AEP’s grid SMART Initiative

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AEP Overview

**AEP Service Territory**

- 5.2 Million customers
- 11 States
- 36,000 MW Generation
- 38,953 Miles Transmission
- 212,781 Miles Distribution
- $45.2 Billion Assets
- $14.4 Billion Revenue
- 21,912 Employees
# AEP gridSMART Vision

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<th>Generation</th>
<th>Transmission</th>
<th>Distribution</th>
<th>Customers</th>
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<tr>
<td>• Environmental Projects</td>
<td>• I-765™ Electric Transmission Texas JV</td>
<td>• Advanced Metering Infrastructure</td>
<td>• Customer programs and incentives</td>
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<td>• Wind</td>
<td>• Electric Transmission America JV</td>
<td>• “Smart Meters”</td>
<td>• Energy efficiency</td>
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<td>• IGCC</td>
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<td>• Home Area Networks</td>
<td>• Direct load control</td>
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<td>• Carbon Capture &amp; Storage</td>
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<td>• Demand Response architecture</td>
<td>• Peak demand reduction</td>
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<td>• Distribution Grid Management</td>
<td>• Energy storage</td>
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<td>• Self-healing distribution circuits</td>
<td>• Energy Information Portal</td>
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<td>• Internal energy efficiency</td>
<td>• Pre-paid Metering</td>
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<td>• Platform for advanced visualization &amp; analytics</td>
<td>• Distributed Generation</td>
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<td>• Distributed generation and energy storage</td>
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<td>• AEP-GE Alliance</td>
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**gridSMART™**: bridging the gap to provide integrated two-way communications & control across the electricity value chain

Existing generation and transmission control systems

Home energy automation
AEP gridSMART Deployment Status

Indiana Michigan Power (AEP) – BEING IMPLEMENTED
- 10,000 AMI pilot program (GE meters)
- Distribution automation
- Programmable communicating thermostats
- Enhanced time-of-use tariffs
- Customer web portal for monitoring & management

AEP Ohio – APPROVED BY PUCO
- 110,000 AMI deployment in NE Columbus area
- Full suite of distribution automation technologies
- Advanced technology deployment (Energy storage, PHEVs)
- Enhanced time-of-use tariffs
- Home area networks & grid-friendly appliances

AEP Texas – FILED WITH PUCT
- Approximately 1 million AMI meters
- In-home display devices
- Tariffs & programs to be offered by REPs
AEP’s gridSMART Advanced Technologies

Distributed Renewable Generation

• 70 KW photovoltaic panels installed on roofs of AEP Service Centers in Newark, OH and Athens, OH [70 KW X 2 = 140KW]

• R&D project comparing traditional PV to concentrated PV at AEP’s Dolan Engineering lab (Groveport, OH)

PHEVs

• 2 Prius converted to PHEV
• Ford Escape SUV converted to PHEV (EPRI collaborative)
• Field testing to monitor performance
AEP’s gridSMART Advanced Technologies

**Substation Scale Battery**

- **2006**: 1 MW, 7.2 MWh; Deferred substation upgrade in Charleston, WV
- **2008**: Three installations; 2 MW, 14.4 MWh each; With “islanding” in Bluffton, OH; Balls Gap, WV; East Busco, IN
- **2010**: 4 MW, 25 MWh; To be installed in Presidio, TX

**Community Energy Storage**

- Small distributed energy storage units connected to the secondary of transformers serving a few houses or commercial loads.
- Pursuing development & deployment:
  - Part of ARRA/Stimulus demonstration grant
  - Proposed to Public Service Commission
Smart Grid: The Benefits

• Operational Improvements
  – Reduced costs
  – Reliability improvements
  – Targeted investment
  – Improved safety

• Energy Market Impacts
  – Smart grids enable demand response – providing demand elasticity
  – Demand elasticity lowers market clearing price
  – Impacts are large due to steep supply cost curve at times of critical pricing
  – Traditionally, demand is relatively static

• Environmental Impacts
  – A smart grid can deliver carbon savings
    • End-use conservation/efficiency; Minimize losses & resistive loads by optimizing distribution voltage; etc.
  – A smart grid can enable more, lower cost carbon savings
    • PHEVs; Support distributed renewable generation; Support intermittent renewables by regulating voltage fluctuations; Efficiently measuring & verifying EE effects; etc.
Smart Grid: The Challenges

• Regulatory Scrutiny
  – Tolerance for level of rate increases (fuel increases, environmental compliance, etc.)
  – Difficult economic environment
  – Dependence societal benefits & externalities

• Codes & Standards
  – Developing technology area
  – Lack of clarity regarding standards bodies & regulatory organization roles
  – Geographically-distributed nature of investment

• Current Credit Conundrum
  – Utility sector extremely capital intensive
  – Recent reductions in credit ratings
  – Current availability & cost of capital
Smart Grid: The Solutions

**Regulatory Scrutiny**
- Continue decline in the cost of deployment
- Collaborative arrangements
- Phased-deployment approach
- Demonstration that initiatives can also include ancillary benefits (environmental, capacity needs, etc.)

**Codes & Standards**
- Engagement with various constituents to coordinate efforts (NIST, FERC, EPRI, etc.)
- Avoid proprietary architecture technologies
- Consider future potential applications

**Current Credit Conundrum**
- Need to retain economic health of utilities
- Need timely return on O&M spent and capital investments
- Creative alternative cost recovery models