



# *AEP's gridSMART<sup>sm</sup> Initiative*

## **EEl National Accounts Workshop**

What the Smart Grid means to Customers

Darren Kelsey

(3/17/2009)

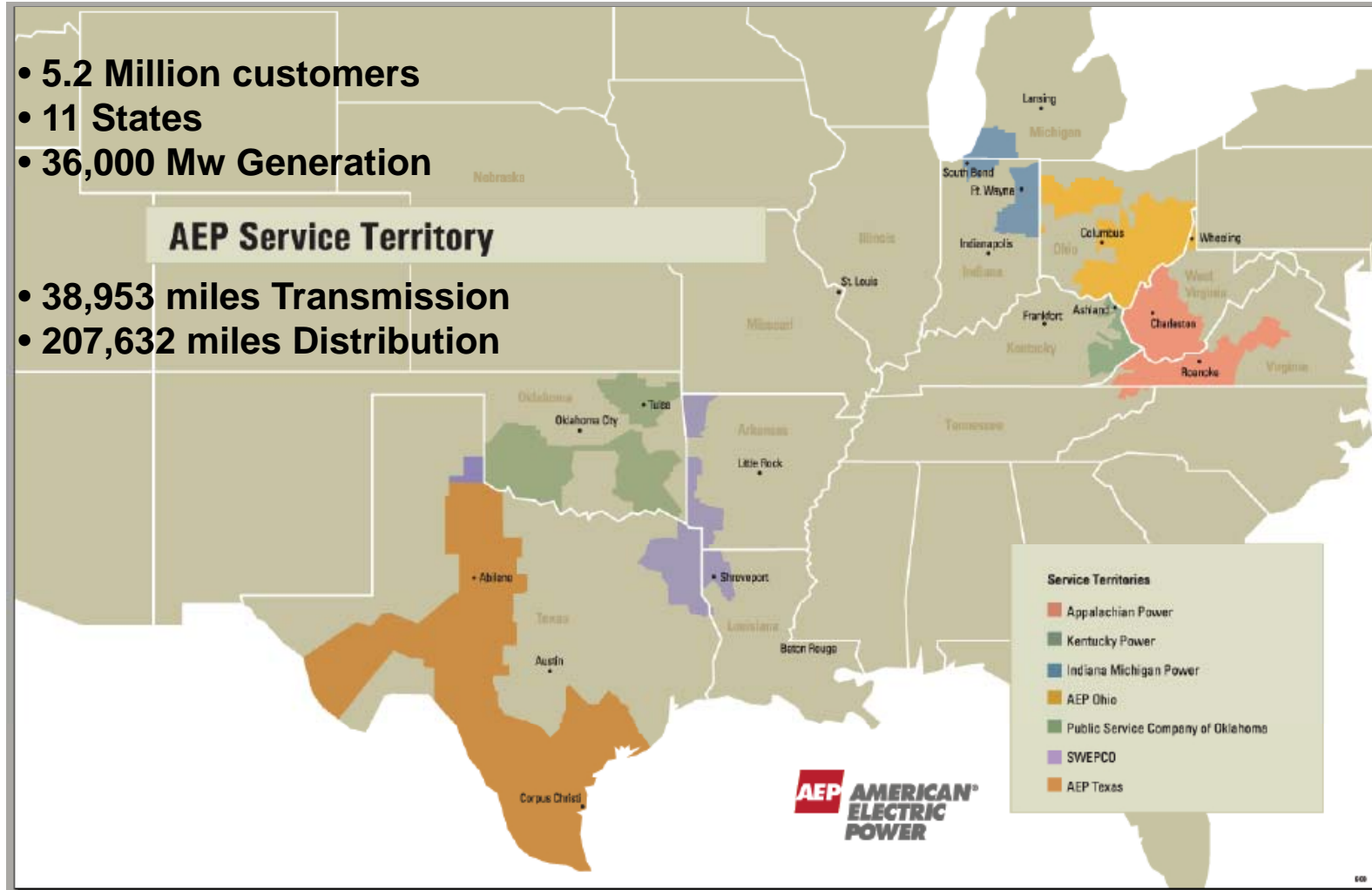


# AEP Overview

- 5.2 Million customers
- 11 States
- 36,000 Mw Generation

## AEP Service Territory

- 38,953 miles Transmission
- 207,632 miles Distribution



## *AEP's need for supply...*

AEP's *Integrated Resource Plan* forecasts customer peak demand (MW) and energy usage (MWh), and determines a preferred demand and supply-side resource portfolio

- providing a reliable supply of power and energy that would meet any Regional Transmission Organization (RTO)-prescribed "reserve margin"; and
- do so in an environmentally-responsible manner

...all at the least reasonable cost to its customers.

