Grid Architecture and V2G

Energy and Transportation Convergence: Challenges and Opportunities for Electric Grid Modernization
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About Austin Energy

- 9th largest public power utility in the US
- Over $1.2 billion in annual revenues
- Servicing almost 400,000 premises representing around 43,000 businesses and ~1 M population
- Leader in conservation and energy efficiency
- Leader in the use and management of distributed generation
- Leader in PEV
What is the Smart Grid?

- The Smart Grid is the **seamless integration** of an electric grid, a communications network, and the necessary software and hardware to monitor, control and manage the generation, transmission, distribution, storage and consumption of energy by any customer type.

- The Smart Grid of the future is distributed, interactive, self-healing and **reaches every device.**
AE Smart Grid Architecture

1. Energy Hedging Sys
   - Wholesale Scheduling and Settlement Sys

2. Generation Management Sys
3. Distributed Control Sys
4. Emissions Mgmt Sys
   - Lab Mgmt Sys

5. Distribution Management System & Outage Management System
   - EMS / SCADA
     - Load Planning Sys
     - Distribution Automation
       - Vegetation Mgmt System

6. Customer Portals / Web Services / IHDs
   - Call Center
     - CRM / CIS / Billing
     - Conservation System
     - Demand Response Sys
     - Marketing Program Sys

7. Meters / MDMS
   - GIS / Materials Mgmt / Asset Mgmt / Facilities Mgmt
   - CAD / CAE Applications and Modeling Tools
   - Workforce and Workflow Management
   - Portfolio Management / Project Management

8. PDAs / Smartphones / PCs / Servers / IT Management Systems / Email / MS Office / App Servers
   - Voice and Data Network(s)
   - Field Force and AMI Networks

9. Smart Appliances
10. Sub-Metering Sys
11. Smart Charging Sys
12. DG Mgmt Sys
13. Storage Mgmt Sys
14. LAN/PAN/HAM
AE Smart Grid New Systems

Phase 1: Smart Grid 1.0

- Central Generation
- Distribution Grid (high voltage)
- Load Planning Sys
- EMS / SCADA
- Distribution Automation
- Vegetation Mgmt System
- GIS / Materials Mgmt / Asset Mgmt / Facilities Mgmt
- CAD / CAE Applications and Modeling Tools
- Workforce and Workflow Management
- Portfolio Management / Project Management
- PDAs / Smartphones / PCs / Servers / IT Management Systems / Email / MS Office / App Servers
- Voice and Data Network(s)

Phase 2: Smart Grid 2.0

- Meters and Customers
- Distribution Management System & Outage Management System
- Customer Portals / Web Services / IHDs
- Call Center
- CRM / CIS / Billing
- Conservation System
- Demand Response Sys
- Marketing Program Sys
- Smart Appliances
- Sub-Metering Sys
- Smart Charging Sys
- DG Mgmt Sys
- Storage Mgmt Sys
- LAN/PAN/HAN

Additional Systems:
- Lab Mgmt Sys
- DG Mgmt Sys
- Storage Mgmt Sys
- Lab Mgmt Sys
- GIS / Materials Mgmt / Asset Mgmt / Facilities Mgmt
- CAD / CAE Applications and Modeling Tools
- Workforce and Workflow Management
- Portfolio Management / Project Management
- PDAs / Smartphones / PCs / Servers / IT Management Systems / Email / MS Office / App Servers
- Voice and Data Network(s)
- Field Force and AMI Networks
AE Smart Grid 1.0 Program Status

- Enterprise Architecture deployed in 2006
  - Portal, Enterprise Service Bus, Data Warehouse, Business Intelligence, Cyber Security, IT Management Tools, Fiber backbone
- 2-way RF network upgraded in 2007
  - One way RF network built in 2003
- Nodal Market Tools deployed in 2008
  - New Generation Management System, New Network Model, SCADA/EMS Upgrades, Maximo / Power Plant for Generation
- All 410,000 smart meters installed in 2009
  - First deployment of 127,000 smart meters in 2003
- New Meter Data Management System deployed in 2009
- 86,000 smart thermostats installed (22% of homes in Austin)
  - Started in 2003, 80k residential, 6k commercial, double by 2015
- New Billing System replacement in progress (mid 2011)
  - RT/TOU Pricing, Pre-pay, Web2.0, TXT/SMS, Self-service
- New Distribution Management System in progress (mid 2011)
  - Piloting now with 2,500 sensors
**PEV at AE When and How Many?**

- **2010**
  - < 1k PEVs
- **2012**
  - < 4k PEVs
- **2015**
  - 31k PEVs

**PEVs:**
- 20% of new vehicle sales
- < 3% of All Vehicles on road
- < 3% of VMT Fraction

**Costs decrease**
Most OEMs Have PEVs
30 to 40-mile EV range

**2020**
- 192 k PEVs

**PEVs:**
- 40% of new vehicle sales
- 10% of All Vehicles on road
- 8% of VMT Fraction

**V2G When and How Many?**
Thank You

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