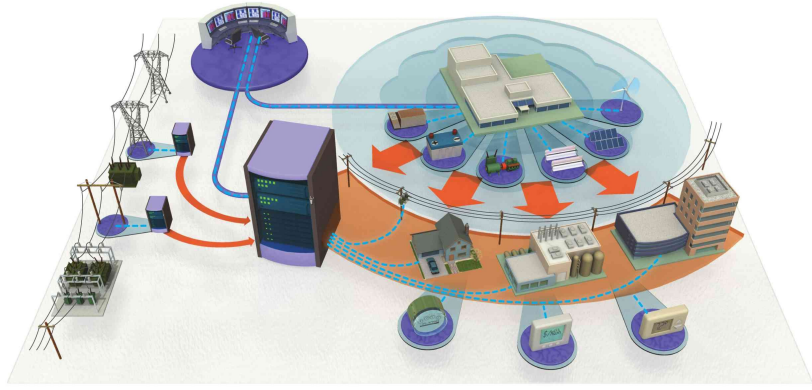


# CES Control Integration in a Virtual Power Plant Simulator



© Electric Power Research Institute. All Rights Reserved.

© AEP. All Rights Reserved.

## EPRI Smart Grid Demonstration March 4, 2010



**S&C ELECTRIC COMPANY**  
Excellence Through Innovation

