American Electric Power’s Integrated Approach to the Smart Grid

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AEP Statistics

- 5.2 Million customers
- 11 States
- 36,000 Mw Generation
- 39,000 miles Transmission
- 201,000 miles Distribution
- $38.0 billion Assets
- $12.6 billion revenue (2006)
- 20,400 Employees

AEP Service Territory
AEP's gridSMART™

Core areas of Study

- Consumer Programs
- Smart Grid
- Distributed Resources

Customer Benefits

- DSM/Energy Efficiency
- T&D system Efficiency
- Building Efficiency
- Vehicle Efficiency
- Generation Parasitics

Utility Benefits

- Consumer Programs
- End use protocols
- Real-time pricing
- Direct Load Control
- Distribution Operations
- Meter Data System
- Communications

Utility Operations Efficiency Programs

Supporting areas of Study

- Business Process Integration
- Information Technology
- Financial Modeling
- Business Development
- Communications
A suite of customer programs and advanced technologies that will transport us into a new era of energy delivery and customer service. It includes consumer programs and new energy delivery system technologies that
• improve service quality and reliability,
• integrate future generation and storage devices that will respond to energy needs in the neighborhood and
• advance AEP internal system efficiencies.
AEP intends to utilize technology at the customer’s premise and throughout the distribution system to reduce demand, improve energy efficiency and improve reliability.
South Bend Model City Demonstration

- AMI 10K Meters
- Utilizing Common Communications Infrastructure for AMI and Grid Management
- Manage 25 reclosers and 25 capacitors
- Utilize GE DMS as DSCADA host
- Integrate DMS with existing GE OMS and new AMI infrastructure
- Software integration utilizing Common Information Model (CIM) in coordination with EPRI
South Bend Pilot Goal – Utilize Grid Management to Improve Reliability, Energy Efficiency, and Customer Experience

Automated switches and reclosers can reconfigure the system to restore customers in un-faulted line sections.

Automated Capacitor Controls can optimize power factor and report capacitor availability.
gridSmart℠ Architectural Requirements

- Current Landscape... “Our major systems are a “patchwork quilt” of interfaces stitched together to support isolated work processes and manual data collection... (34 systems)”
- gridSmart ... “Our future system should be driven by our integrated business process changes, which will require new systems and redesigning the way our systems integrate”
  - Leverage legacy systems as much as possible
  - Industry standards based interfaces and messaging structure
  - Common data model
  - New Systems & applications to meet gridSmart objectives
AEP Architecture – Step #1 AMI

Network Management Server (NMS)

Backhaul Networks

Gateways

Distribution Networks

Meters
AEP Architecture – Step #2 Smart Home

- Network Management Server (NMS)
- Backhaul Networks
- Gateways
- Distribution Networks
- Meters
- Home LAN
- PCT Eco-Panel
- Smart Homes
AEP Architecture – Step #3 DA
AEP Architecture – Step #4 Substation Automation
AEP Architecture – Step #5 CIM

Integration Bus

Data Management
- Hist
- CIM

Network Management Server
- EMS

ENMAC DMS
- ICCP

T&D Stations
- Station LAN
- Protection
- I/O
- Monitoring & Diagnostics

Distribution Networks
- Distribution Devices
  - Switches & Reclosers
- Caps
- Meters

Backhaul Networks

Gateways

Home LAN
- PCT Eco-Panel
- Smart Homes
AEP Architecture – Step #6 TERS & MDM Interface
AEP Architecture – Step #7 Power On

Integration Bus

Data Management
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Backhaul Networks

Network Management Server

EMS

ENMAC DMS

Gateways

Distribution Networks

T&D Stations
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- I/O
- Monitoring & Diagnostics

Distribution Devices
- Switches & Reclosers
- Caps
- Meters

Home LAN

PCT Eco-Panel

Lode Star Meter Data Management

ERS

Security

PowerOn

Integration Bus

 empresarial Users

ICCP
AEP Architecture – Step #8 Enterprise Interfaces

Integration Bus

- T&D Stations
- Network Management Server
- EMS
- ENMAC DMS
- ICCP

Backhaul Networks

- Distribution Networks

Gateways

- Home LAN
- PCT Eco-Panel
- Smart Homes

Distribution Devices

- Meters
- Switches & Reclosers
- Protection
- I/O
- Monitoring & Diagnostics

Distribution Networks

- T&D Stations

Data Management

- Hist
- CIM

Integration Bus

- Security
- TERS
- Lode Star Meter Data Management
- Enterprise Users
- PowerOn
- Security
- Enterprise Systems ERP., CIS, MMS, WMS, WFM, etc

Customer Portal

- Security

ERS

Security

Hist

CIM

ENTRYS

Security

Hist

CIM

Integration Bus

Security

Hist

CIM

Integration Bus
System Integration Goals

- Improve timeliness and number of outage notifications received by using meters as initial outage notification
- Improve the accuracy of predicted device analysis for non-SCADA outages
- Use meter up notifications as the restoration time for partial & full restoration times
- Eliminate crew responses to non-utility problems using power up results & meter ping capabilities
- Auto-detect and respond to nested customer outages as larger scale outages are restored
- Integrate AMI and Interrupting device data for use in OMS time stamps and reliability statistics
Grid Management Goals

• Assess ability to utilize a common communication infrastructure for AMI and Grid Management
• Integrate the results of auto-restoration with a Distribution Management System (DMS)
• Provide Distribution Dispatchers full DMS schematic displays of entire feeder & all devices
• Integrate all feeder-level device operations with current OMS
• Provide remote capacitor monitoring & control
• Assess ability to improve reliability, energy efficiency, and customer experience
Future Plans

• Complete Grid Management Projects that are part of Operating Company Reliability Strategies

• Include Grid Management in Model City Demonstrations and larger deployments as Regulatory support is achieved

• Continue development of Distribution Management System (DMS / GE ENMAC) to integrate SCADA, Power-On OMS, and AMI messaging.

• Include Integrated Volt/Var Control (IVVC) in Model City Demonstrations

• Add IVVC to existing DA Schemes where practical

• Deploy Grid Management where benefits justify. Examples include loss reduction, reliability improvement, and avoiding higher cost projects to provide needed additional capacity.
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Questions?
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