The Journey of the OSIsoft PI System at Xcel Energy

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Xcel Energy: Who we are

- Eight states served
- Approximately 3.5 million electric and 2.0 million natural gas customers
- Revenue of $11.7 billion (YE 2014)
- No. 1 wind energy provider
- No. 5 in utility solar capacity
- Top 5 in energy efficiency programs
- Industry-leading in voluntary emission reductions through new technologies
Xcel Energy: Who we are

- Over 12,000 Employees
- Assets: $28 billion (property, plant, & equipment)
- Own and operate:
  - 17,000 MW of Generation
  - 20,000 miles of Transmission lines
  - 1,200 Substations
- $14.5 billion Capital Expenditure Plan (2015-2019)
- The multiple mergers led Xcel energy to have disparate process in each of the jurisdictions
Transformation through Innovation

- The utility industry has seen more change in last 10 years than in the previous 100 years.
- There are many business drivers that are causing us to innovate:
  - Renewable energy
  - Energy efficiency
  - Distributed generation
  - Energy storage
  - Electric vehicles
  - Grid Modernization
- Xcel Energy Four Pillar Plan
  - Improve Operating Companies Performance
  - Transition a Workforce Ready for Competition
  - Compete for Customers
  - Grow the Business
Xcel Energy and OSIsoft

- Business Systems CIO strategic priorities
  - Think more strategically
  - Maximize partner value
  - Increase our throughput
- Xcel Energy’s partnership with OSIsoft helps achieve this criteria
- OSIsoft PI System real-time operational information infrastructure helps with bridging the gap between assets and people while providing visibility across service territories
Productivity Through Technology (PTT) Initiative

• Productivity Through Technology (PTT) is a commitment to innovation to drive consistent processes

• We are implementing technologies that can streamline, simplify, and improve work processes throughout all of our Operating Companies.

• We are employee driven. This initiative is about people, process and technology.

• We are implementing enterprise systems which leads to consistent process and data usage across three Operating Companies.

• The Enterprise Agreement (EA) with OSIsoft is a cornerstone of PTT.
Xcel Energy and OSIsoft Success is based on…

• The strength of our partnership with OSIsoft
• Business customers who are committed to the journey
• Business leadership sees the benefits that PI System can drive for enterprise consistency in data, reporting and process
• Strong centralized PI System delivery team with an enterprise focus
• Delivery team who educates/evangelizes the benefits of the PI System on a regular basis.
The journey is loaded and ready to go
The Journey Begins

- 1990’s: Four individual plants have separate PI System installations
- 2003: First centralized installation in Colorado Transmission Operations, followed by Installations in Minnesota and Texas
  - Generation and market pricing data used by Commercial Operations
  - System expanded for new SPP market and MISO market changes
- 2008: Wind Forecasting efforts begins
- 2011: Enterprise Agreement (EA) Signed Covering PSCO, SPS and NSP Transmission Operations and Commercial Operations as well as Wind Data Integration
- 2013: Pilot added to cover 6 coal fired generation facilities for diagnostic purposes
- 2015: EA expanded to cover 7 more Combined Cycle (Gas) and 1 coal fired generation facilities along with a centralized Diagnostic Center
Overview of PI Deployments at Xcel Energy

PI System deployments at Xcel Energy include:

- **EMS**
  - Electric Transmission Operations
    - All Operating Companies
    - With limited Gas, Distribution and Substation Data

- **Corporate**
  - Commercial Operations
    - Wind and load forecasts, ISO data, internal applications
  - Xcel System Summary Dashboard

- **Generation** (~13,300 MW of ~17,000 MW)
  - Two Nuclear plants, seven coal and seven gas generation facilities
  - Centralized Diagnostic Center
  - eLog – all 76 owned generation facilities
Xcel Energy PI System Point Counts

- Initial PI install (Nov. 2003)
- Wind forecasting efforts begin
- EA Agreement
- EA Agreement expanded

Graph showing point counts from 2004 to 2016:
- Corporate
- Diagnostic
- Transmission
- Total
Transmission – PI AF, Counterparty Connections
The Journey Continues: Wind Forecasting

• Started in 2008 and continues with ongoing improvements
• Partnered with NCAR and NREL
• Now hosted by GWC

• Benefits
  – Reduced error by 38%
  – Savings/efficiencies of $46M over six years
  – More efficient and maintenance minded operation of Fossil Fuel Plants
  – Allow coal plant to be shut down for a weekend
  – Colorado Territory %50 wind for 24 hour period
Wind Forecasting
### Commercial Operations

#### Wind Generation data quality – AF Analysis

**Xcel Energy**

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This table and diagram show the data quality analysis for Xcel Energy's wind generation systems, highlighting key metrics and performance indicators.
The Journey Expands: Monitoring and Diagnostic Center

- PI System provides primary data to M&D center and is the foundation for many applications including Predictive Analytics, Process Screens, Controllable Parameters and On-line Heat Rate Monitoring.
- PI System is installed at seven major coal plants and seven major combined cycle plants
- Allows centralized SMEs secure access to plant data for assistance in troubleshooting and analysis

- PI System will be an enabler for the following:
  - Smart Signal
  - Executive Operating Report - “150z”
  - Near Real time Dispatch Curves
  - Vibration Analysis
  - Meridium
  - Near Real time Dispatch Curves
  - Emissions Tracking
  - Energy Supply Initiatives (Provides data access for SMEs, Meridium Data, Controllable Losses, and E-Log)
  - Smart Signal Diagnostics (M&D Center)
  - Plant Operations and Engineering Expertise (Knowledge retention)
Stream real-time data and calculations into cycle monitoring sheets and provide embedded trend charts.
## Monitoring and Diagnostic Center

Streams real time data and calculations for plant controllable monitoring sheets

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<td><strong>Net Unit Heat Rate</strong></td>
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* Spray deviation is a percentage of MS and HRH flow
* Note a decrease in Heat Rate is an improvement
Executive Summary Dashboard

- Commercial Operations & Generation
  - PSCo, SPS, NSP, all systems

- Energy Supply
  - Controllable Parameters, Steam Cycles

- Transmission
  - PSCo, SPS, NSP

- Executive Summary
  - All Operating Companies in one view
Executive Summary
The Journey Ahead of Us

- Substations and Dissolve Gas Analysis
- SAP
- Gas Distribution
- Gas Transmission
- Emissions
- Electric Distribution
- Distributed Generation
- Smart Meters
- Anything the Business can dream of
Thank You

Remember: “Don’t Stop Believing”
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