Tom Walker  
Principal Engineer  
[tjwalker@aep.com](mailto:tjwalker@aep.com)

Will Yadusky  
Manager, Product Engineering  
[WYadusky@sandc.com](mailto:WYadusky@sandc.com)



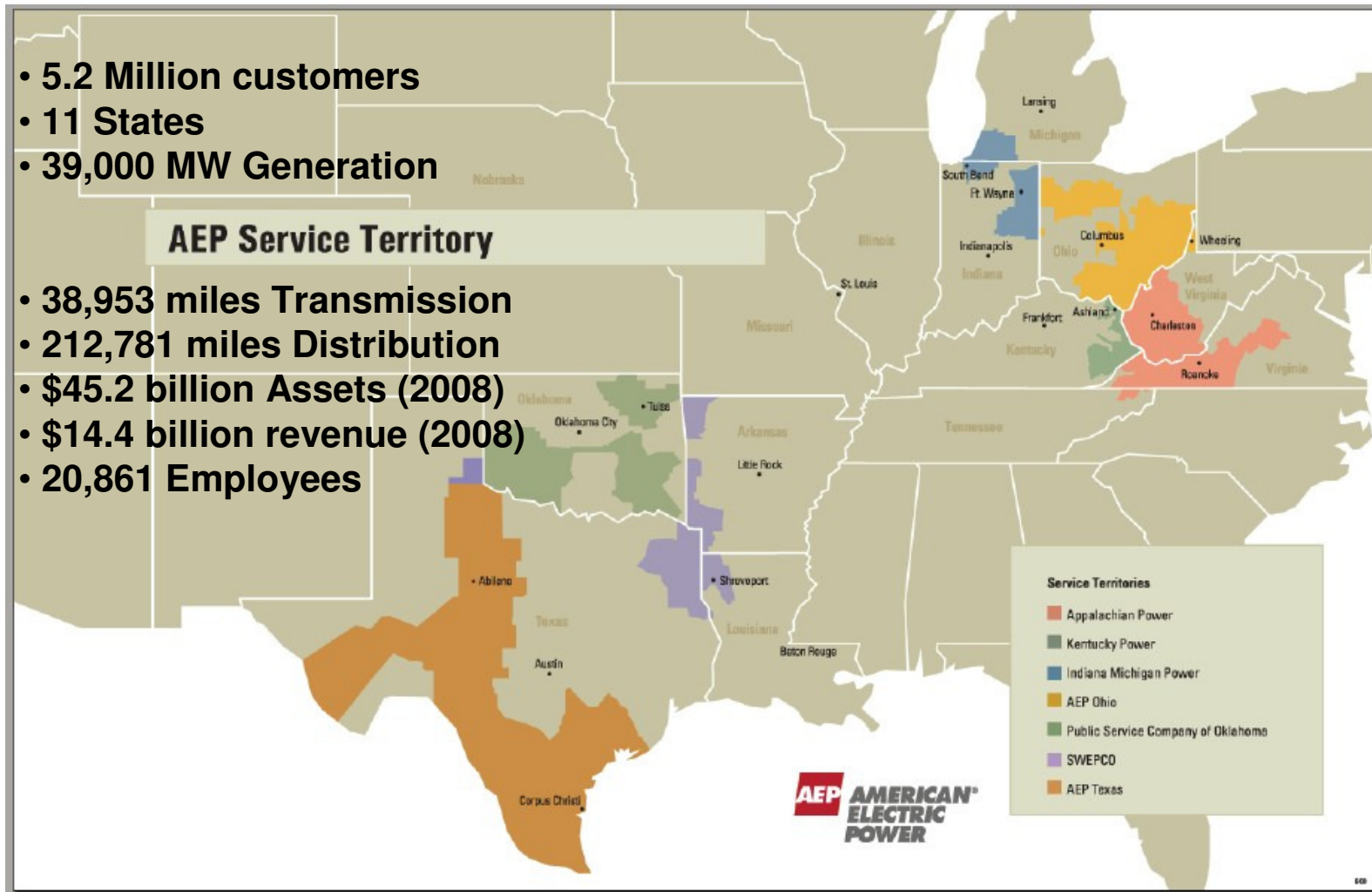
**gridSMART™**  
from American Electric Power

