American Electric Power
Energy Storage

Presentation to:
IEEE / DOE / EAC
Energy Storage
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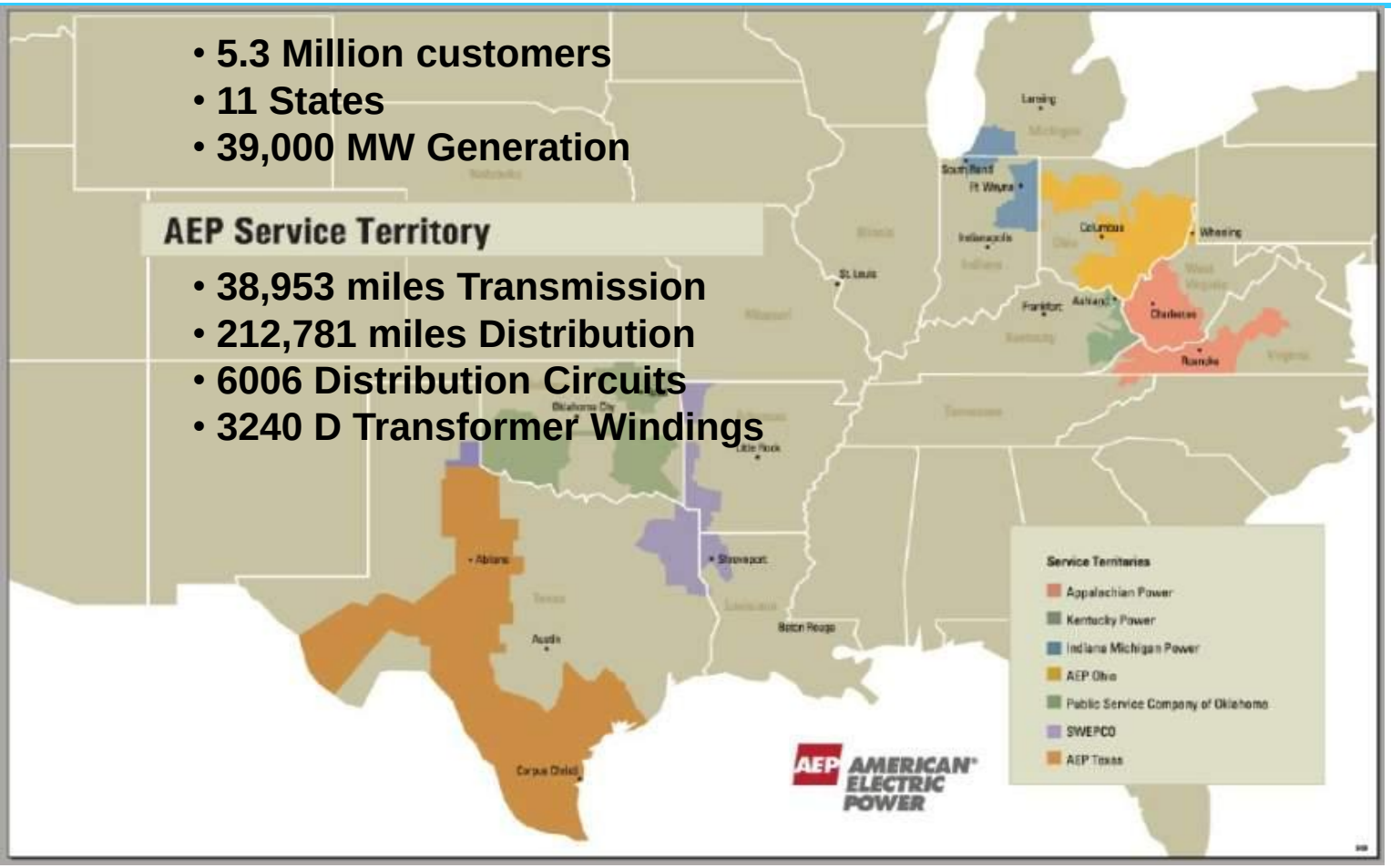
AEP System Overview