AEP operates and performs unique planning for its "Eastern" (residing within the PJM RTO) zone, and its "SPP-Western" (residing within the SPP RTO) zone.

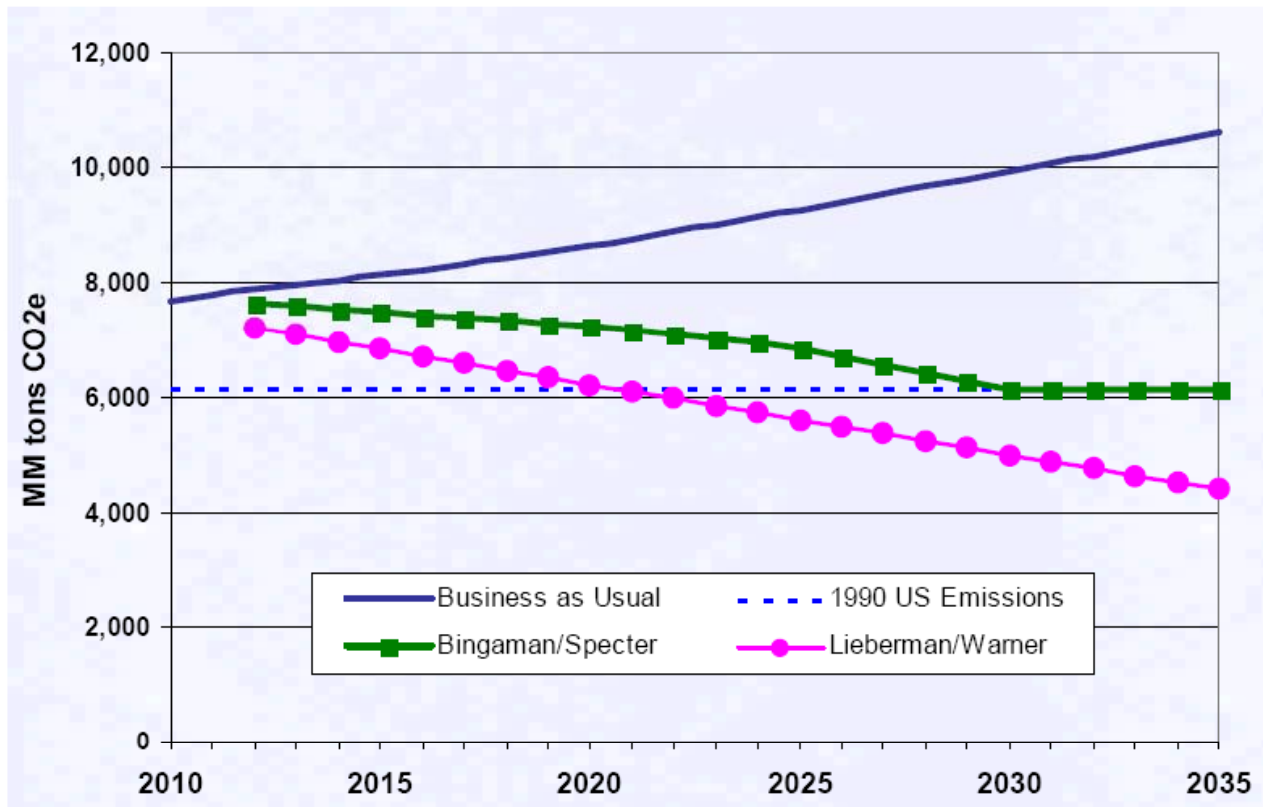
Some scenarios in AEP's most recent forecasts and planning indicate:

- The possibility exists for customer peak-hour (summer) demand to ***exceed the capacity*** of all of its *current* supply (owned generating capacity and purchase entitlements) within the next 4-7 years
- The possibility also exists for customer (annual) energy consumption to ***exceed the energy production*** from those current supply sources within the next 8-12 years.