# AEP Overview

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

## AEP Service Territory

- 38,953 miles Transmission
- 212,781 miles Distribution
- \$45.2 billion Assets (2008)
- \$14.4 billion revenue (2008)
- 20,861 Employees



# Community Energy Storage Project

## Columbus Ohio by June 2011

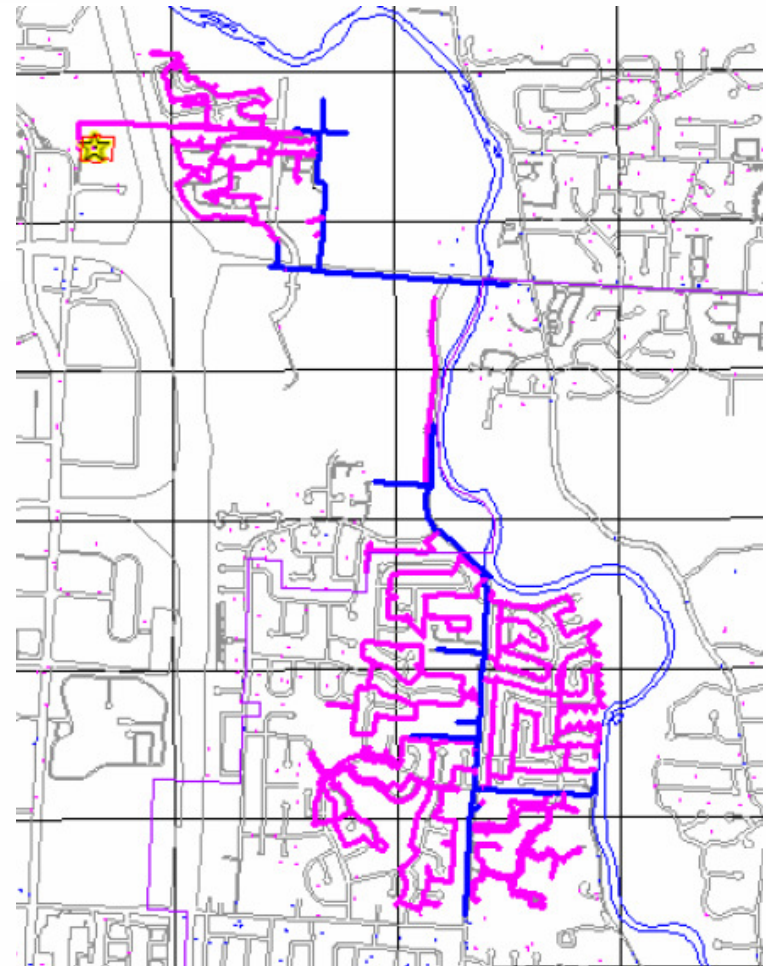
- AEP Ohio Stimulus package
- Morse Rd Station 13 kV Circuit 5801
- 1 Controller, 80 CES Units (2 MWh)
- Now in design phase

