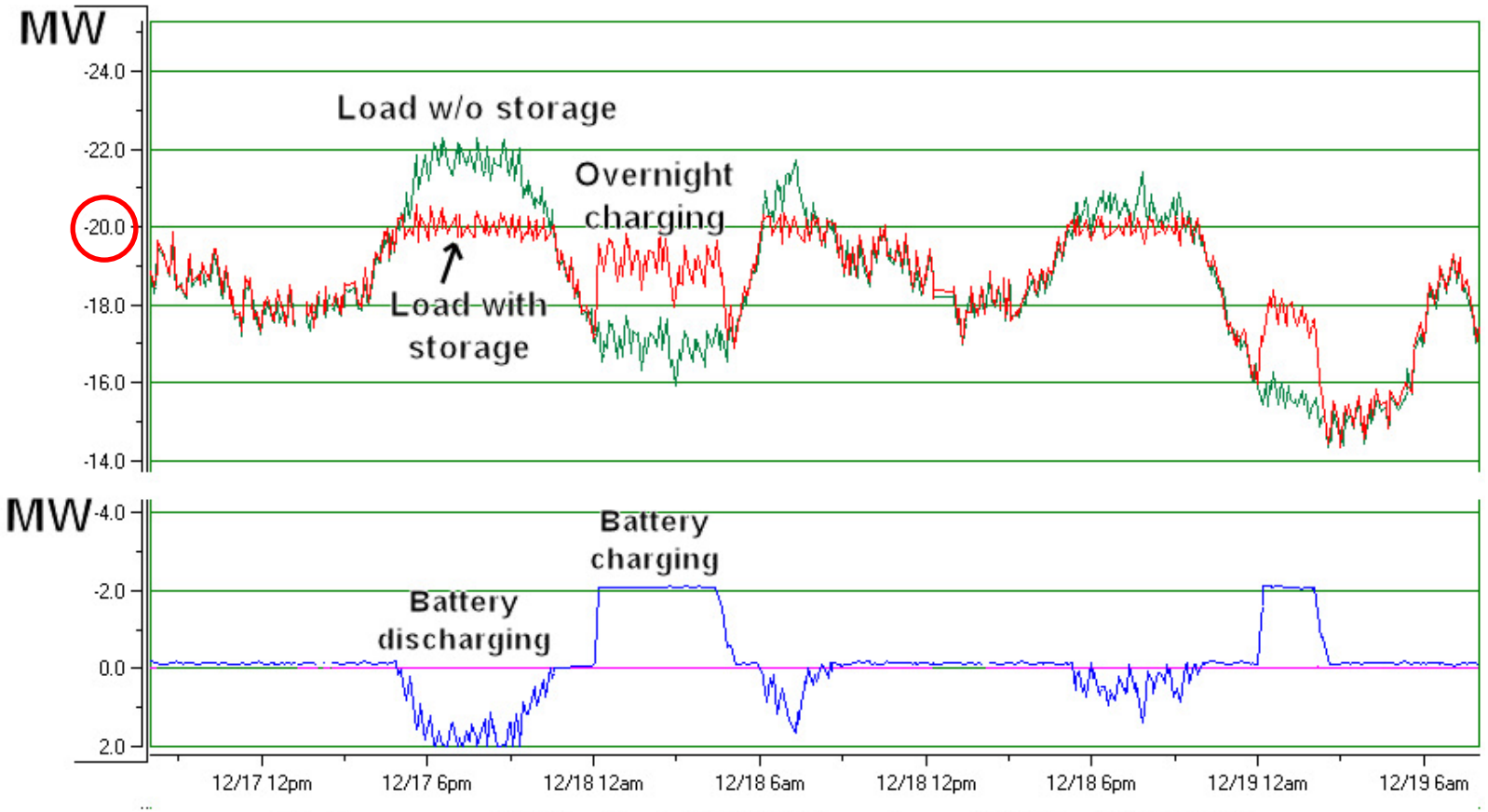
# Load Leveling Example




Performance of Balls Gap's 2MW Battery from 12/17 to 12/19/2008

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# AEP Ohio GridSMART Demonstration

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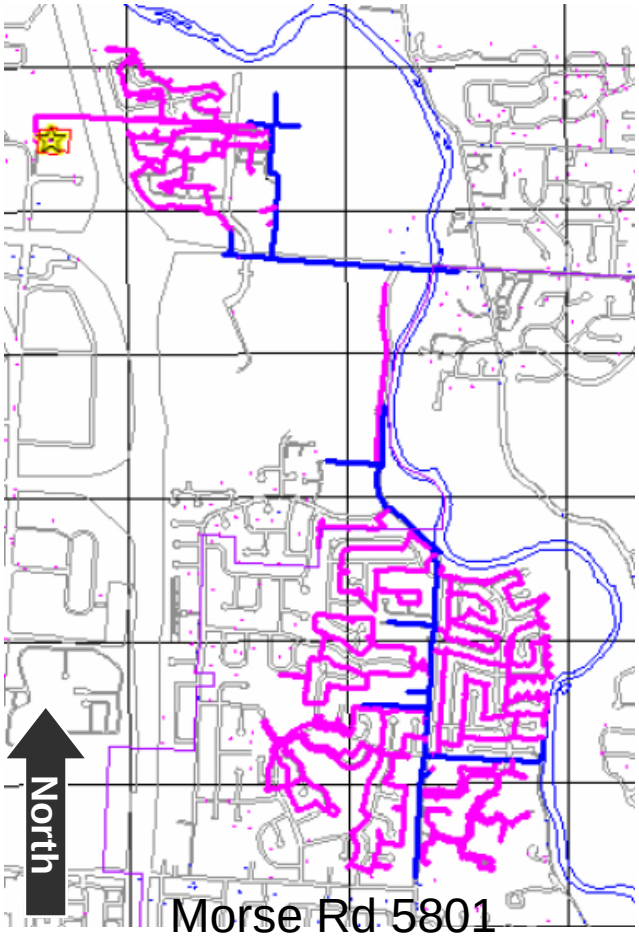
A unit of American Electric Power

