# The Evolution and Expansion of System Planning

**Gordon van Welie**, President and CEO
ISO New England Inc.

NECPUC Symposium
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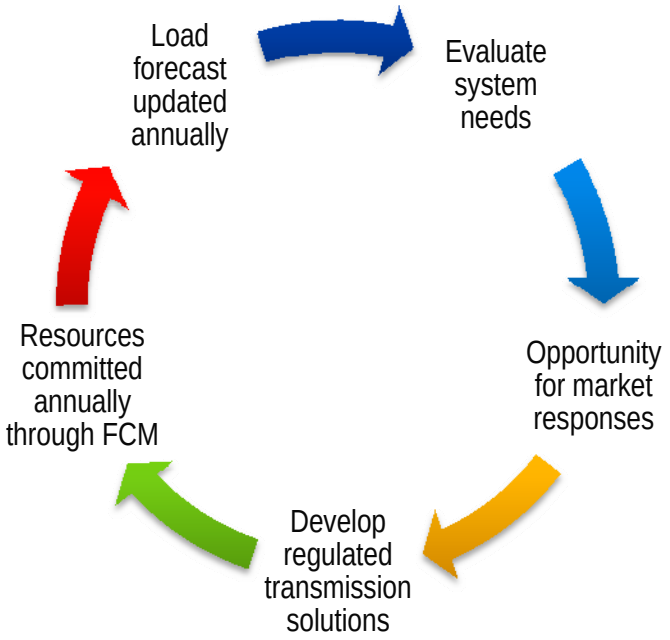
# New England Planning Process is Continuous, Adaptive, Successful

- Transparent, 10-year annual needs assessment reflects:
  - Updated load forecasts
  - Market responses
  - Timing of future resource needs
- Preferred transmission solutions
- Results: reliability-based transmission investment across the region