- 5.3 Million customers
- 11 States
- 39,000 MW Generation



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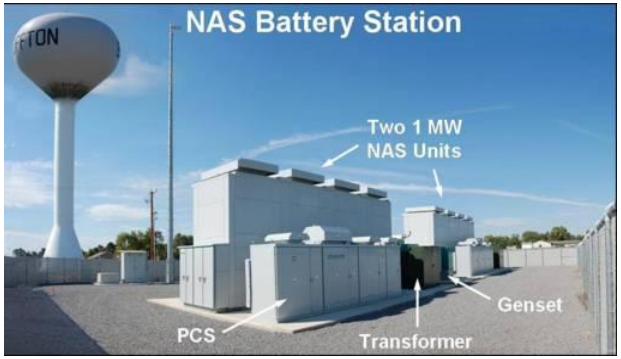
Energy Storage At AEP

- The Next Step -



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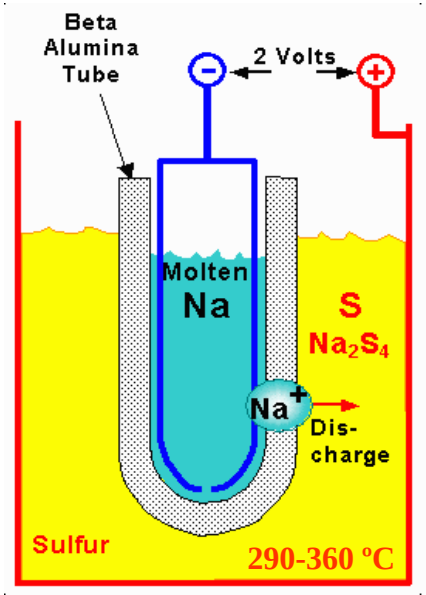
AEP's (NaS) Battery Application

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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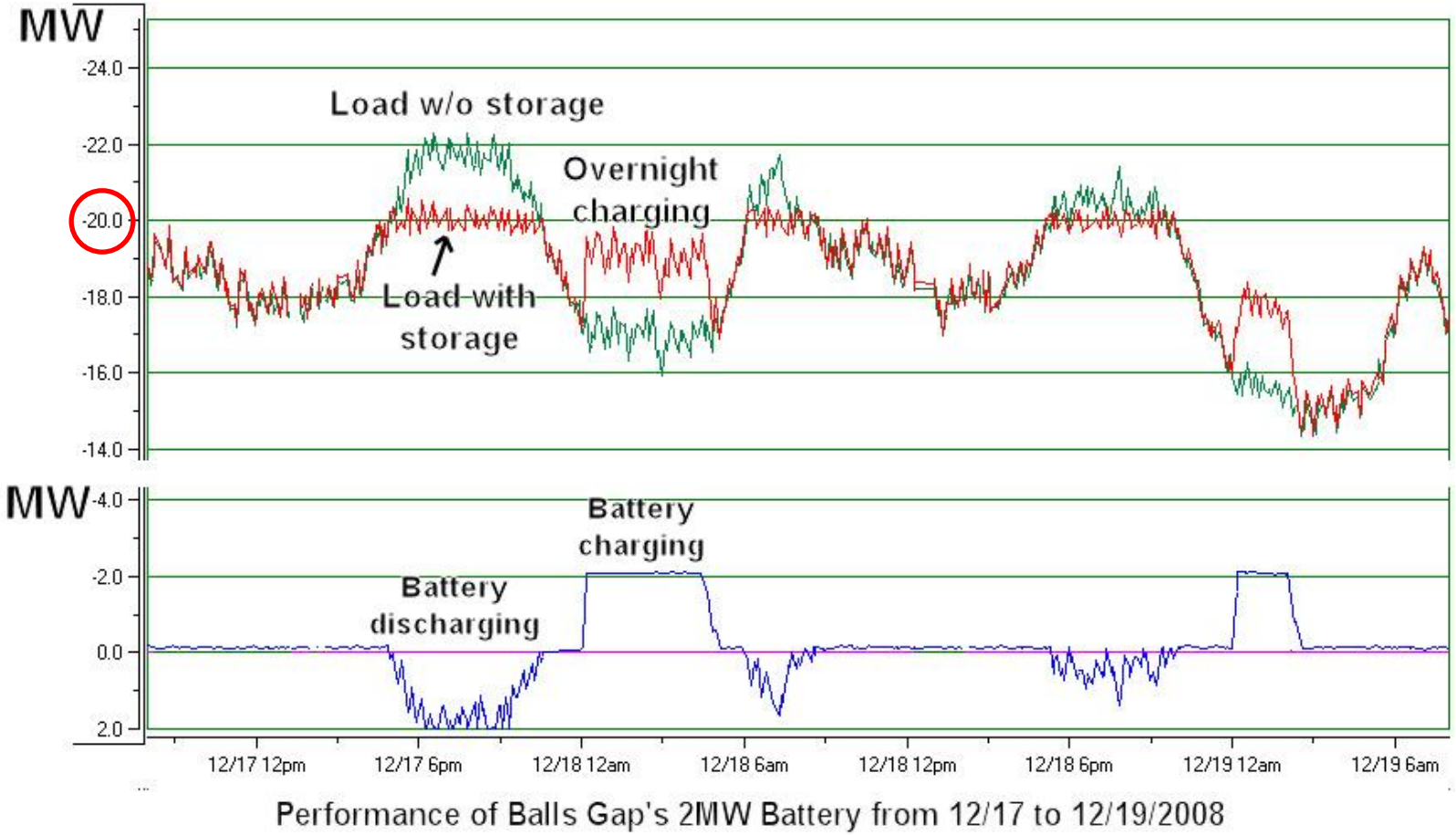
Load Leveling Example



