Smart Grid, Energy Storage & Demand Response Deployment and Plans

October 27th, 2010

AEP AMERICAN® ELECTRIC POWER

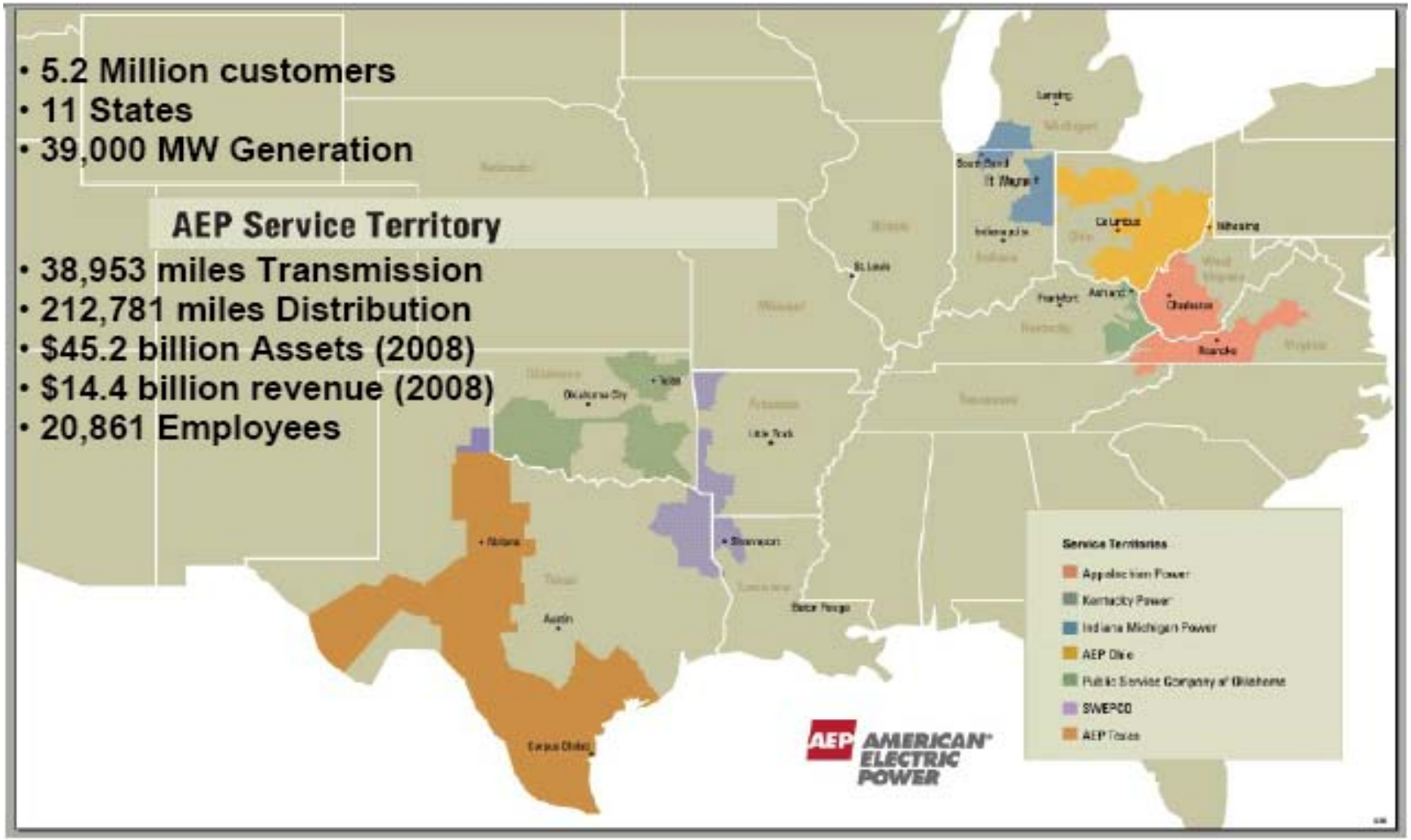
gridSMART℠ from American Electric Power

American Electric Power : Company Profile

- 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