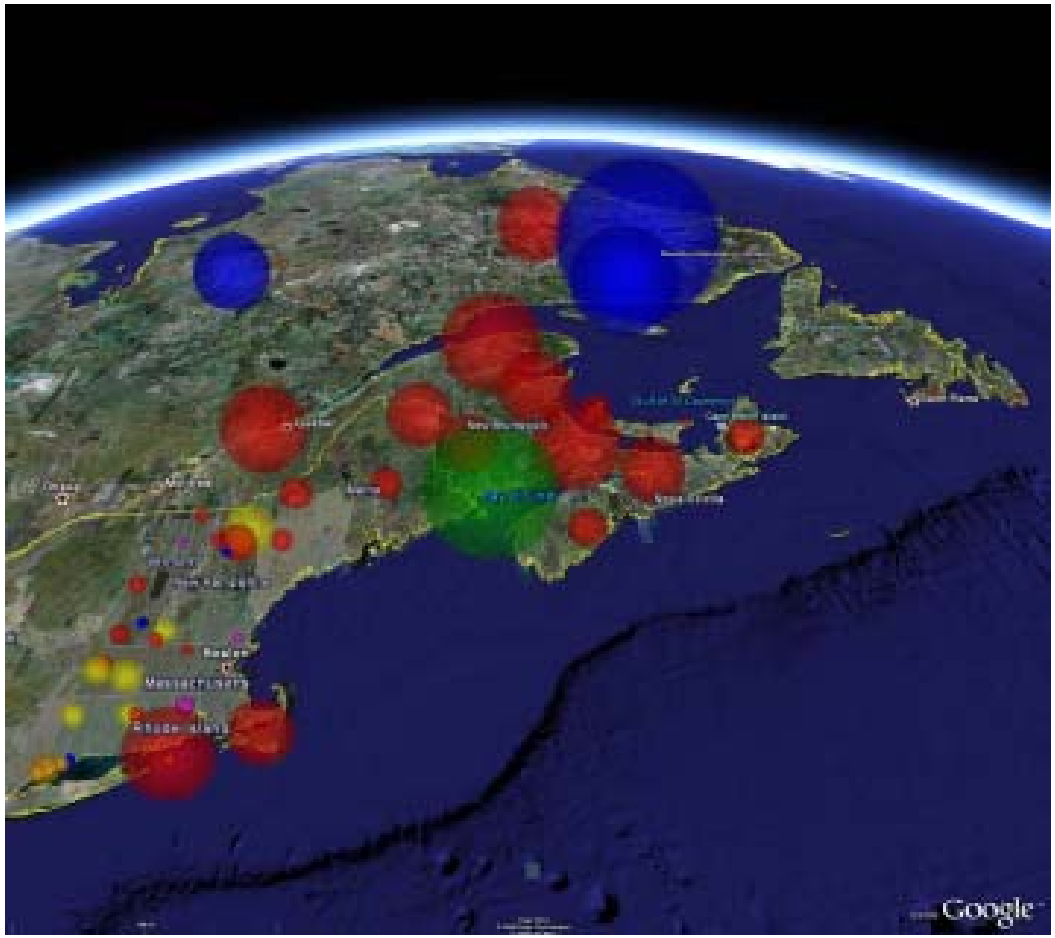


# Planning Evolving Beyond Reliability Needs

***Policymakers seek environmental, economic solutions***

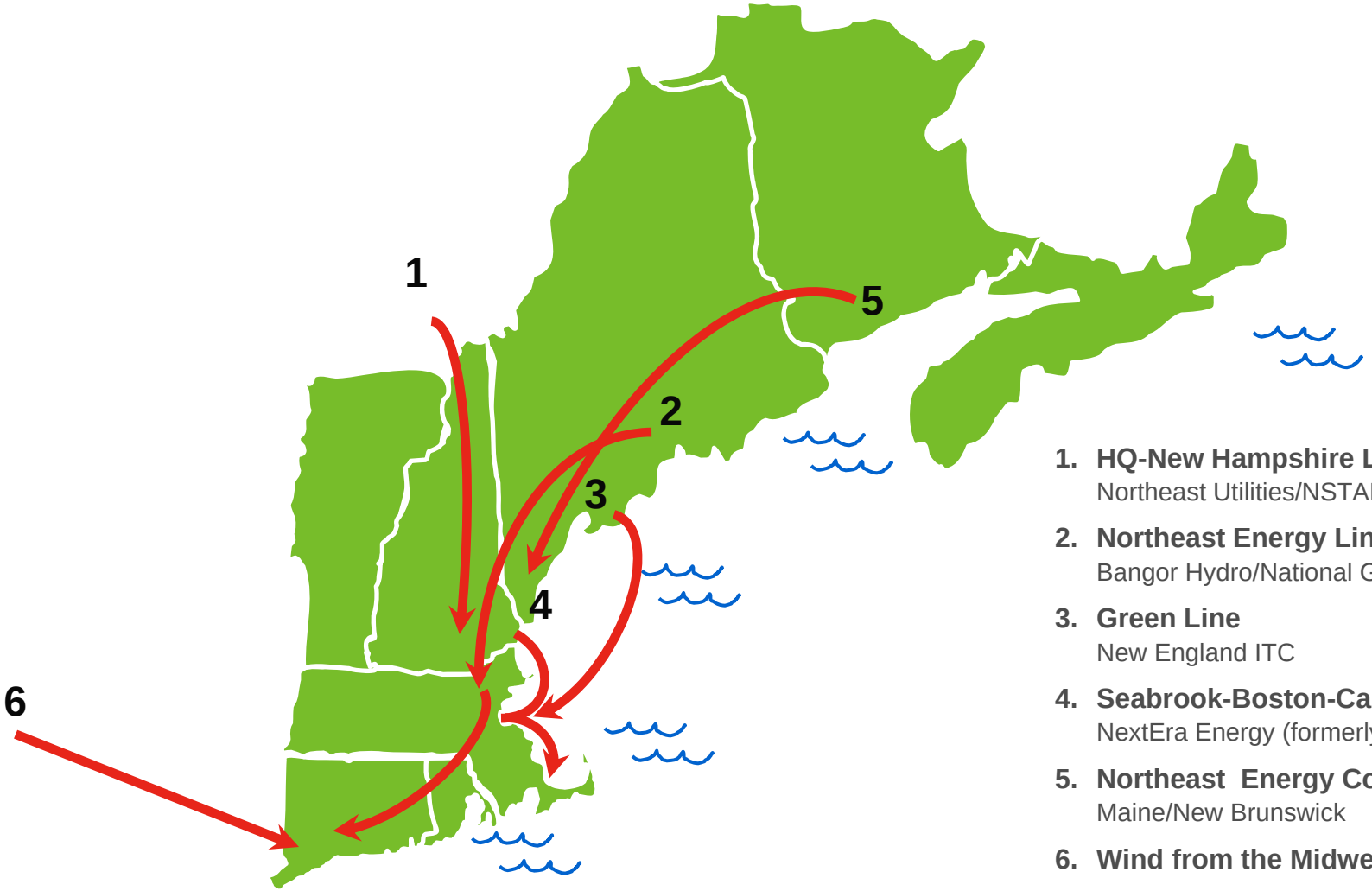
- **FERC** requires economic studies in 2008
  - Studies evaluating multiple long-range resource and transmission scenarios have been performed but cost allocation is undecided
- **Governors** pursue long-term vision for renewable integration
- **Congress** seeking legislation for:
  - Aggressive transmission development, broader planning, a smarter grid, national carbon cap and trade, national RPS

# Developers Proposing Renewable, Low- and Non-Emitting Resources in New England, Eastern Canada




- Hydro
- Wind
- Biomass
- Landfill gas
- Fuel cell
- Nuclear

# On- and Off-shore HVDC Projects Vying to Move Renewable Energy to New England Load Centers




1. **HQ-New Hampshire Line**
   Northeast Utilities/NSTAR
2. **Northeast Energy Link**
   Bangor Hydro/National Grid
3. **Green Line**
   New England ITC
4. **Seabrook-Boston-Cape Cable**
   NextEra Energy (formerly FPL)
5. **Northeast Energy Corridor**
   Maine/New Brunswick
6. **Wind from the Midwest**

# Governors' Request ISO Technical Support for Regional "Blueprint"

- States seek to identify:"***significant sources of renewable energy available to New England, the most effective means to integrate them into our power grid, and the estimated costs***."
  - New England States Committee on Electricity (NESCOE), March 2009
- Request economic study for 2009
- Transmission funding methodology uncertain

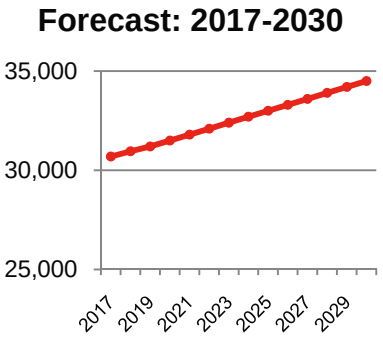
# Blueprint: Approach

- Study is based on renewable resource scenarios
  - Combination of wind, demand resources, PHEV, energy storage and expanded imports
  - Range of resource penetrations (low / medium / high)
  - Long-term horizon: approximately 20 years into the future (around 2030)
- Evaluates generation retirement scenarios
  - Gas units added if needed to meet Installed Capacity Requirement
- States are developing study assumptions