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

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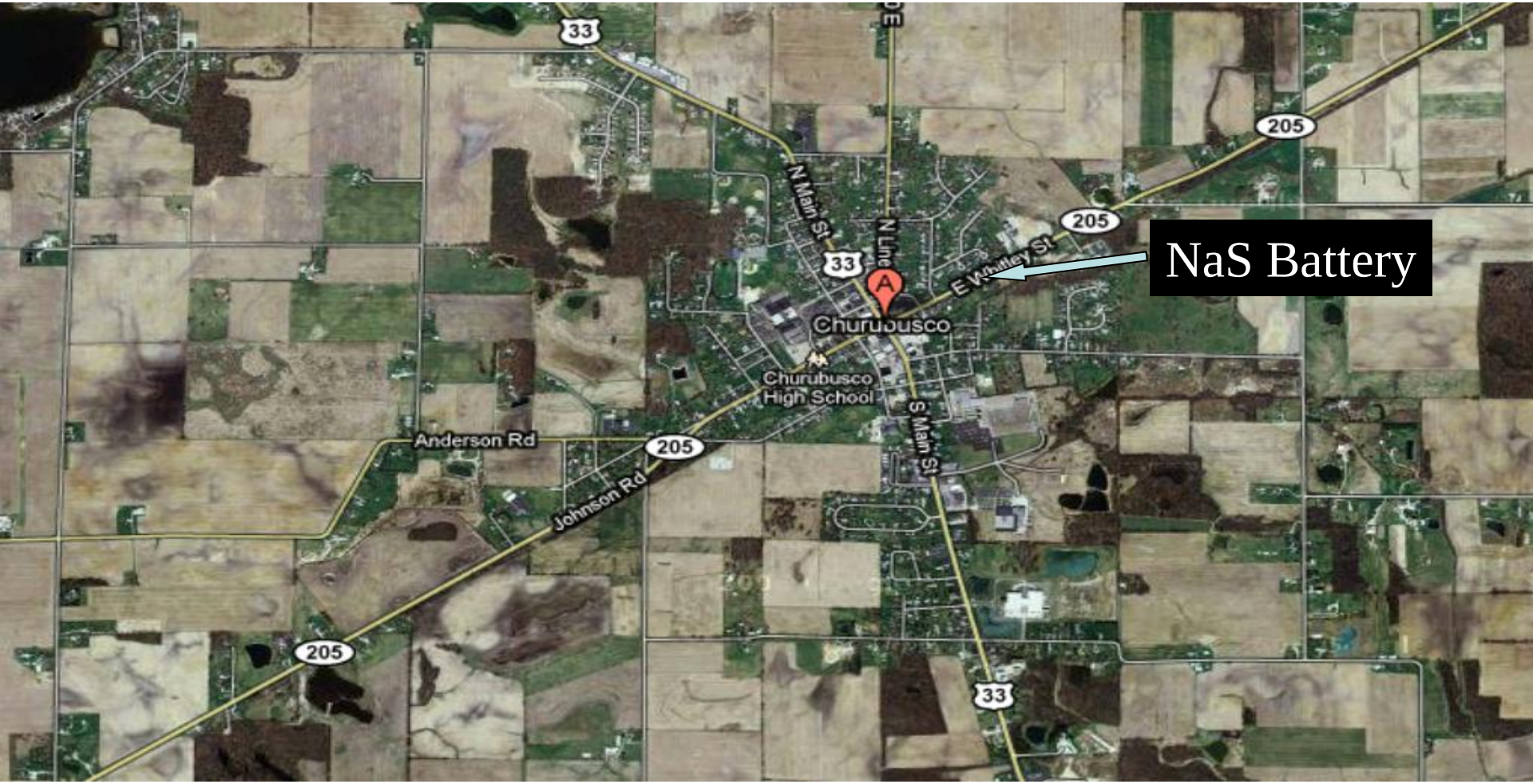
Churubusco, IN with Islanding