5.9 MVA Winter

5.9 MVA Summer

Blue – Overhead

Pink – Underground



# Community Energy Storage (CES)

CES is a fleet of small distributed energy storage units connected to the secondary of transformers serving a few houses controlled together to provide feeder level benefits.

Key Parameters	Value
Power	25 kW
Energy	75 kWh
Voltage - Secondary	240 / 120V
Battery - PHEV	Li-Ion
Round Trip AC Energy Efficiency	> 85%

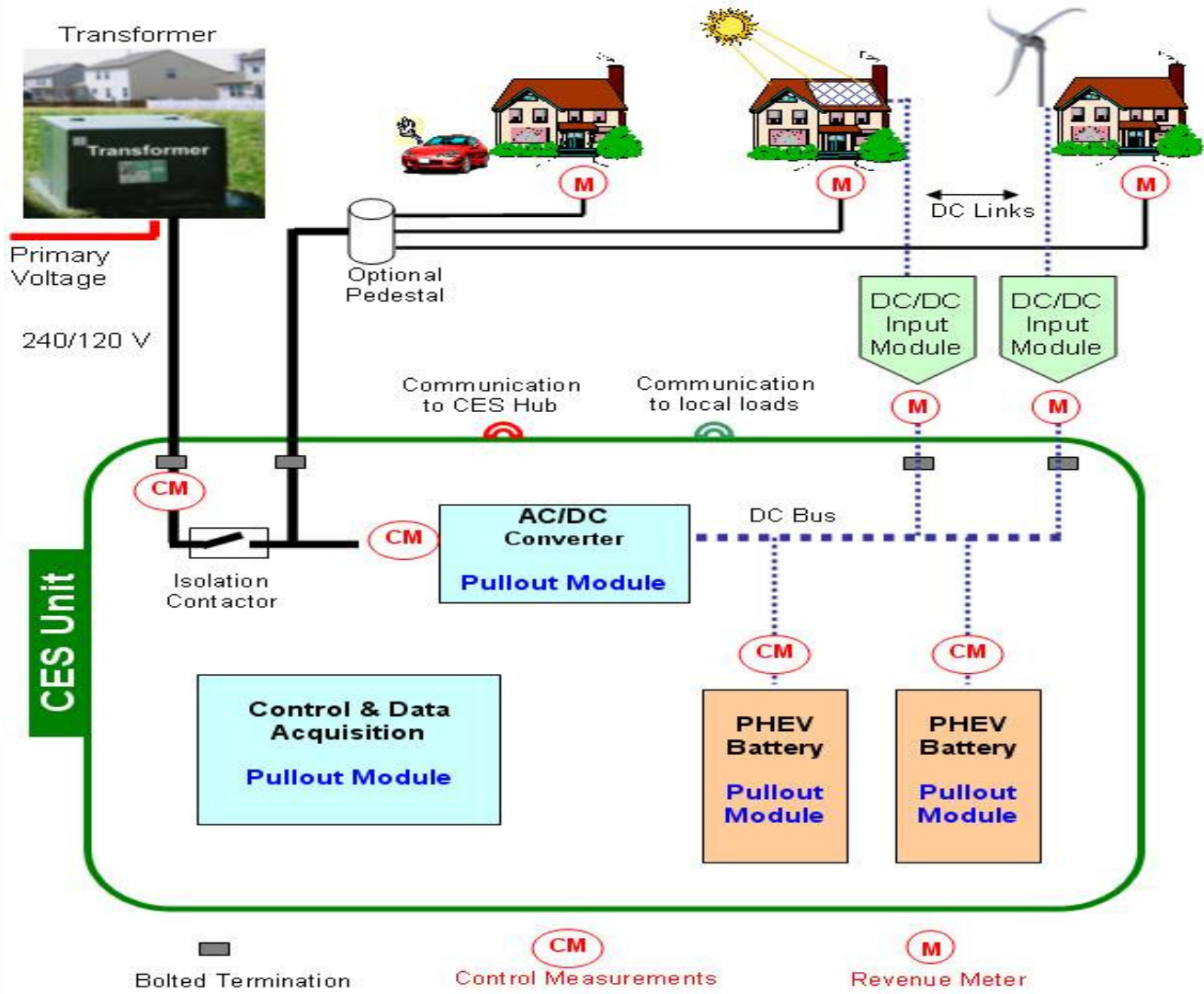


Functional Specifications for CES are “OPEN SOURCE”  
In 2009 EPRI hosted open webcasts to solicit industry wide input.

[www.aep\*\*tech\*\*center.com/\*\*ces\*\*](http://www.aep<b>tech</b>center.com/<b>ces</b>)