- **CES**: 2MW/2MWh; Fleet of 80 25-kW Units
- **Circuit**: Morse Rd 5801; 13 kV, 6.3 MVA Peak Load, 1742 customers
- **Coverage**: Approximately 20% of customers
- **Schedule:**
  - Aug 2011 Begin installations
  - Dec 2011 Complete installations
- **Customer Contacts:**
  - 53 letters resulted in 17 signed agreements
  - Total of 140 targeted xfmrs < 22 KVA load



Morse Rd 5801

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# Mock Installation

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# Drivers for Energy Storage

- Peak Load Shaving / Leveling
  - T&D infrastructure project deferrals
  - Increased utilization of existing Generation
- Islanding of Load Area
- Smoothing Variability of Solar / Wind Generation
- Energy Arbitrage
  - Charge at lower cost / Discharge at higher value
- Ancillary Services
  - Frequency regulation
  - Spinning reserve

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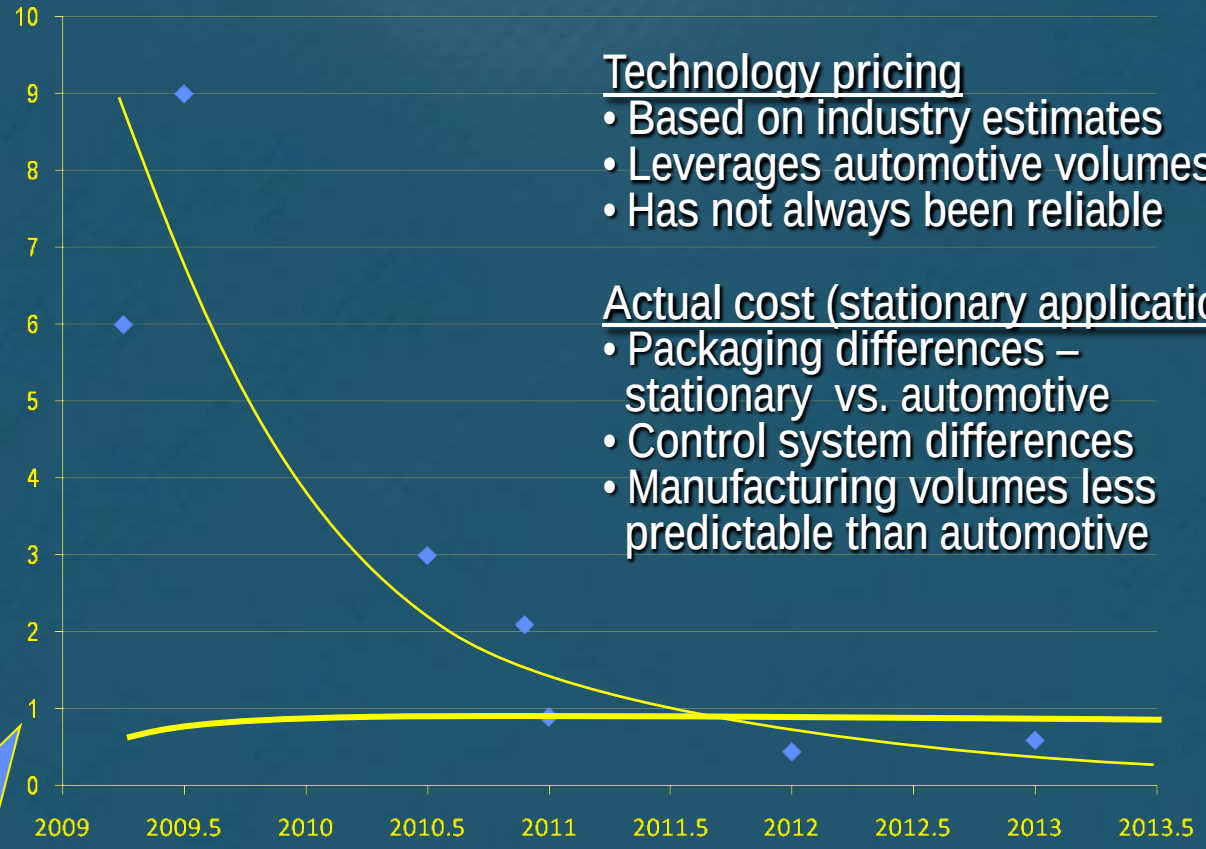
# Cost Parity – Peaking Plant vs. Storage

Cost per Equivalent Unit of Demand @3KWh/KW **($000's/KW)**




Year

Technology pricing
- Based on industry estimates
- Leverages automotive volumes
- Has not always been reliable

Actual cost (stationary applications)
- Packaging differences – stationary vs. automotive
- Control system differences
- Manufacturing volumes less predictable than automotive

Costs shown are representative for high level discussion only

# Balancing Cost and Benefits

- Energy Storage Cost is still high
- Energy density needs to improve
- Utilities need to find full value of energy storage
  - T&D deferral is easiest to calculate but varies greatly
  - Other values such as energy arbitrage, frequency, enhancement of variable energy sources, etc. do not have identified $$ values

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# DOE Project Enhancements


This material is based upon work supported by the Department of Energy under Award Number DE-OE0000193."



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## Community Energy Storage

**Questions?**

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