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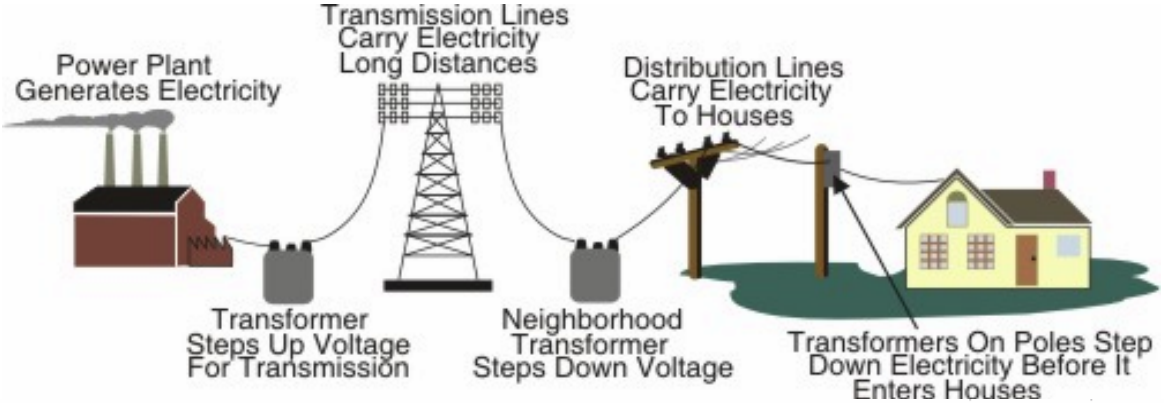
The Evolution of the Electric Utility System

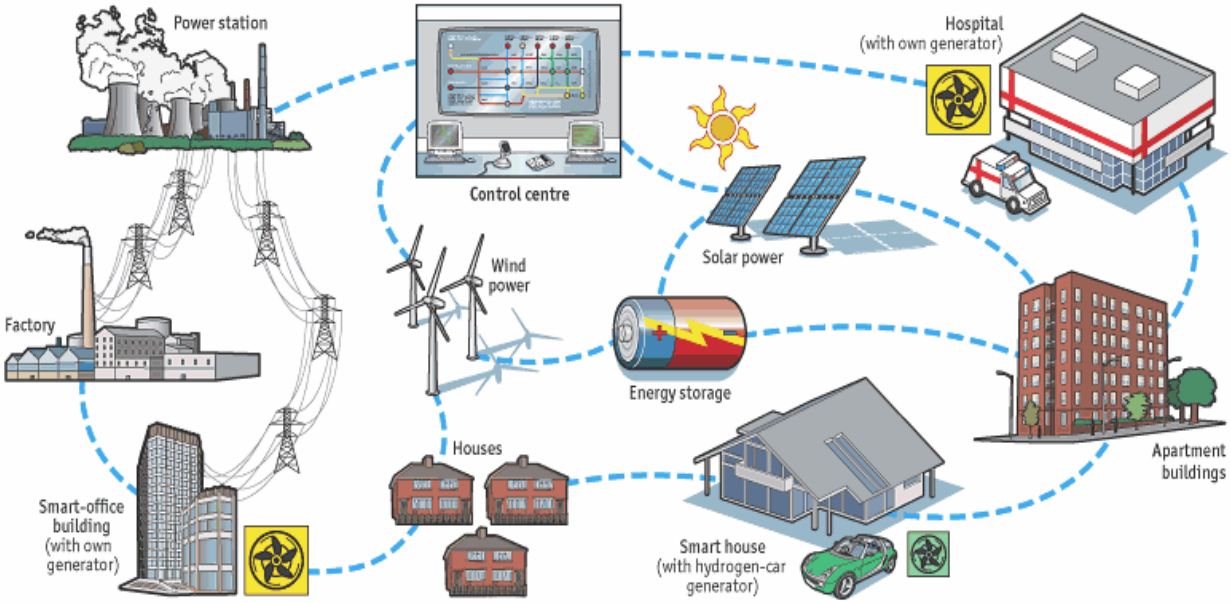
Before Smart Grid:

One-way power flow, simple interactions, limited sources of renewable generation



After Smart Grid:

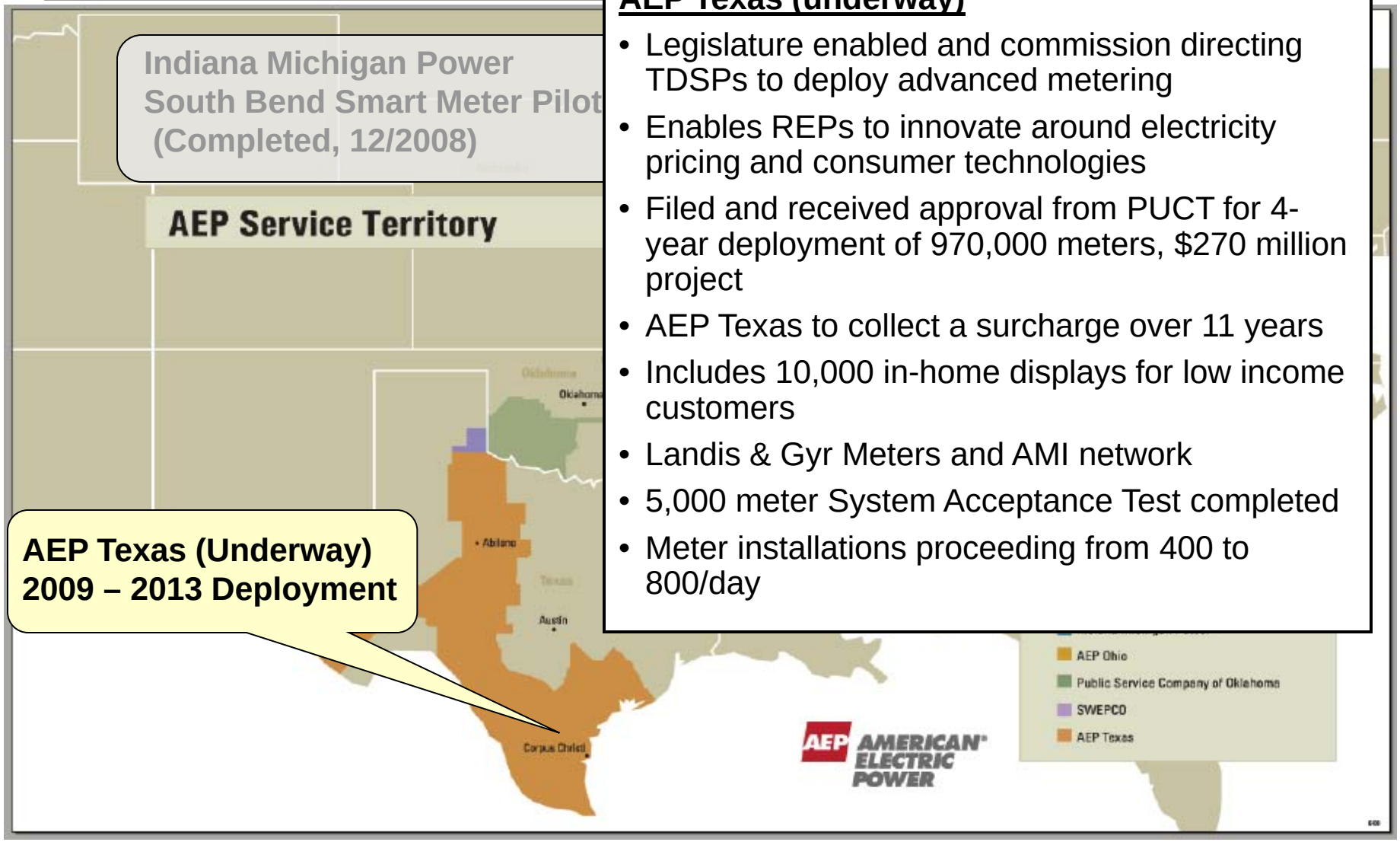
Two-way power flow, multi-stakeholder interactions, increased penetration of renewable generation



Sources: *The Economist*; ABB

Adapted from EPRI Presentation by Joe Hughes
NIST Standards Workshop
April 28, 2008

AEP's "Smart Grid" Deployment Status



AEP Texas (underway)

- Legislature enabled and commission directing TDSPs to deploy advanced metering
- Enables REPs to innovate around electricity pricing and consumer technologies
- Filed and received approval from PUCT for 4-year deployment of 970,000 meters, $270 million project
- AEP Texas to collect a surcharge over 11 years
- Includes 10,000 in-home displays for low income customers
- Landis & Gyr Meters and AMI network
- 5,000 meter System Acceptance Test completed
- Meter installations proceeding from 400 to 800/day