# Blueprint: Preliminary Assumptions

## Existing Resources

- Existing capacity plus resources selected in Forward Capacity Market




## Demand Forecast

- Extrapolate *2009 Regional System Plan* forecast to 2030 (Approx. 34,500 MW peak demand)

# Blueprint: Preliminary Assumptions

## Wind

- Add up to 12,000 MW of on- and off-shore wind in New England
  - Off-shore wind distributed evenly between Maine, Massachusetts, and Rhode Island

## New Demand Resources

- On-peak and seasonal peak energy efficiency (Passive)
- Real-time Demand Response (Active)
- Emergency Generation

# Blueprint: Preliminary Assumptions

## Energy Storage

- Add generic energy storage scenario as a proxy for new pumped storage hydro, batteries, compressed air, or other technologies


## Plug-in Electric Vehicles

- Up to 2.5 million PHEVs in New England by 2030

# Blueprint: Preliminary Assumptions

## **Repowering**:

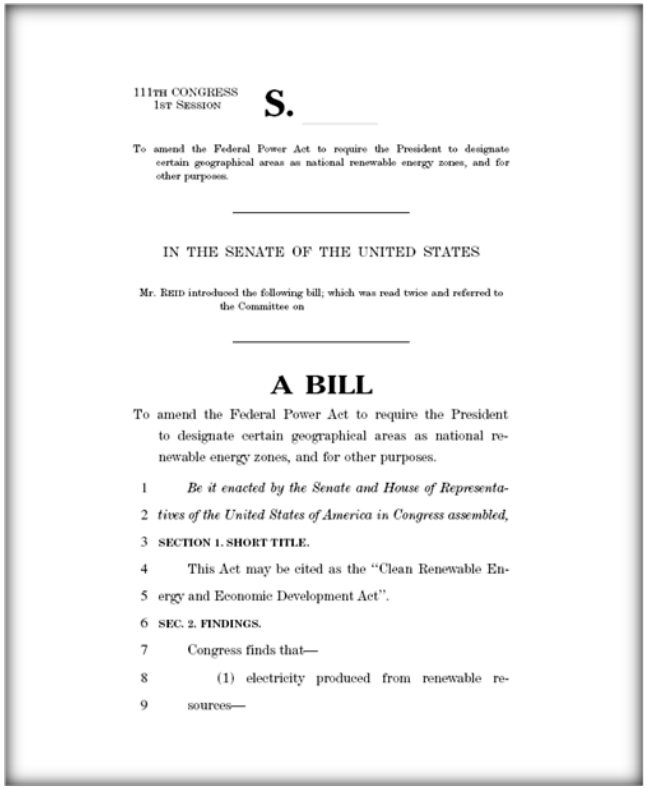
- Repower older fossil generators (oil and coal) with new state-of-the-art natural gas generators

## **Imports**:

- Expand interconnections with neighboring systems to increase imports of clean energy supplies

# Congress to Require Broad-based Planning

- Stimulus calls for interconnection-wide planning, study of renewable integration
- Discussion of new planning entity to develop transmission for Eastern Interconnection
- National debate ongoing:
  - Should planning be top-down or bottom-up?
  - Scenarios or plans or combinations?
  - Appropriate role of ISOs/RTOs and states?



111TH CONGRESS
1ST SESSION

**S.** _____

To amend the Federal Power Act to require the President to designate certain geographical areas as national renewable energy zones, and for other purposes.

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IN THE SENATE OF THE UNITED STATES

Mr. REID introduced the following bill; which was read twice and referred to the Committee on

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**A BILL**

To amend the Federal Power Act to require the President to designate certain geographical areas as national renewable energy zones, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

**SECTION 1. SHORT TITLE.**

This Act may be cited as the "Clean Renewable Energy and Economic Development Act".

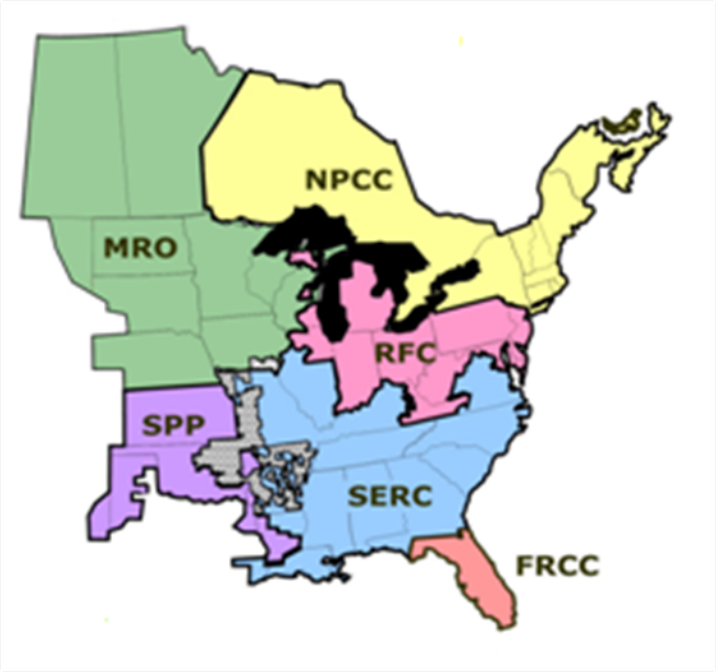
**SEC. 2. FINDINGS.**

Congress finds that—

(1) electricity produced from renewable resources—

# Making Broad Interconnection Planning Work for New England

- Planning authorities establishing collaborative for coordinated planning
- Create analysis of Eastern Interconnection using regional plans as foundation
- “Bottom-up” approach ensures New England characteristics, including Governors’ Blueprint, are considered
- FERC authority to modify regional plans