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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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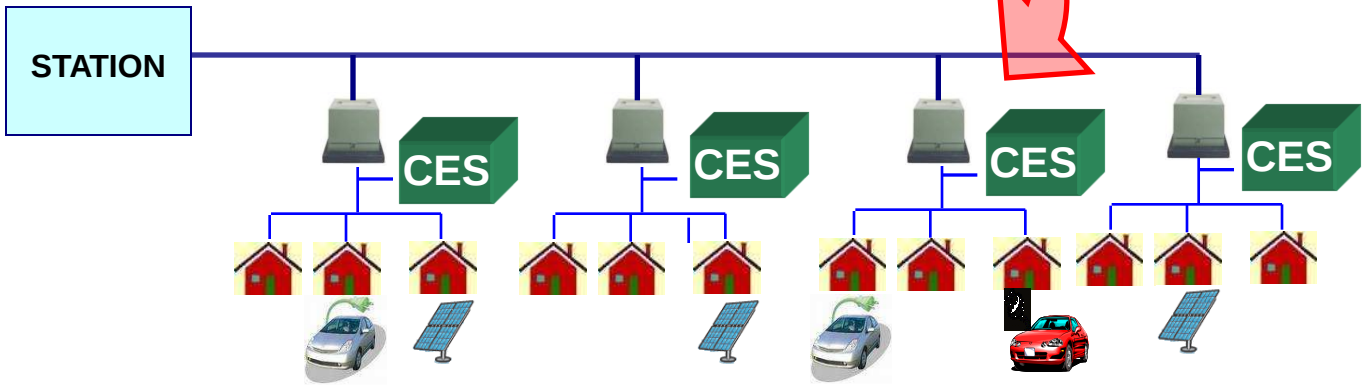
Community Energy Storage (CES)