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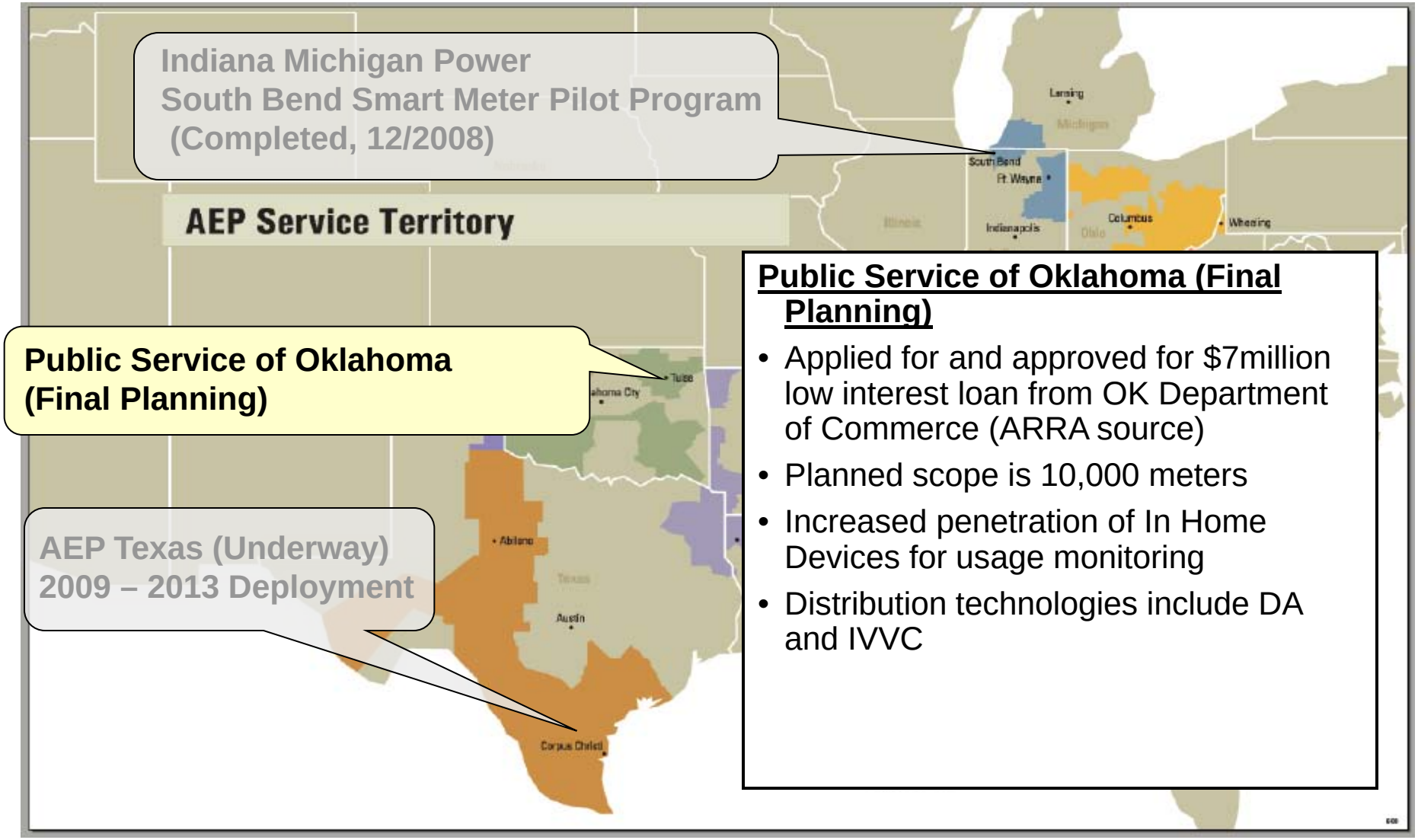

Public Service of Oklahoma (Final Planning)

- Applied for and approved for $7million low interest loan from OK Department of Commerce (ARRA source)
- Planned scope is 10,000 meters
- Increased penetration of In Home Devices for usage monitoring
- Distribution technologies include DA and IVVC

