Wide Area Voltage Dispatch

- Case studies of ISO New England using NETSS AC XOPF program

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EPRI AVC Workshop
PJM, Norristown, PA
May 19, 2011
Outline

• Introduction of ISO-NE
• Voltage / Reactive Operating Practices of ISO-NE
• Motivation of wide area voltage dispatch study
• NETSS XOPF Program
• Case studies using NETSS AC XOPF program
• Summary and recommendations
About ISO New England

• Private, not-for-profit corporation created in 1997
  – Independent of companies doing business in the market
  – Regulated by the Federal Energy Regulatory Commission (FERC)

• Approximately 450 employees
New England’s Electric Power System

- 6.5 million electricity customers; population 14 million
- 350+ generators, 400+ Participants
- 8,000+ miles of high-voltage transmission lines
- 13 interconnections with systems in New York and Canada
- 31,000 MW of installed generation capacity
- Peak demand: 28,130 MW on August 2, 2006 (after approximately 640 MW of load reduction from DR programs and other actions)
- $8 billion electric energy market (2009)
Three Primary Areas of Responsibility

Reliability
- Maintain minute-to-minute reliable operation of the region’s bulk power generation and transmission system

Markets
- Oversee and administer New England's wholesale electricity marketplace, through which bulk electric power is bought, sold, and traded

Planning
- Plan and ensure the development of a reliable and efficient bulk power system to meet New England’s current and future power needs
ISO – Local Control Center (LCC) Start-up Dates

- NH ESCC, Manchester: June 1, 1970
- CONVEX, Connecticut Valley Electric Exchange: January 1, 1964
- REMVEC, Rutland, VT: April 1, 2005
- VELCO, Rutland, VT: April 1, 2005
- Maine: November 1, 1969
- NSTAR, Boston: December 1, 2007
- Rhode Island E. Mass Energy Control: April 1, 1969
Voltage / Reactive Operating Practices of ISO New England

• **Traditional Voltage / Reactive control**
  Use of shunt capacitors and reactors.
  Maintain LTC Transformer voltage schedules.
  Generator Automatic Voltage Regulators (AVR’s)

• Transmission interface transfer limits to avoid low voltages after contingency

• Circuit switching to control high voltage

• Load management for voltage / reactive reliability
Responsibilities of Voltage Control

• Generators and Transmission Stations:
  
  ➢ Maintain voltage schedules set at the high side of the generator step up transformer.
  
  ➢ When unable to maintain scheduled voltages the generating or transmission station operators should notify their respective LCC operator.

• Local Control Centers are responsible for:
  
  ➢ Detecting and correcting deviations from normal scheduled voltage/reactive operations.
  
  ➢ Responding to notifications by station operators of difficulty in maintaining station or other local voltage or reactive schedules.
  
  ➢ Responding to ISO requests to assist with inter-LCC or inter-Area problems.
Responsibilities of Voltage Control

• Local Control Centers monitor and supervise the following within their territories:
  - Voltage schedules and limits
  - Unit MVAR loadings, capabilities and reserves
  - Shunt capacitor and reactor dispatches
  - Transformer voltage schedules or fixed tap settings
  - MVAR flows between the AC and HVDC facilities
  - Static VAR Compensator operation (must be coordinated with ISO)
  - Line switching for voltage/reactive control (must be coordinated with ISO and other LCCs)
  - Load management (must be coordinated with ISO)
Responsibilities of Voltage Control

• ISO-NE is responsible for:
  ➢ General monitoring and supervision of voltage/reactive conditions in the New England area (115KV and above)
  ➢ When a LCC reports to the ISO that it is not possible to correct a problem at a station or LCC level, the ISO will assume direct responsibility for alleviating the problem
  ➢ Monitoring and supervising voltage/reactive operations of inter-Area ties

• ISO-NE is authorized to work with/through the LCCs to eliminate voltage problem using:
  ➢ All actions of LCC, and
  ➢ Unit MW re-dispatching
Motivation of Wide Area Voltage Dispatch

• No simultaneous optimization of real power generation and reactive power / voltage dispatch

  ➢ Real power interface limits are often used as a surrogate for the voltage limits

• Voltage profile is not really optimized and well coordinated

• Reliability and efficiency enhancement by means of nonlinear and robust AC OPF software