# Moving New England Toward Smart Grid

- Drivers:
  - Improve capacity utilization, reduce consumer costs, promote integration of DR, renewables, energy storage technology
- Requirements:
  - Clear objectives from federal and state policy makers
  - National standards; communications, interoperability, cybersecurity
- Progress:
  - Multiple ISO initiatives to enhance communications, visibility of smart grid devices, and testing of new technologies

# Challenges for ISO New England

- **Growing requirements in a period of significant cost control**
  - Existing initiatives stretching current resources
  - Accelerating state, regional and national regulatory requirements to integrate renewable resources and implement smart grid initiatives
  - Increasing stakeholder demand for complex and resource-intensive market improvements and planning services
- **Dilemma: Deciding priorities in a budget-constrained environment**

# Conclusion

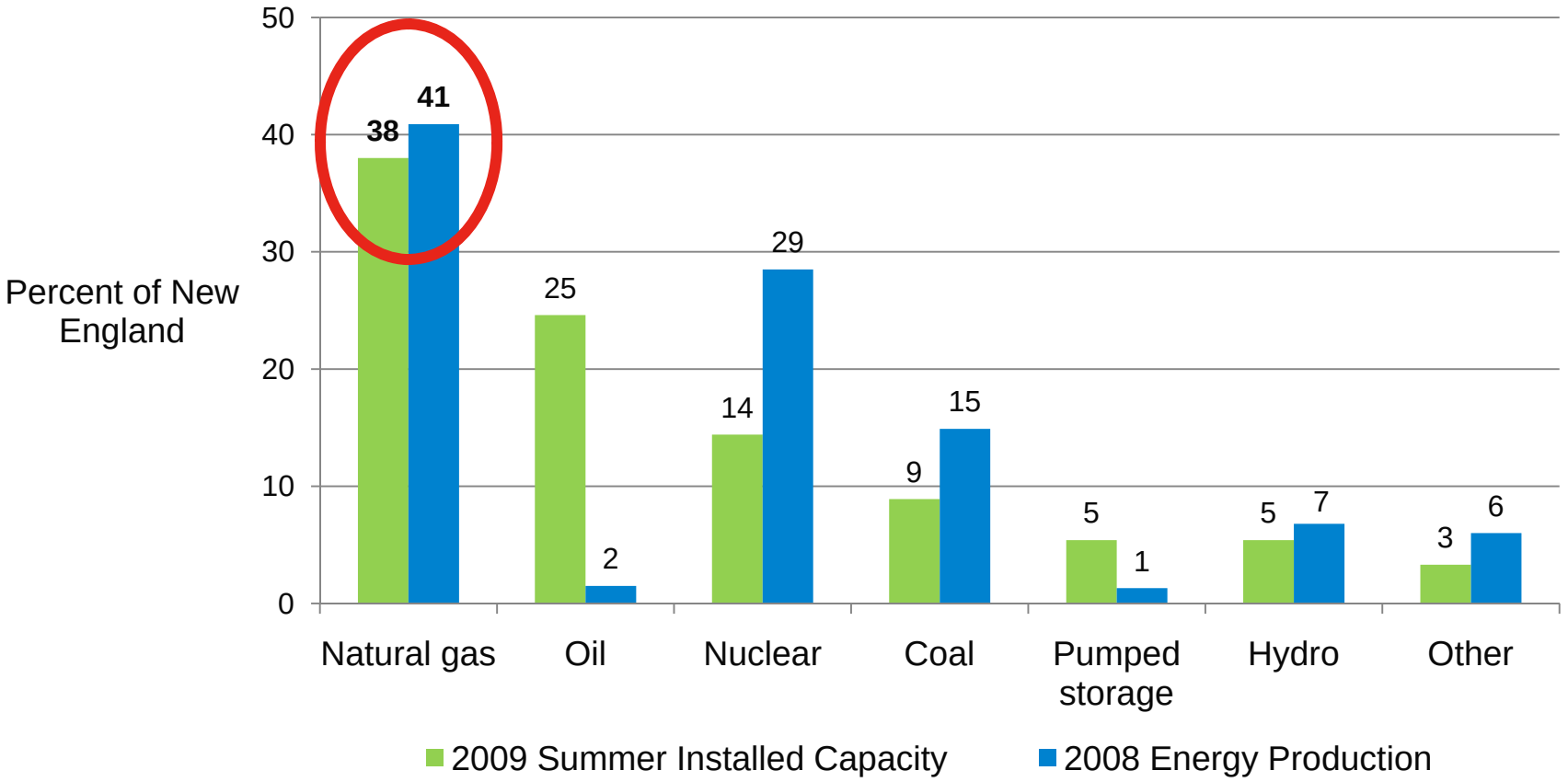
- Regional planning and cooperation is a solid foundation to meet new planning requirements
- New England to contribute to national energy goals
- ISO New England:
  - To support New England states in developing a regional blueprint for the future
  - Seeks input on five-year business plan and priorities