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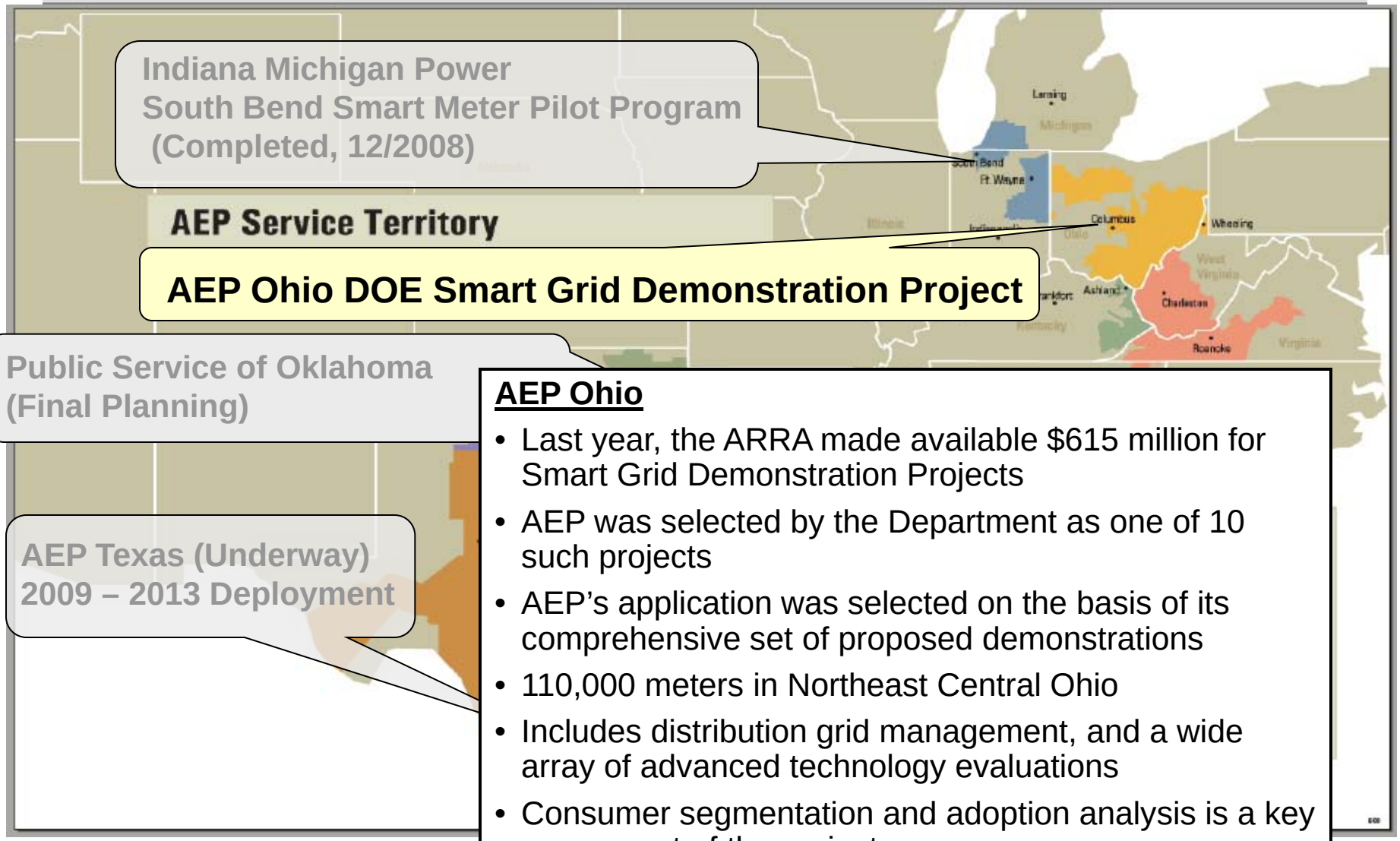