**A baseload power plant can take from three to six years to bring on-line.**

*...coupled with emerging environmental programs...*

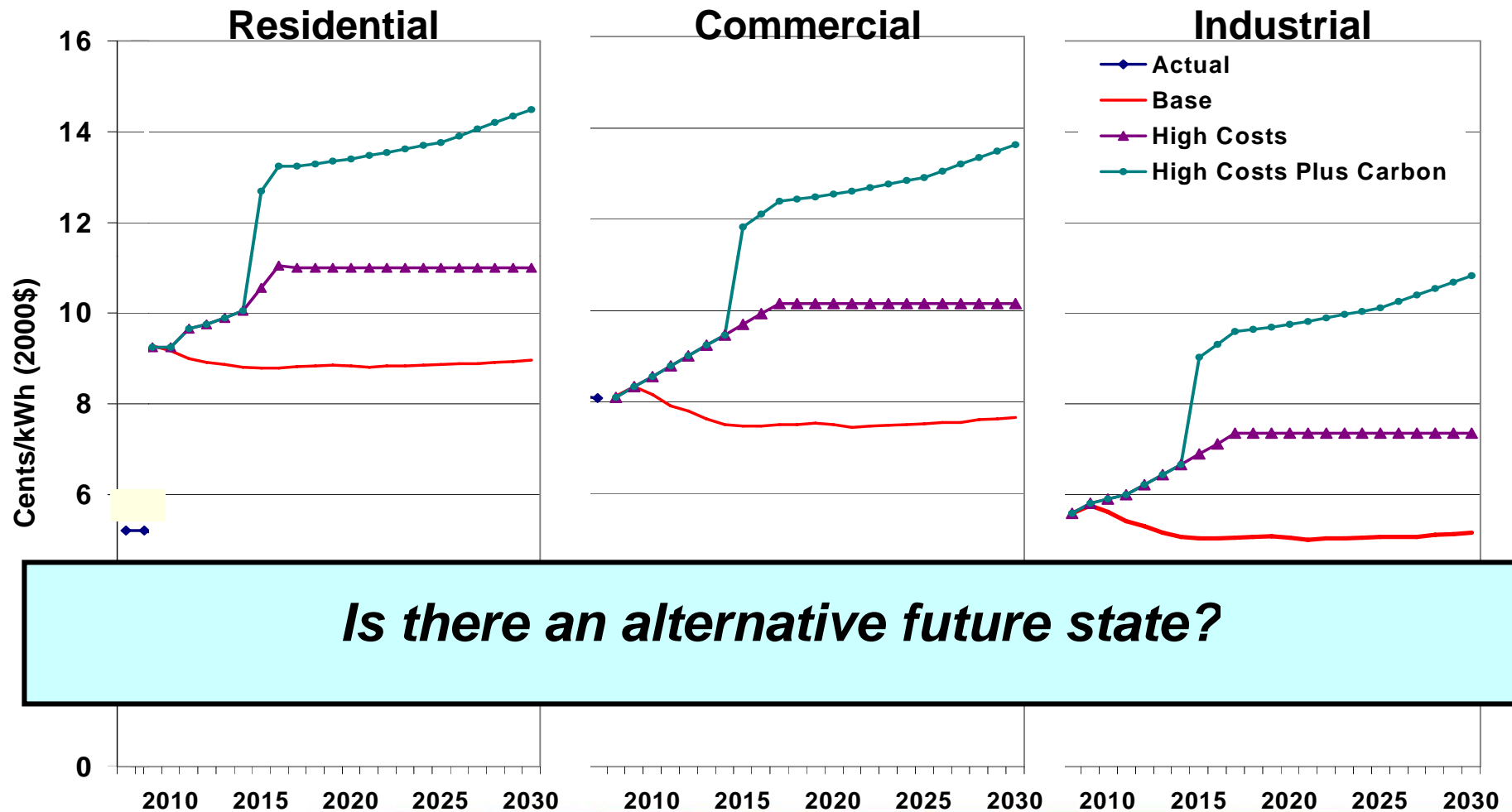
### US GHG Emissions and Proposed Cap-and-Trade Programs



Meeting either objective will require improvements in supply-side emissions and reduction in consumption.





