Smart Grid Strategies

National Academy of Sciences workshop

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About ISO New England

• Private not-for-profit
• Regulated by the federal government
• Independent of companies doing business in market

• Administer competitive wholesale electricity markets
• Operate transmission system
• Plan for long-term system needs
New England’s Electric Power Grid at a Glance

- 6-state region
- 14 million residents; 6.5 million meters
- 350+ generators
- 37,000 MW of resources with capacity supply obligations
  - 32,000 MW generation
  - 2,900 MW demand resources
  - 1,900 MW imports
- 8,400 miles of transmission
- 28,130 MW all-time peak demand
Strategies to Improve System Control & Stability

• Dynamic Line Ratings
  – Real-time dynamic ratings using tension, line current or sag sensors
    • Can enable the integration of variable energy resources
      – i.e. wind power

• Adaptive Contingency (Emergency) Line Ratings
  – Move from static emergency line ratings to adaptive contingency line ratings
    • Adaptive line rating calculated using shadow re-dispatch software

• Alternative Technology Regulation Resources
  – Integrate new technologies that enable fast regulation performance
    • i.e. fly wheels, battery storage, compressed air, and demand resources

• Enhance state estimator and contingency analysis software
  – Run continuous solutions rather than periodic (5 minute) solutions
  – Possible with improved computer hardware performance
Strategies to Improve System Control & Stability

• Development of new system monitoring tools for system operators to manage increasing “data overload”
  – Visualization, intelligent alarming and new reporting tools will be needed

• Phasor Measurement Units (PMU)
  – Improved real-time information to allow operation closer to stability limits
  – Enhanced situational and wide area monitoring of angular differences
ISO’s DOE-Funded Smart Grid Investment Grant

Project Name: Synchrophasor Infrastructure and Data Utilization

- Total cost: $18
- Entities involved:
  - ISO New England
  - Bangor Hydro-Electric Company
  - Central Maine Power Company
  - National Grid
  - Northeast Utilities
  - United Illuminating Company
  - Vermont Electric Power Company
- Implementation Project Schedule:
  - Start: July 2010
  - End: June 2013
- Equipment:
  - 8 Phasor Data Concentrators and disturbance applications
  - 35 new synchrophasors
  - 5 existing PMUs enhanced
  - Communication infrastructure
ISO’s DOE-Funded Smart Grid Investment Grant

- GPS satellite used to ensure that data is sampled at the same instant in time by PMUs installed at remote locations throughout the power system
ISO’s DOE-Funded Smart Grid Investment Grant

- With this project, the entire New England region is expected to realize the following benefits:
  - Improved reliability through enhanced situational awareness
  - Faster response to real-time system events
  - Increased capability of monitoring system stability and more accurate system models
  - New capabilities in system restoration

The synchrophasors measured by the PMUs will be communicated to local control centers and the ISO.
New Opportunities for Regional Consumers to Benefit from Demand Response and Smart Grid

• On June 1, 2010, ISO implemented the Forward Capacity Market (FCM)
  – Demand resources now represent approximately 10% of capacity supply obligation

• New infrastructure developed to securely communicate dispatch instructions, and receive near real-time telemetry and revenue-quality meter data from active demand response capacity resources
Dispatch Zones Help Improve DR Performance

- DR dispatched in “Dispatch Zones”
  - Allows dispatch of resources only when, where and in amounts needed
  - Dispatch in 19 targeted areas:
    - Prevents unnecessary activation of DR
    - Limits customer fatigue
  - Flexibility allowed for providers to use a portfolio of assets to respond within a zone
Communication of Real-Time Information

- Significant investment has been made to integrate demand resource information
- Interruption instructions
  - When, where, and how much load to interrupt when needed
- Interval metered load data
  - Information from thousands of facilities that provide load reductions when the system is capacity deficient

- Communicate performance in response to dispatch instructions