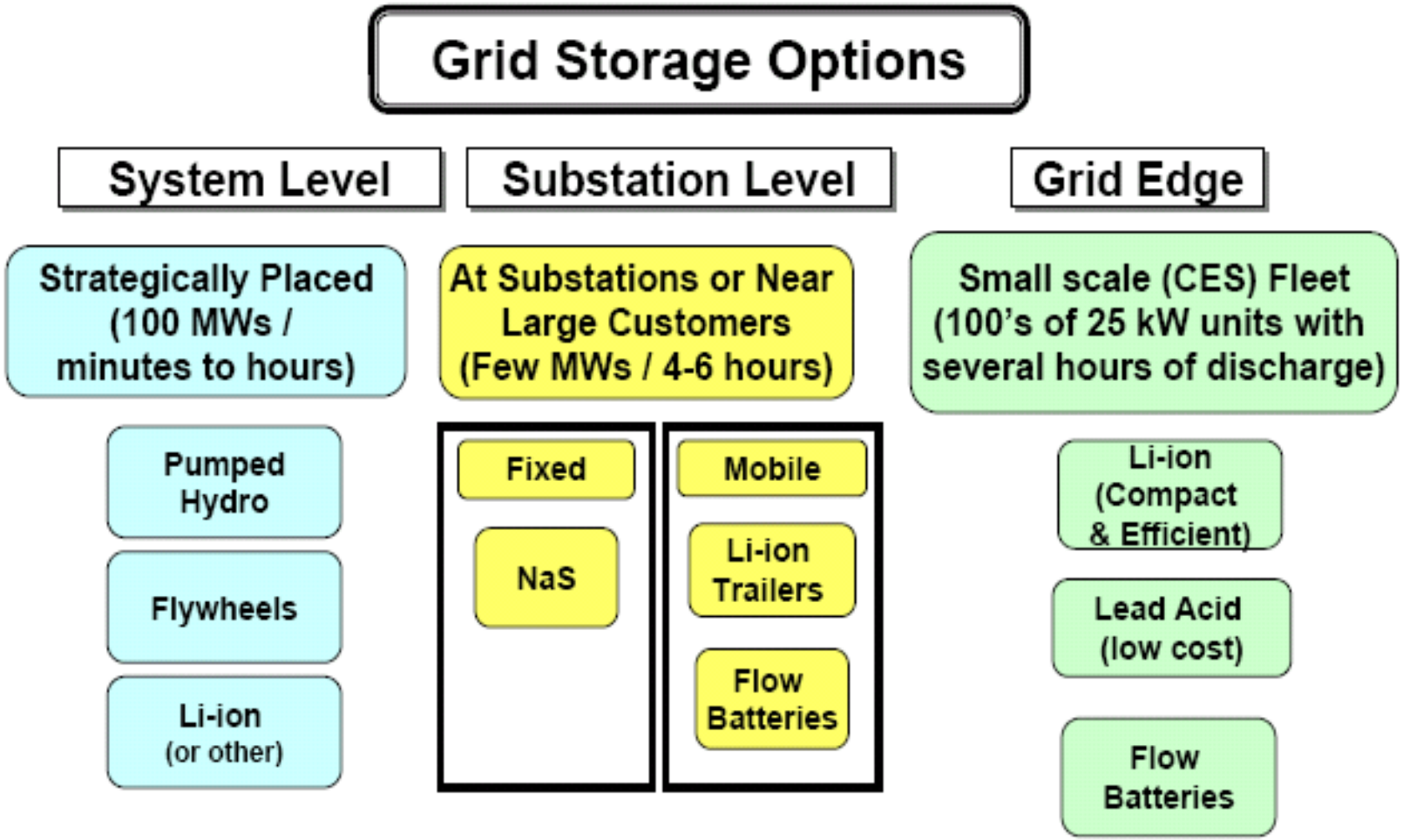
AEP's "Smart Grid" Deployment Status