*...will result in significant increases in costs to customers.*

### Retail Electricity Price Forecasts by Sector



*Is there an alternative future state?*

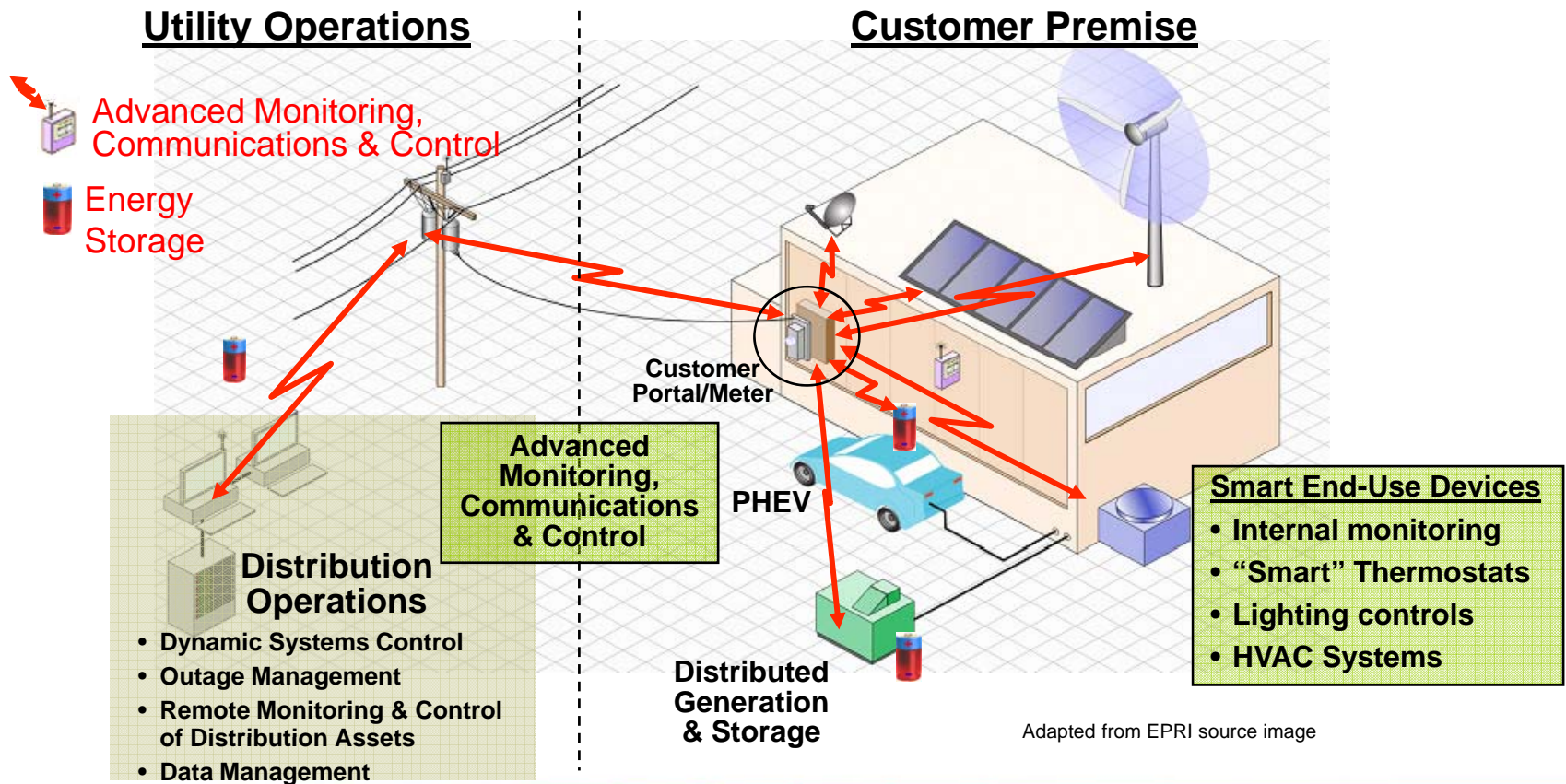
## Vision for Sustainability

Generation	Transmission	Distribution		Customers
 <ul style="list-style-type: none"> <li>Environmental Projects</li> <li>Wind</li> <li>IGCC</li> <li>Carbon Capture &amp; Storage</li> </ul>	 <ul style="list-style-type: none"> <li>I-765<sup>TM</sup></li> <li>Electric Transmission Texas JV</li> <li>Electric Transmission America JV</li> <li>AEP-ABB Alliance</li> </ul>	 <ul style="list-style-type: none"> <li>Advanced Metering Infrastructure</li> <li>“Smart Meters”</li> <li>Home Area Networks</li> <li>Demand Response architecture</li> <li>Distribution Grid Management</li> <li>Self-healing distribution circuits</li> <li>Internal energy efficiency</li> <li>Platform for advanced visualization &amp; analytics</li> <li>Distributed generation and energy storage</li> <li>AEP-GE Alliance</li> </ul>		 <ul style="list-style-type: none"> <li>Customer programs and incentives                             <ul style="list-style-type: none"> <li>Energy efficiency</li> <li>Direct load control</li> <li>Peak demand reduction</li> </ul> </li> <li>Energy storage</li> <li>Energy Information Portal</li> <li>Pre-paid Metering</li> <li>Distributed Generation</li> </ul>
Existing generation and transmission control systems		<b>gridSMART<sup>SM</sup></b> : bridging the gap to provide integrated two-way communications & control across the electricity value chain		Home energy automation