# CES Layout

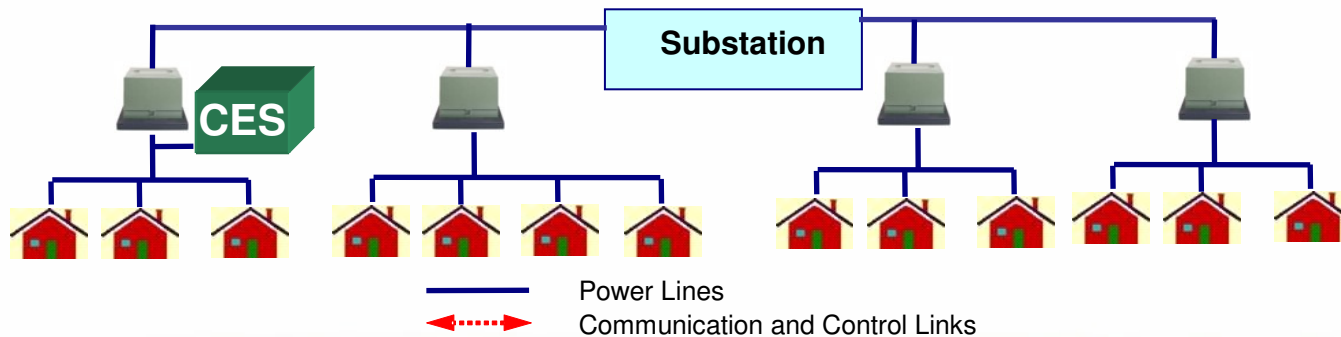


# CES – A Virtual Substation Battery

CES is Operated as a Fleet offering a Multi-MW, Multi-hour Storage

## Local Benefits:

- 1) Backup power
- 2) Voltage correction
- 3) Renewable Integration



# CES – A Virtual Substation Battery

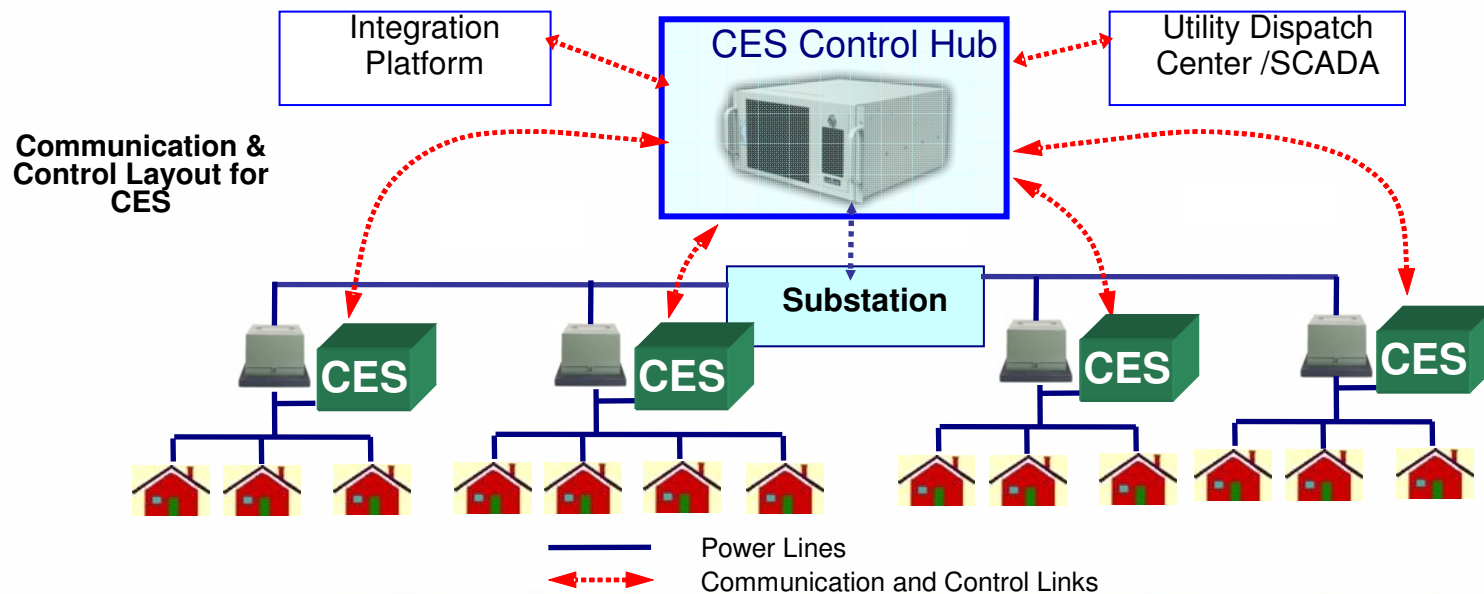
CES is Operated as a Fleet offering a Multi-MW, Multi-hour Storage