AEP Ohio

- Last year, the ARRA made available $615 million for Smart Grid Demonstration Projects
- AEP was selected by the Department as one of 10 such projects
- AEP's application was selected on the basis of its comprehensive set of proposed demonstrations
- 110,000 meters in Northeast Central Ohio
- Includes distribution grid management, and a wide array of advanced technology evaluations
- Consumer segmentation and adoption analysis is a key component of the project.

Energy Storage Options



AEP Storage 2010 – 11MW, 75MWh

1 MW, 7.2 MWh installed in 2006

- Deferred substation upgrades

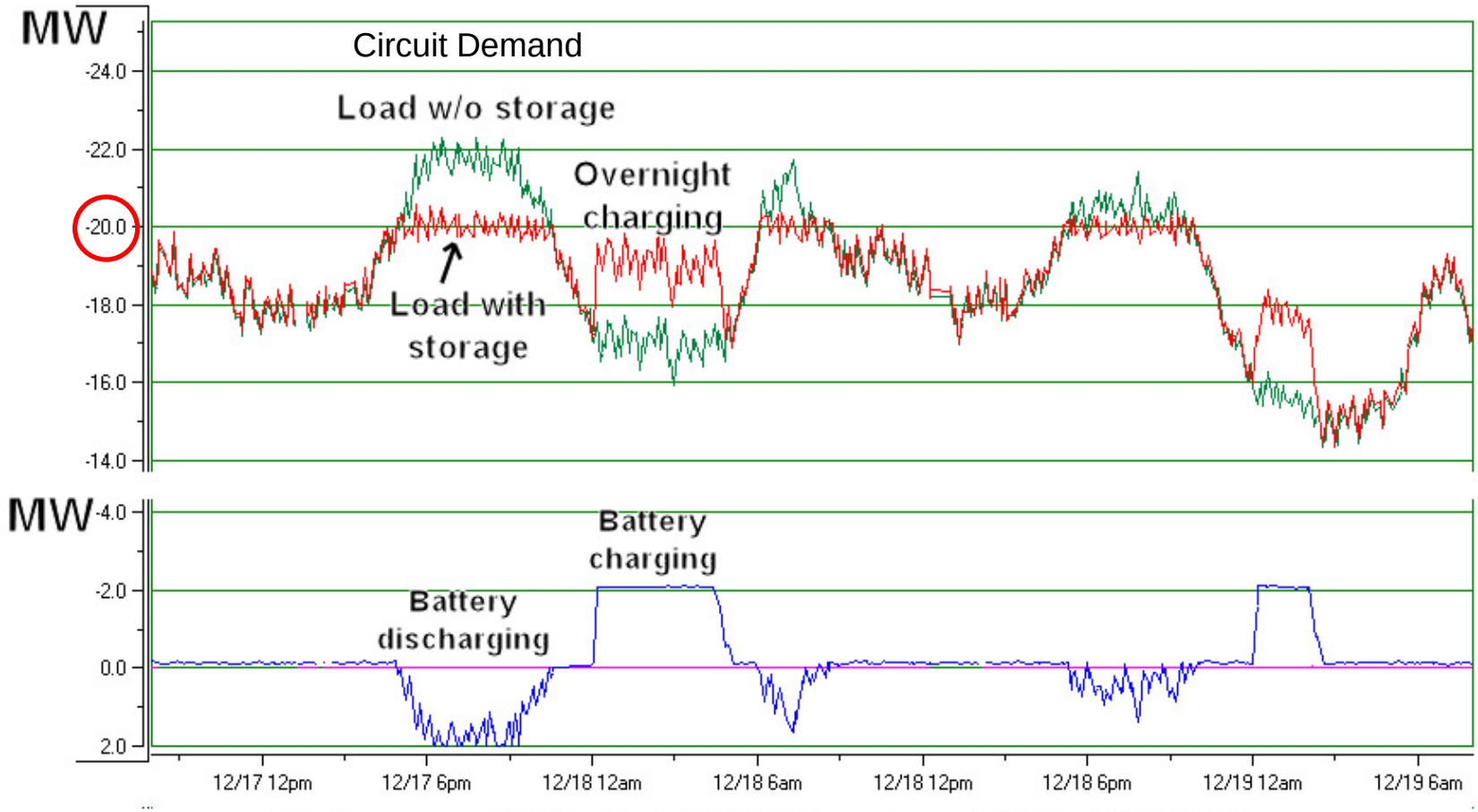
3 - 2MW,14.4 MWH Commissioned in 2009

- Implemented **"Load Following"**
- Demonstrated **"Islanding"**

4MW, 25MWh substation on-line in 2010

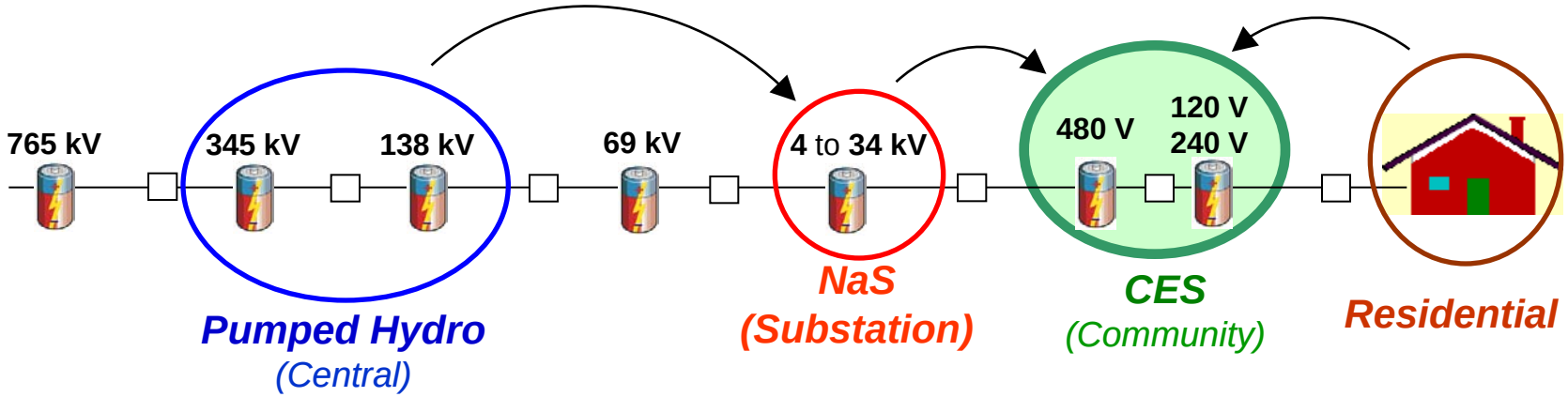
The New "Islanding" feature is Partially Funded by DOE/Sandia

