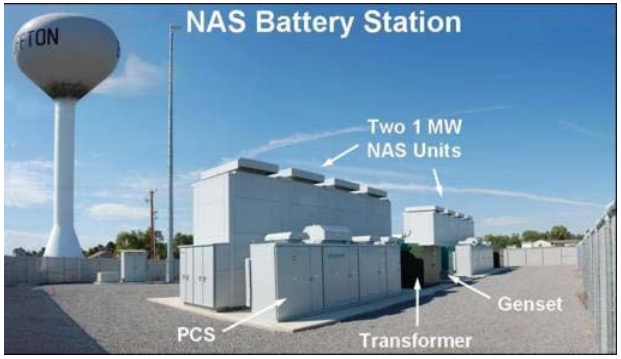
Energy Storage At AEP

Pumped Hydro:

- Difficult to site
- 100s of MW



Substation Scale:

- Easier to site
- 1-10s of MW

Community Energy Storage:

- Easiest to site
- 25-500kW

Costs remain too high for single benefit value streams although they are coming down

AEP is in "learning" mode

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Drivers for Energy Storage

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

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Integrating Energy Storage to the Distribution System

- Connection & protection is relatively simple electrically
- Current IEEE 1547 Guidelines conflict with some benefits
- Traditional “cost / benefit” analysis sub-optimizes application
- Should be “visible and controllable” to Distribution operators via SCADA
- Should have “configurable” control algorithms to allow dynamic changes to meet economic / reliability benefit opportunities
- Should be “self discoverable” for automated integration
- Higher penetrations may require “market clearing”

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Integrating Energy Storage

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

AEP APPALACHIAN POWER®
A unit of American Electric Power

Started Operation on June 26th , 2006

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

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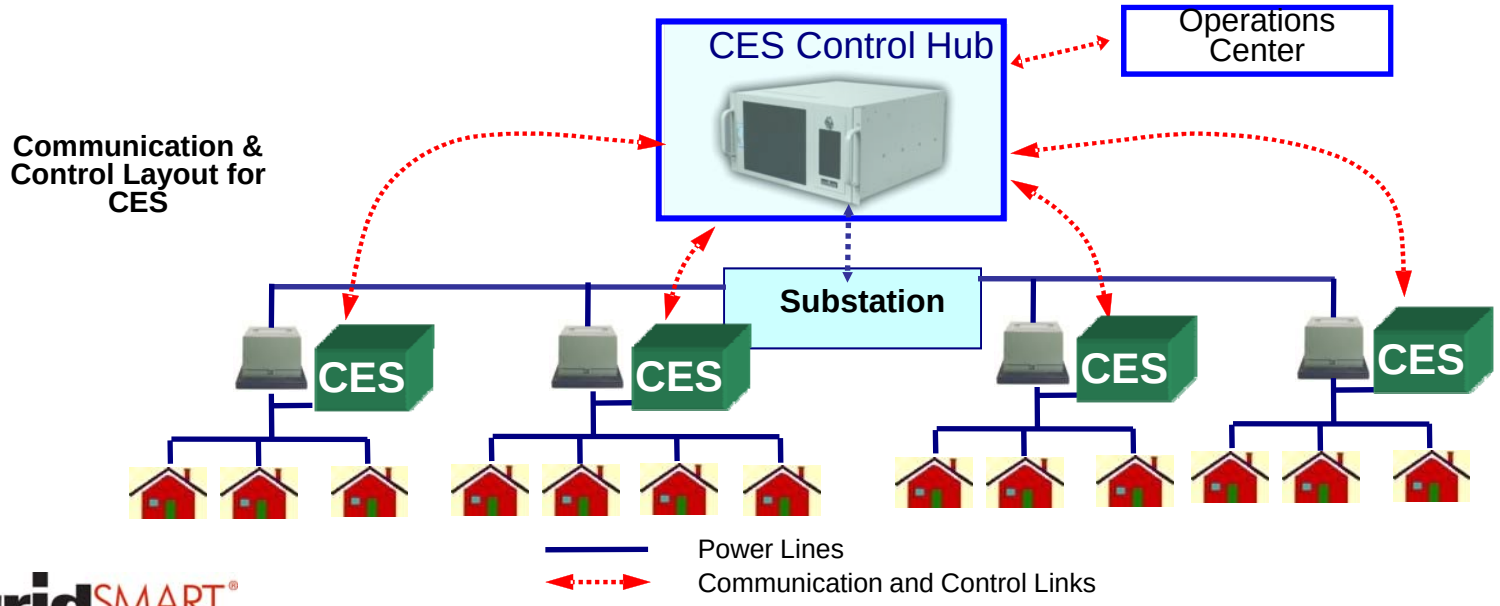
CES – Virtual Station Scale Storage