## Local Benefits:

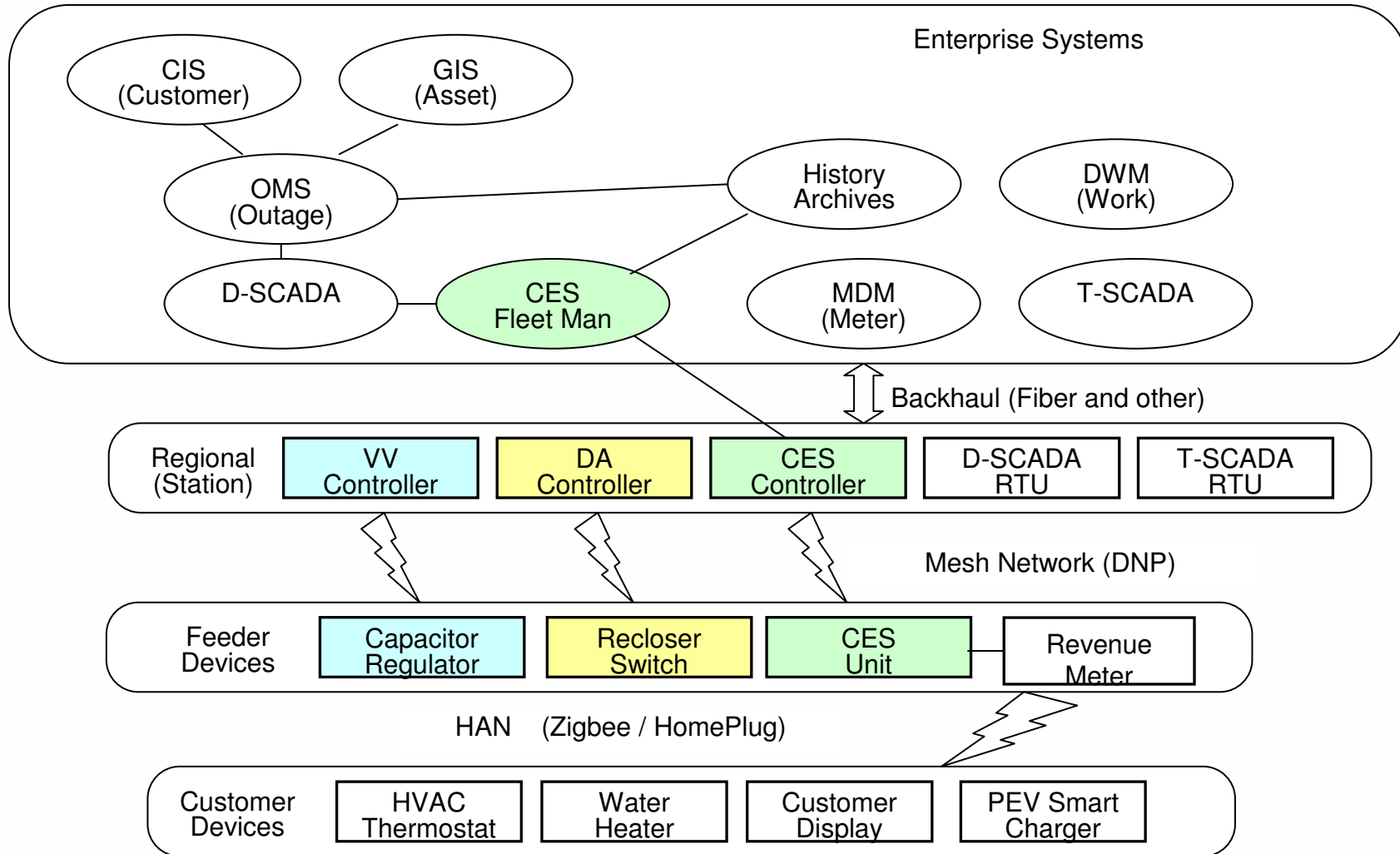
- 1) Backup power
- 2) Voltage correction
- 3) Renewable Integration

## Grid Benefits:

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



# CES Interface Diagram





# ***CES Control Hierarchy***

---

## **CES Unit:**

- Autonomous for Islanding (Including Energy Allocation)
- Stay within Power and Voltage Constraints
- Participate in Scheduled Energy Dispatch

## **CES Controller:**

- Manage Scheduled Energy Dispatch
- Respond to System or Manual Override
- Save Operational Reports to Archive

## **CES Fleet Manager:**

- Remote CES Setup and Maintenance
- High level / detailed view of CES performance
- Manual override of CES Fleet / Units

## ***CES Project Gaps and Challenges***

---

- Significant Development with tight time frame
- Customer acceptance – aesthetics
- Initially separate from other DER and automation schemes
- New technology is one of many – training and procedures
- Heavy reliance on slim communications infrastructure
- Dependence on imperfect operational data

## ***Conclusion - Looking Ahead***

---

VPPS will serve as a useful tool to look into opportunities such as:

- Pf correction & integration with Volt/VAR Optimization
- Local DG – Solar in particular
- Time shifting of PEV charging
- Integration into schemes for ancillary services
- System scale effects of wide deployment of CES and Station storage