# Natural Gas Use in New England's Power Sector

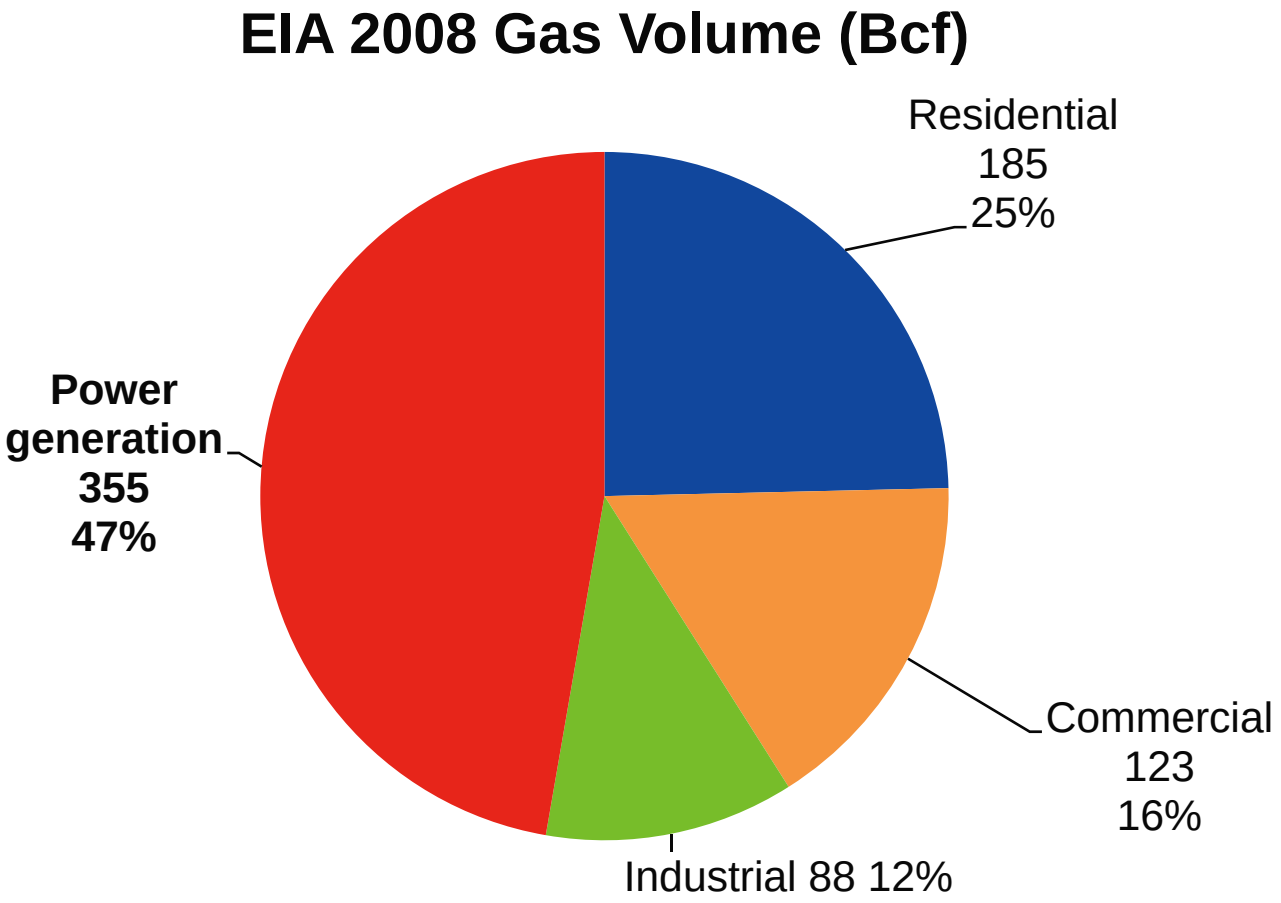
**Mark Babula**, System Planning
ISO New England Inc.

NECPUC Symposium
May 2009

# New England is Heavily Reliant on Natural Gas for Capacity and Energy



# Nearly Half of Natural Gas Consumed in New England is for Power Generation



# Power Supply and Gas Supply Diversity in New England

- State *Renewable Portfolio Standards* (RPS) promote diversity of generation
- Diversification of the regional natural gas supply and delivery system is in progress
  - New natural gas delivery infrastructure
    - Northeast Gateway & Neptune Deepwater Ports
    - Canaport LNG
    - Rockies Express
    - Enhanced storage capability and ability to flow gas bi-directionally
  - New natural gas supply sources
    - Global LNG
    - Rocky Mountain gas
    - Shale gas (Marcellus & others)

# New and Improved Tools to Improve Electric System Operators' Visibility of Gas System

- Electric/Gas Operations Committee (EGOC) facilitates education, understanding, communications and coordination
- Access to all regional pipeline Electronic Bulletin Boards (EBBs)
- Software tool that compiles information from EBBs: maps, gas flows, notices, etc. (Bentek Energy)
- FERC Order No. 698 provides ISO with authority to obtain fuel supply information from individual gas-fired generators

# Communications is Key

- Electric system operators need advance notice of events on the gas system that may impact fuel deliveries to gas-fired generators
  - *Electric/Gas Operations Communications Protocol* provides real-time gas system information to ISO control room
  - Northeast Gas Association (NGA) supports ISO-NE, NYISO & PJM
    - Winter Gas Supply Manual
    - Gas Supply Task Force (GSTF) debriefing notes
    - Any other pertinent gas sector information
- ISO-NE and regional pipelines are now coordinating maintenance outages to ensure both electric & gas system reliability

# Mitigating Reliability Issues

- **Completed actions**:
  - Improvements to market rules and procedures
  - New inter-industry coordination and communications protocols
  - Prominent infrastructure additions within both sectors
- **Continued challenges**:
  - Mismatch between the wholesale natural gas and electric markets
  - Resource commitment uncertainties
  - Unforeseen events in real-time operations
  - LNG supply risks
  - Natural gas quality/interchangeability
  - Price exposure
  - Others