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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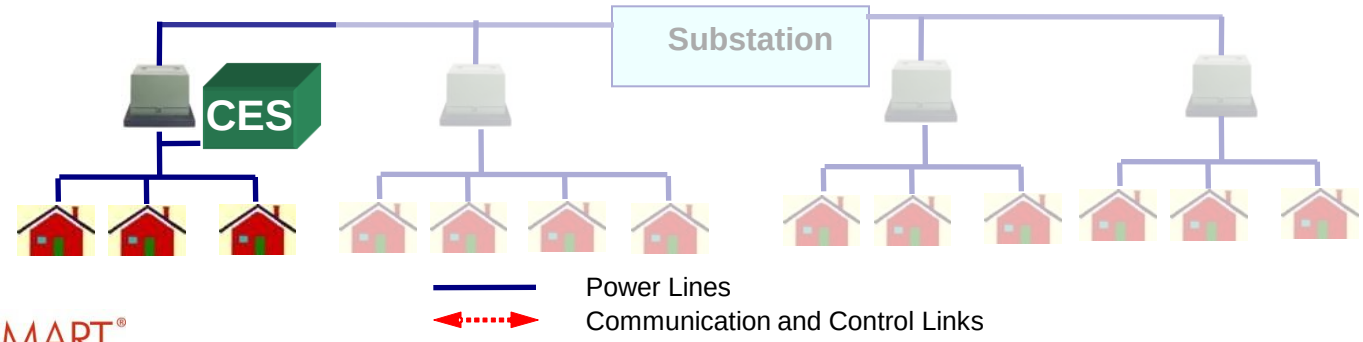
CES – Virtual Station Scale Storage

Local Benefits:

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



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CES – Virtual Station Scale Storage

Local Benefits:

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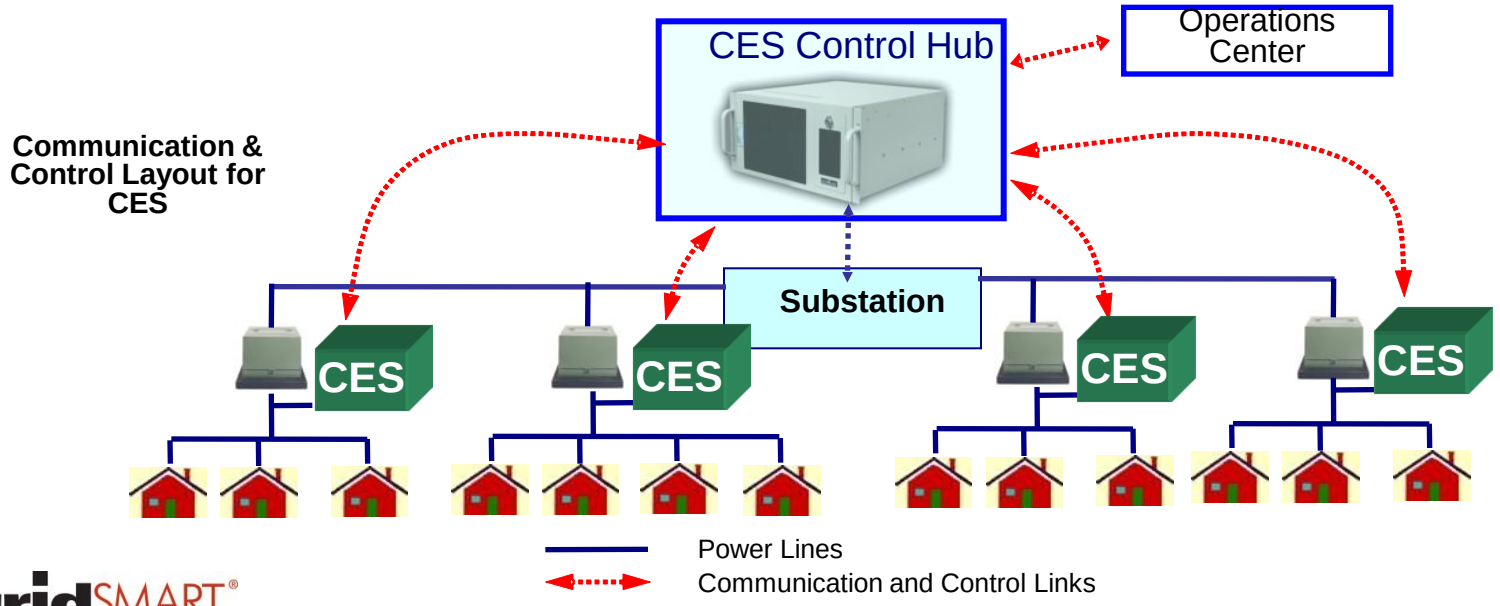
Grid Benefits:

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



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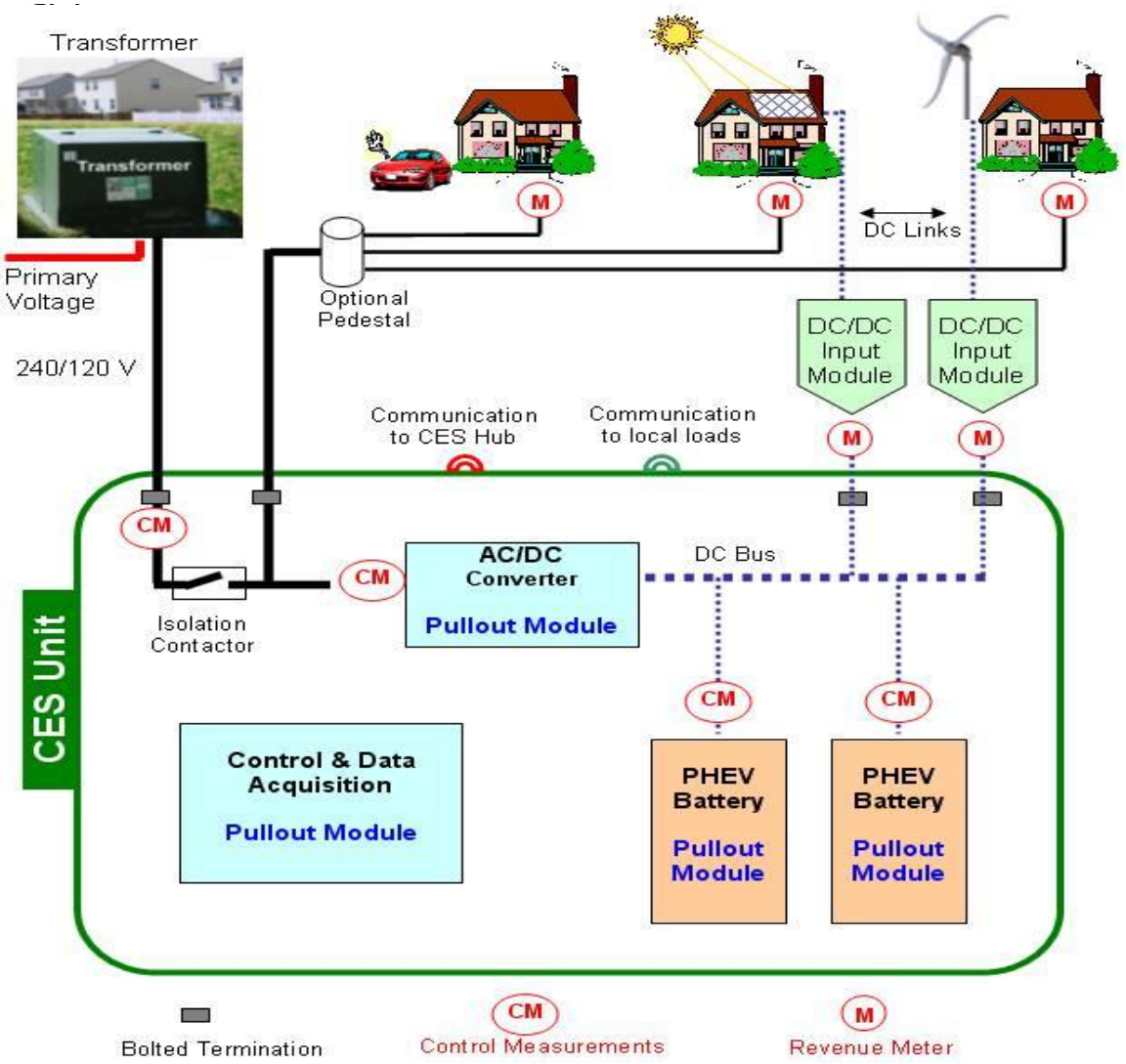
CES Layout



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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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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

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Questions?

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