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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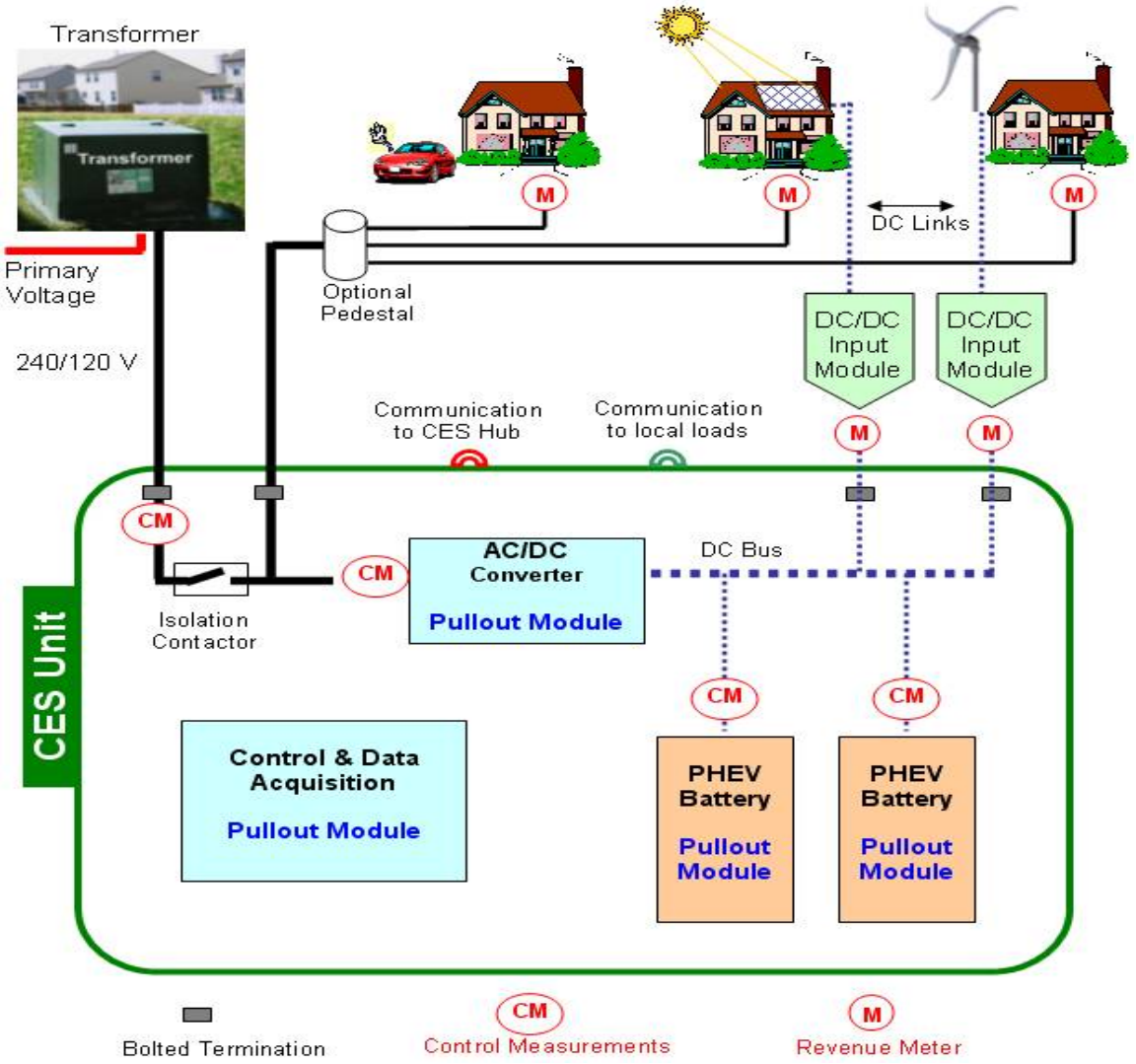
CES Layout



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Energy Storage

Questions?

Tom Weaver – AEP – tfweaver@aep.com

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