# What's Next on the Horizon?

- Significant interest in renewable projects
  - Wind, biomass, small hydro, fuel cells, other projects
  - Imports from Eastern Canada
- System will need resources with quick-start, fast-ramping characteristics
  - Newer gas-fired generators can balance output from intermittent resources
- *New England's power sector will continue to rely on natural gas for many years to come*

# Roadmap to Renewable and Demand Resource Integration in New England

**Vamsi Chadalavada**, Sr. Vice President & Chief Operating Officer
ISO New England Inc.

NECPUC Symposium
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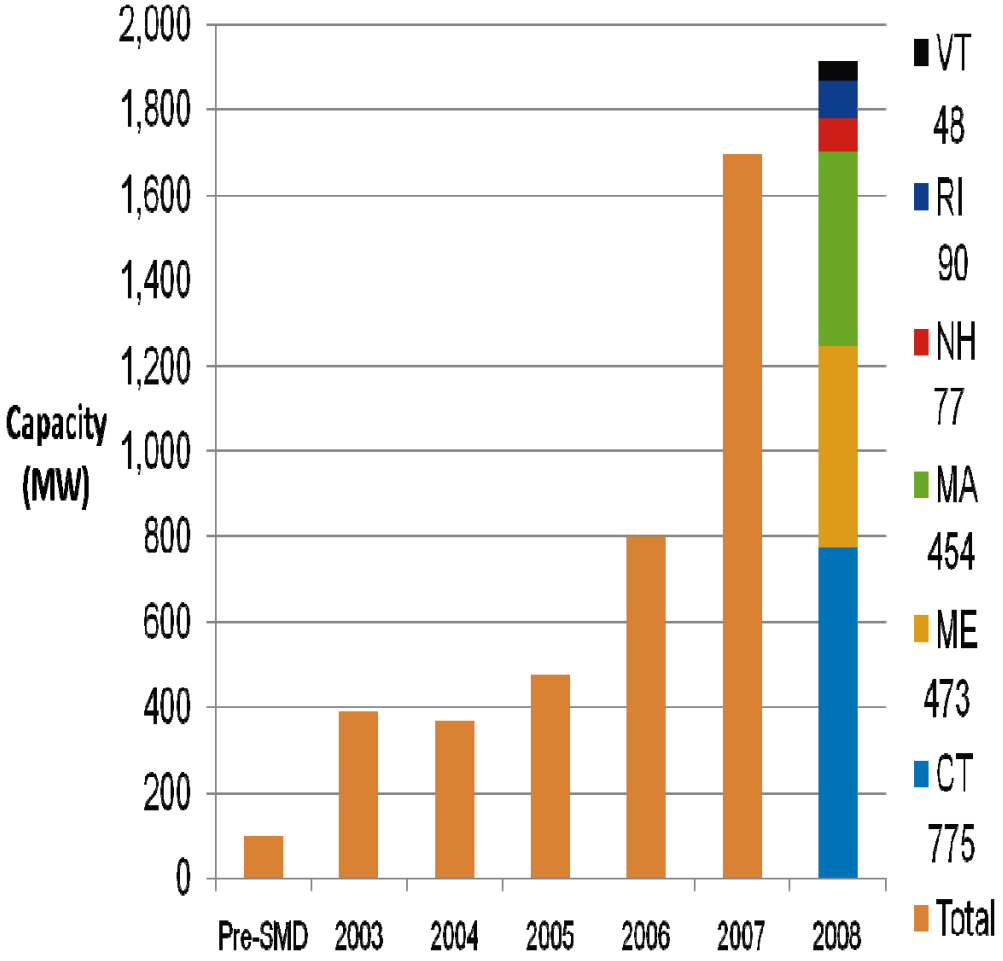
# New England's Future Grid

- Distributed and renewable resources are starting to become main-stream
- The power system grid is evolving from a traditional generation base to various different kinds of resources:
  - Demand Resources
  - Wind and other intermittent renewable resources
  - Storage devices such as flywheels, batteries and plug-in hybrids
- Wind resources present the largest opportunity for growth in renewable integration

# Operational Challenge

- Integration of demand and renewable resources effectively into real-time operations is critical to maintain reliability
  - Today, the ISO is focused on the integration of Demand Resources
  - Next, the ISO will be focused on the integration of wind and “smart grid” resources