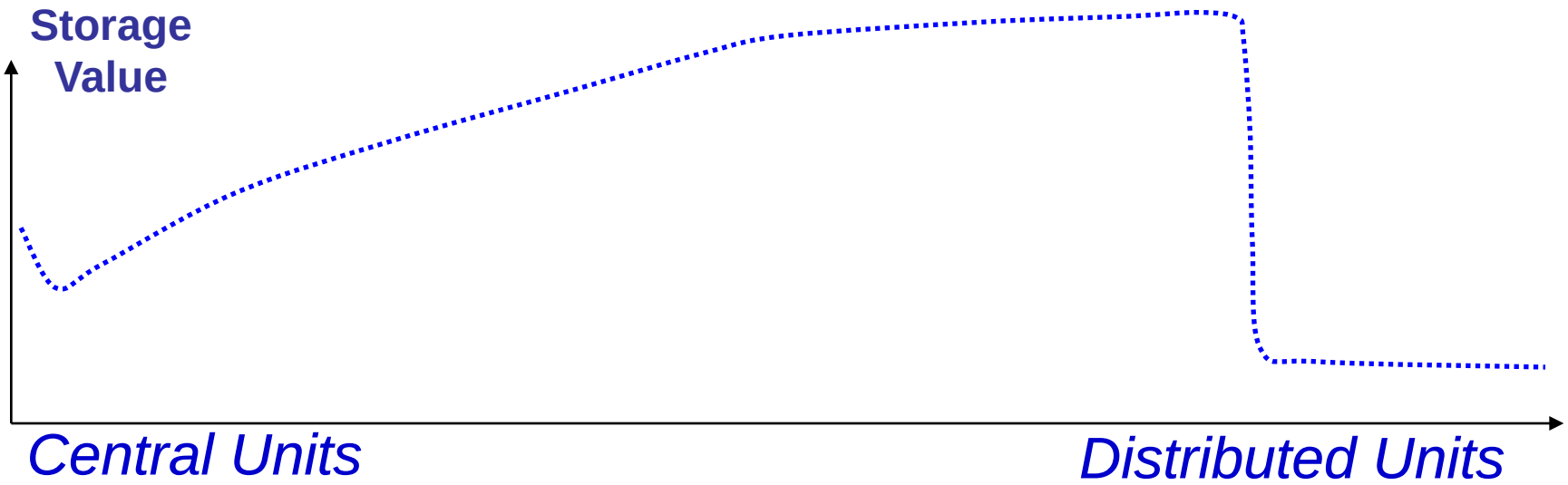
Load Following Peak Shaving



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

Locational Value of Electricity Storage





AEP believes there is great value for storage at the CES level

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	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.aeptechcenter.com/ces

Demand Response Initiatives

- **Various interruptible tariffs, time-of-use rates, and peak load management programs are in place**
  - **C&I load management programs in AEP Texas, SWEPCO, and PSO**
  - **Interruptible Tariffs in most jurisdictions for large C&I**
  - **South Bend Smart Meter Pilot – Thermostat Control through AMI network**
  - **Residential Direct Load Control programs are being ramped up, or are in the planning stage, for PSO, SWEPCO & Kentucky**

- **Demand Response Strategy Team in place to identify opportunities and develop a strategy to participate in PJM DR Emergency program and other initiatives**
  - **Interviewing various curtailment service providers (CSPs) to identify partnering arrangements, if applicable**
  - **Addressing issues with intermittent DR**
  - **Also looking at organizational structure required to optimize DR**

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Industry Changes Supporting DR

- Federal – 2008 FERC Order 719
  - Proposed to eliminate barriers to DR participation by ensuring comparable treatment of resources
  - Suggested DR can provide competitive pressure to reduce wholesale market prices, provide for more efficient operations of markets, mitigate market power, and enhance reliability
  - Supported the use of new technologies to achieve these goals
- States
  - Enacting requirements for efficiency and demand reduction programs
- Wholesale Markets / RTOs
  - Creating new market participants aggregating retail customers for DR
  - Allowing consumers, who are served at retail, to directly compete with supply-side resources
- New Technology
  - Enabling customers to become more price and/or load responsive

AEP's Current Exposure

- Curtailment Service Providers (CSPs) have secured 810 MW of DR from over 900 AEP customers in AEP's Eastern states
  - These 900 customers represent revenue and peak demand erosion
  - No capacity-related benefits for customers signed up by CSPs
  - CSP owns relationship with customer; 37 of AEP's top 100 customers working with CSPs
  - CSPs providing advanced technology interface to customer
  - Estimate PJM will pay $90M to CSPs and our customers in incentives over next 3 years

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AEP's Current Situation

- Current Integrated Resource Plan (IRP) includes incremental DR
  - 100 MW AEP East by 2011, 600 MW by 2015
  - 20 MW each PSO and SWEPCO by 2011, 190 total MW by 2014
- Demand and energy reduction goals (1,000 MW and 2,250 GWh by 2012) communicated externally
  - GWh allocation to operating companies based on ratio of retail sales to total system sales
  - MW allocation to operating companies based on energy sales, adjusted summer peak demand and adjusted maximum peak demand
    - Adjustments take into account legacy interruptible capacity
  - Does not assess feasibility or value proposition to AEP
- Operating companies initiating "locally customized" EE/DR programs
- No formalized business / execution strategy for DR

Business Drivers For DR

- **Resource Portfolio Optimization**
  - Unit disposition
  - Capital deployment
  - Transmission and Distribution system benefits (in addition to Generation)
  - Environmental compliance
- **Enhanced Customer Service**
  - Increased customer knowledge and satisfaction
  - Real-time information for company and customer
  - Risk mitigation of losing customers to other providers in states where choice exists
- **Technology Innovation**
  - Utilization of consumer response to signals to shape their load profile