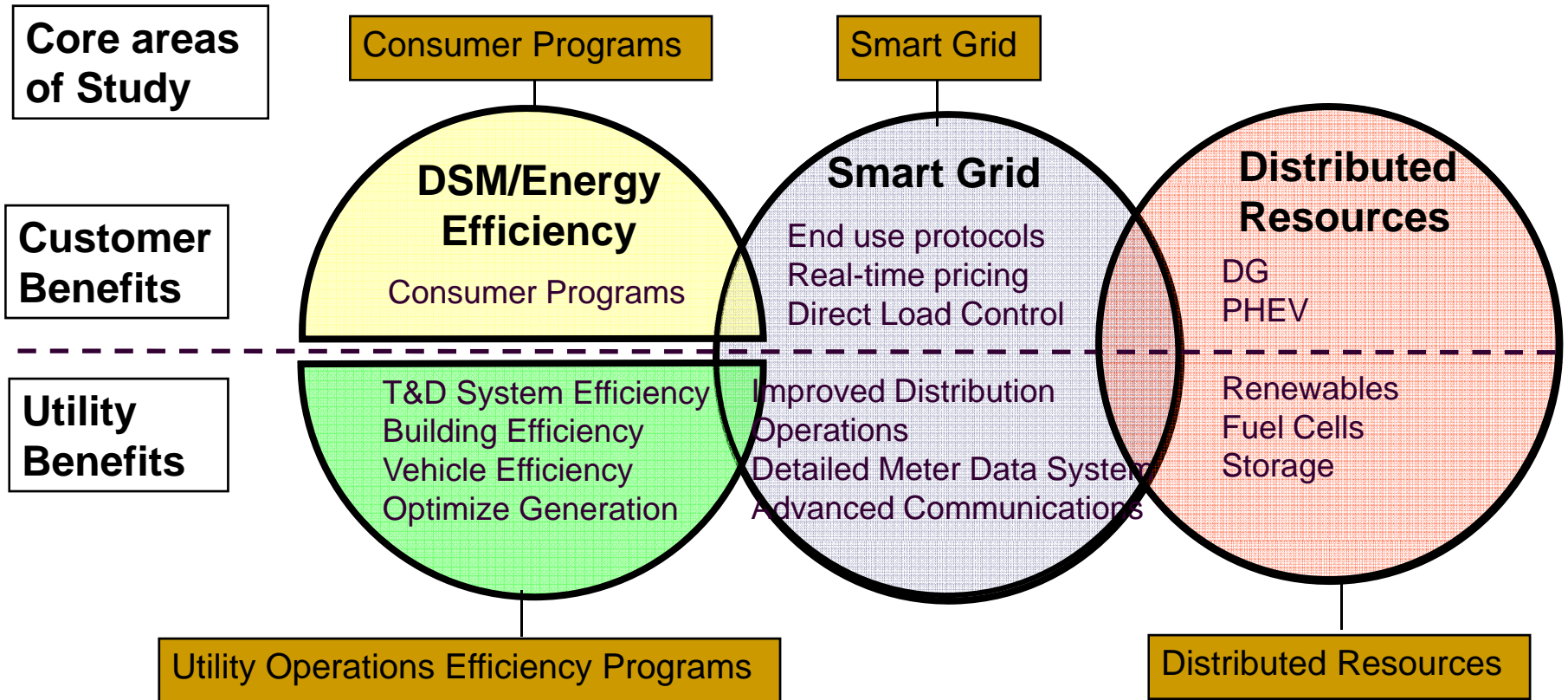
**AEP** is committed to operating responsibly, efficiently and profitably for customers, shareholders, employees and communities.

# Distribution Operations of the Future

AEP believes that utilities must prepare for a future that integrates many technologies and requires a more advanced state of monitoring, communications & control.