# Demand Resources Integration

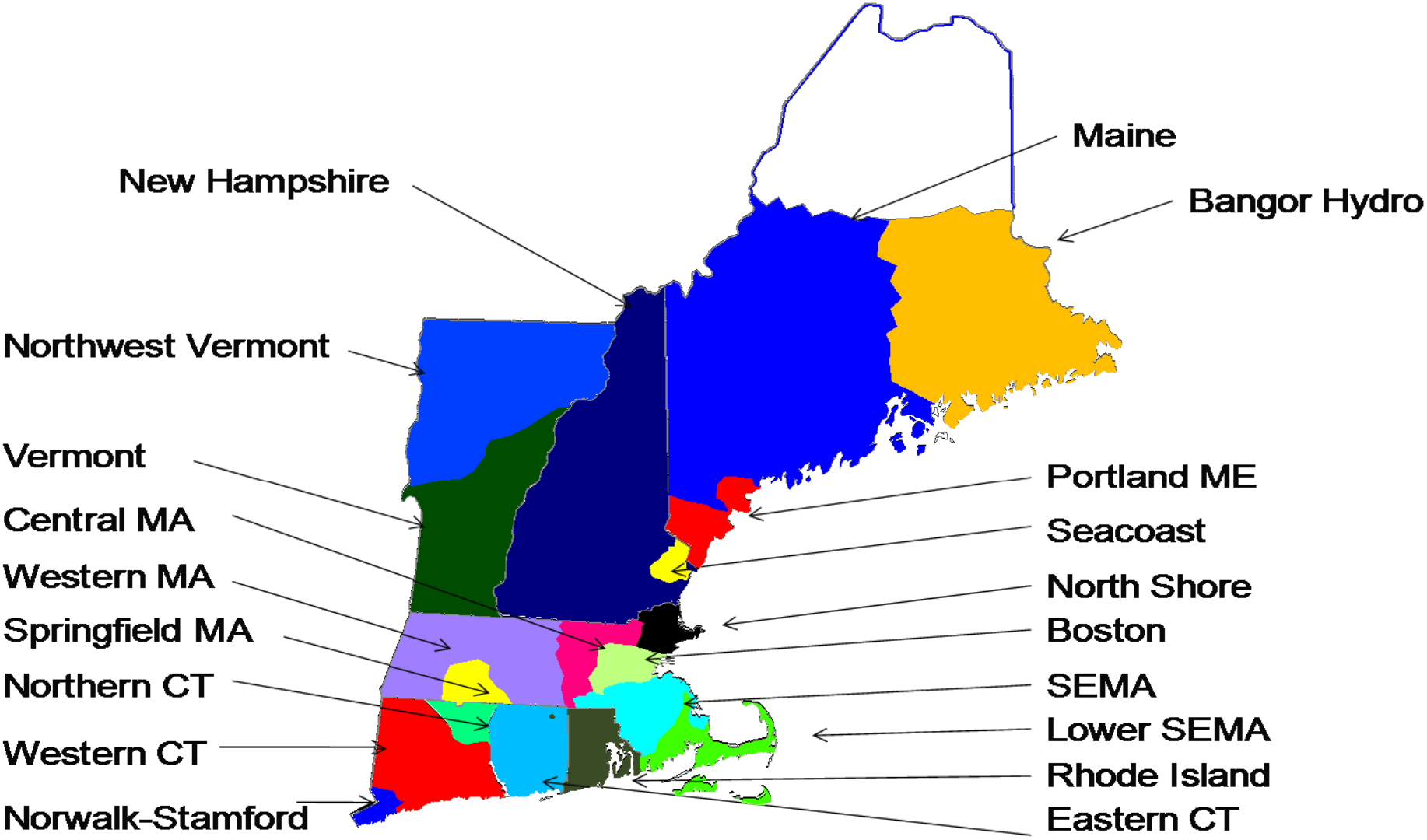



- Growth of Demand Resources (DR) continues under FCM
- DR Clearing in Forward Capacity Auctions:
  - FCA #1: over 2500 MW
  - FCA #2: over 2900 MW

# New Dispatch Rules Improve DR Performance

- DR to be 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

# Dispatch Zones Under FCM



# Improved DR Software & Communications Infrastructure

- Developing enhanced and secure communication with DR
- Improving forecasting of DR availability and projected use
- Implementing new software that will fully integrate the DR solution into the Energy Management System

# Integrating Wind Resources

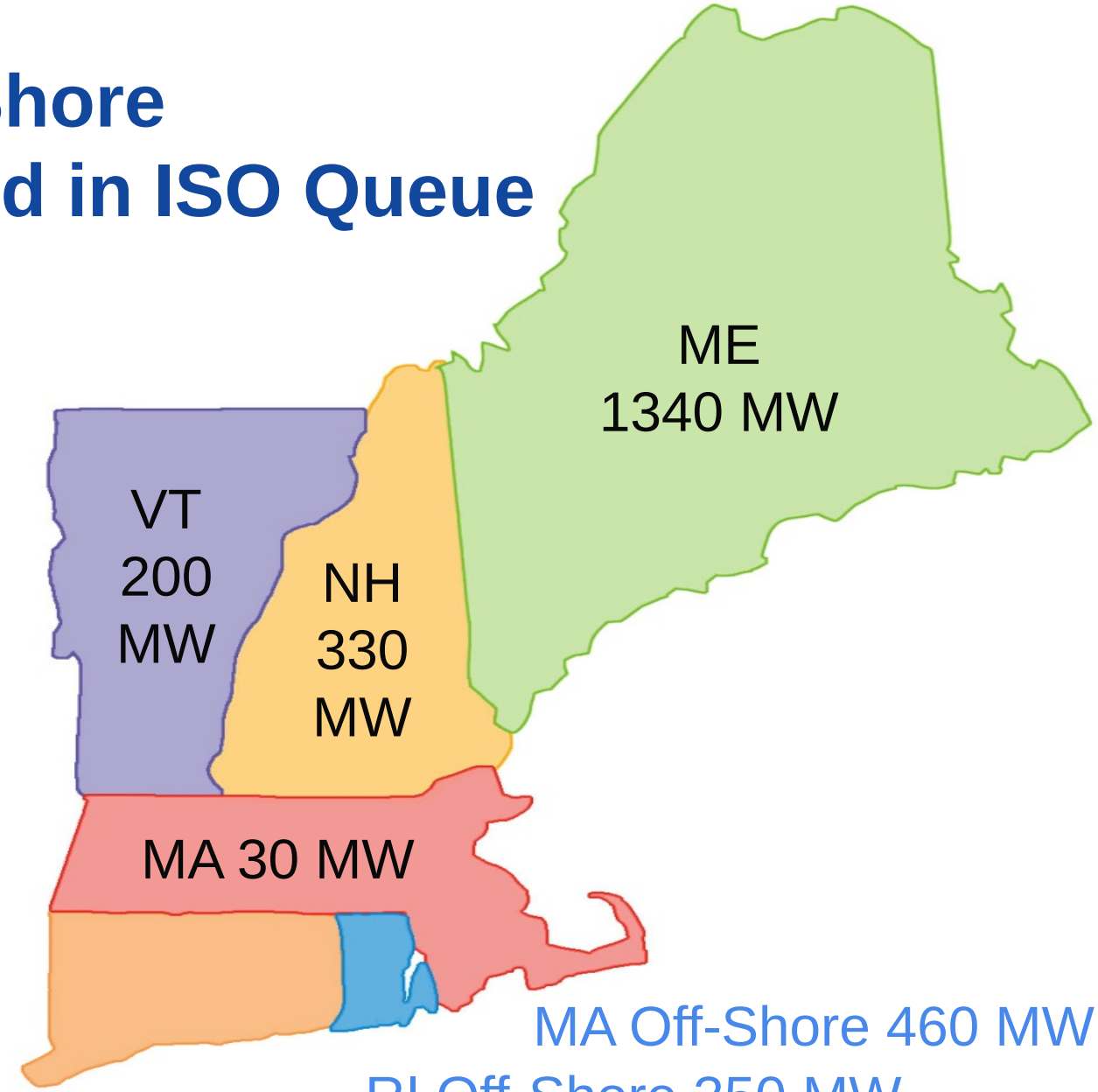
- Transmission infrastructure to deliver large-scale wind from remote areas to load centers
- Transmission funding mechanisms
  - i.e., participant funding, cost sharing agreements, federal incentives
- Favorable investment and regulatory environment
- Identification and resolution of operational challenges