# AEP's gridSMART<sup>SM</sup> Project Addresses Energy Value Chain





# *Energy Efficiency and Demand Response are Demand Side Management*

The terms “Energy Efficiency”, “Demand Response”, and “Demand Side Management” have historically been used interchangeably creating some confusion among stakeholders

- **Energy Efficiency (EE)** targets energy reduction (MWh)
  - Includes energy conservation measures and efficiency upgrades
  - Has some coincidental impact on peak demand reduction
- **Demand Response (DR)** targets load reduction (MW)
  - Includes peak shaving and valley filling strategies
  - Minimal impact on energy reduction
- Both EE and DR are needed to support corporate sustainability initiatives

AEP has set a corporate demand reduction target (1,000 MW), and is working to establish an appropriate energy reduction target as part of our sustainability goals

# Advanced Metering Infrastructure (AMI) - the Foundation for the “Smart Grid”

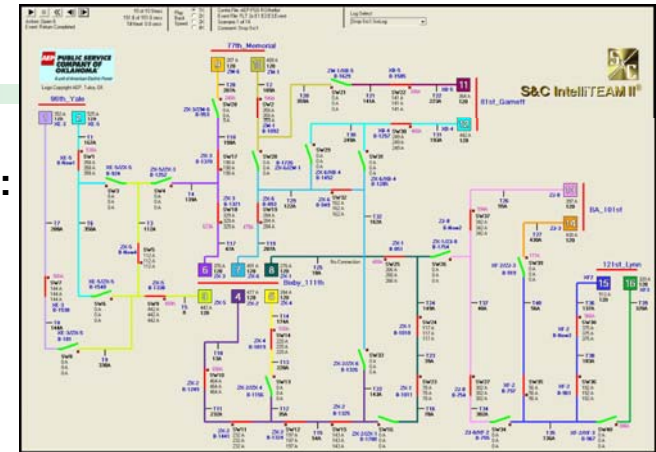
- AEP’s goal to install five million smart meters by 2015
- Provide customers time-based usage information
- Allow utility monitoring and control of the delivery of electricity at the meter
  - Remote Connect/Disconnect
  - Delivery Status
- Enables “Demand Response” Programs
- Provides communications foundation for distribution automation and grid management



AEP completed deploying approximately 10,000 meters in South Bend, Indiana, and is pursuing additional deployments in jurisdictions for deployments that range from “model city deployments” to one million meters (Texas).

# Grid Management Demonstrations

- **Utilizes communication and intelligent technology to perform:**
  - Circuit reconfiguration
  - Circuit optimization
  - Real Time Monitoring and diagnostics of equipment
  - Fault location identification
- **This technology has been evolving over several years and some standards are being developed. Actual deployment is still limited in most utilities. AEP has deployed this technology on less than 2% of our circuits. The potential for improving reliability and increasing energy efficiency of distribution circuits is high if more automation is deployed.**
- **Benefits Expected:**
  - Improves safety for field employees by using SCADA for switching remotely
  - Provides tools to improve reliability. Automated circuit reconfiguration can improve circuit reliability by 30 – 50%
  - Improves customer experience by notifying dispatchers of outages before a customer calls
  - Improves energy efficiency by optimizing power factor and by notifying operations when a capacitor bank is abnormal
  - Permits transition to “condition based” maintenance with fewer inspections



# ***Evolving Customer-Utility Relationship***

## **Significant shifts in customer expectations are expected**

- More timely information about consumption
- Increased electric service reliability
- Utility support for energy management components

## **Expected changes in basic utility services and operations**

- Moving from “fixed” rates to “variable” rates
- Broader use of internet for services and communications
- Integration of utility applications supporting work management, outage management, and asset management
- Support for energy management services
- New employee roles

AEP must focus on exceeding customer expectations while supporting these shifts in services and operations.

# *AEP's Research Projects Linked to gridSMART*

## **Large Scale Energy Storage (Sodium-Sulfur, NaS )**

- Partnership with NGK and S&C

## **Microgrids**

- Consortium for Electric Reliability Technology Solutions

## **Fuel Cells**

- Partnership with Rolls-Royce

## **Distributed Solar Pilots**

- Installed solar on two service centers in Ohio
- Approximately 70-75 kW at each site, using different vendors, technologies, and configurations
- Recovery will be sought for the installations as part of the Ohio RPS target

## **Plug-in Hybrid Electric Vehicles (PHEV), Electric Vehicles (EV)**

- Members of Electric Drive Transportation Association
- Forming Ohio State's Center for Automotive Research
- Active participant in EPRI/GM and EPRI/Ford studies
- Converted two Toyota Prius to Plug-in Hybrid operation

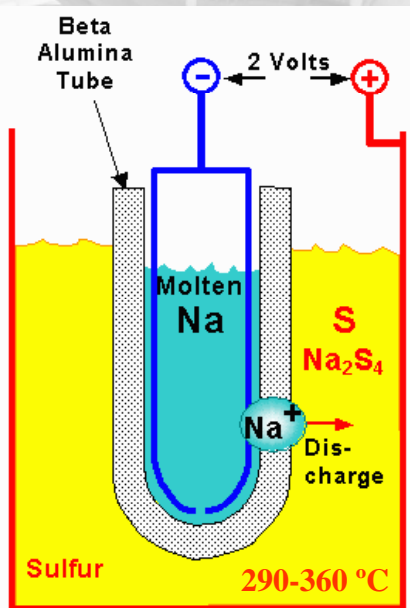
# AEP's Sodium-Sulfur (NaS) Battery Application

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

- Deferred substation upgrades

Three installations in 2008 (2.4MW Each)

- 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

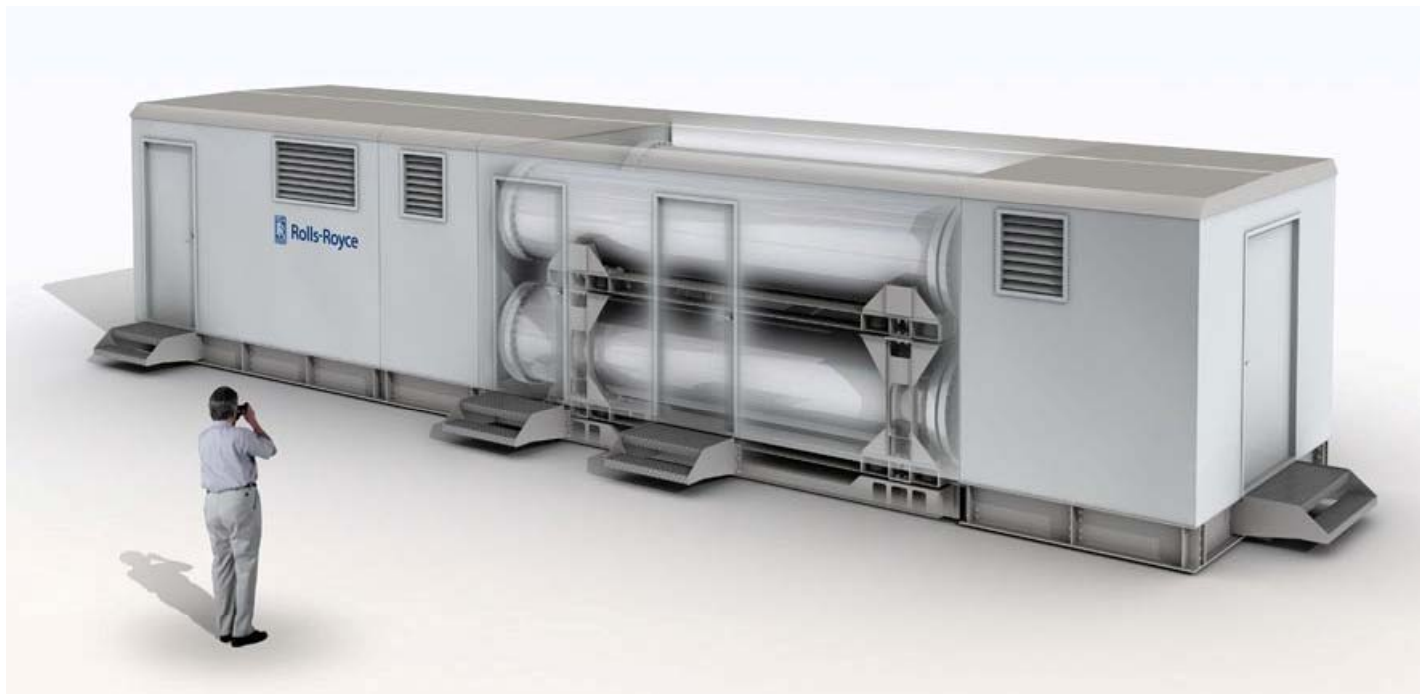
# AEP's Microgrid Test Bed



## *Rolls-Royce Fuel Cell*

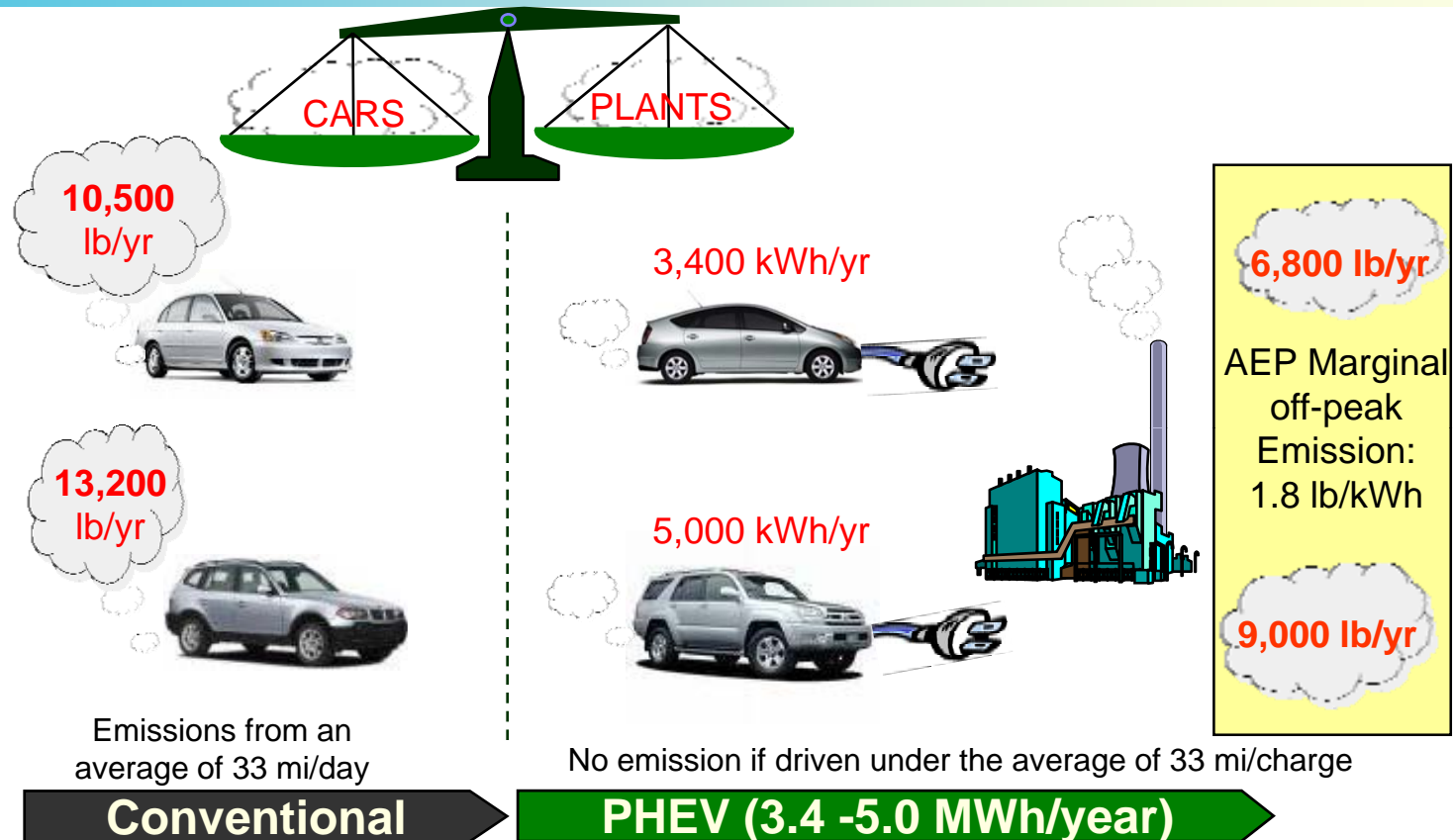
# **Rolls-Royce Fuel Cell Systems**

## **1 MW SOFC Test & Evaluation Program**





# PHEV Environmental Benefits



Source: EPA Emission Facts 2005  
Based on 12,000 mi/yr

Source: PNNL impacts Assessment of PHEV on Grid - Based on 12,000 mi/yr (33 mi/day)  
ACEEE = American Council for Energy Efficient Economy – Sep 2006, report T061

Power plant versus conventional gasoline powered vehicle efficiency results in a 30% CO2 opportunity.

# AEP's Converted Toyota Prius PHEVs





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POWER**