# On- and Off- Shore Wind Proposed in ISO Queue

On-Shore = 1900 MW

Off-Shore = 810 MW

Total = 2710 MW



# Roadmap to Wind Integration

ISO's objectives:

- Understand New England-specific characteristics
  - How wind, load, generation and transmission interact
- Determine forecasting needs and techniques
- Develop operating requirements and solutions

# Regional Wind Patterns and System Characteristics

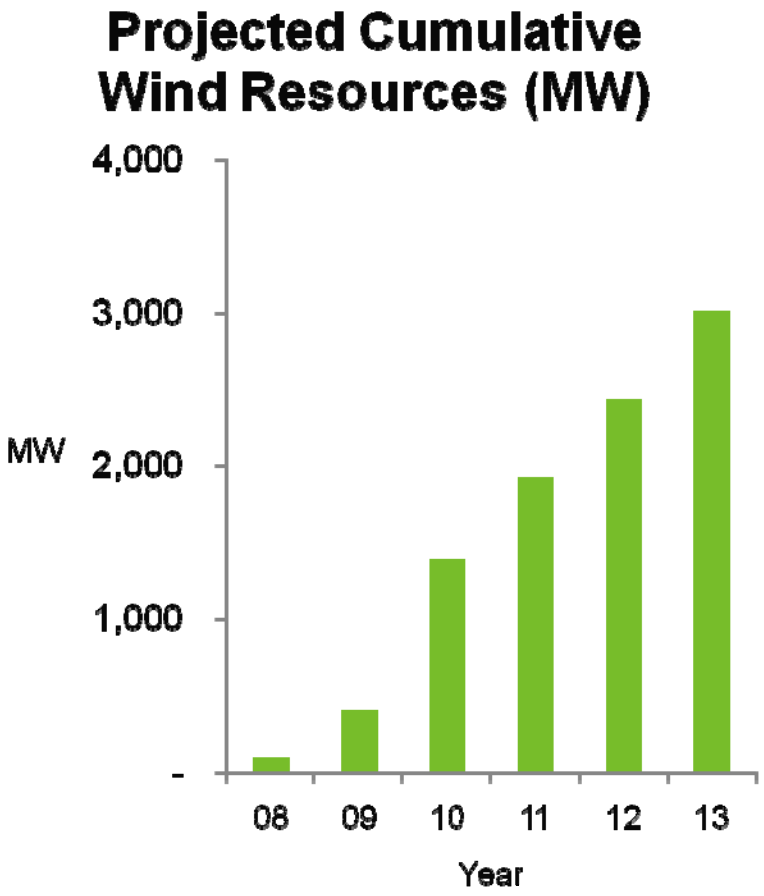
- Wind diversity and interactions
  - Wind and load patterns
  - Installed generation
- Impact of region-specific characteristics
  - Off-shore
  - Neighboring control areas with strong wind resources
  - Located near the end of the Eastern Interconnection
  - Market systems

# Operational Issues

- Over/under commitment caused by forecast uncertainty
- Wind curtailments due to lack of transmission
  - Minimum generation and congestion management issues
- Variability may require additional resources including regulation, load following, and reserves
- Coordination of variability with neighbors

# New England Wind Integration Study

- Determine technical requirements
- Create wind model including on-shore and off-shore capability
- Assess impact of wind development scenarios on system operations
- Identify best practices to forecast wind
- Determine contribution of wind to system adequacy



# Wind Integration Study (cont.)

- Through RFP, ISO has selected industry leaders to complete the study:
  - General Electric (Project Leader)
  - Enernex
  - AWS Truewind
- Study Completion in Summer 2010
  - Technical Review Committee established
  - Scenario assumptions to be reviewed with the Planning Advisory Committee

# Integration of DR and Renewables

## *Sets the stage for the development of the Smart Grid*

- Greater reliance on demand and renewable resources will increase complexity of bulk power system management
- From a grid operator perspective, balancing a diverse set of technologies and resources requires controllability and visibility
- Smart Grid technologies and applications will increase the efficiency of the grid
  - Advanced Metering
  - Storage technologies
  - Advanced Grid Simulator
  - Various other technologies and software applications