How Will Natural Gas Impact New England's Electricity Markets and Reliability?

129th New England Restructuring Roundtable

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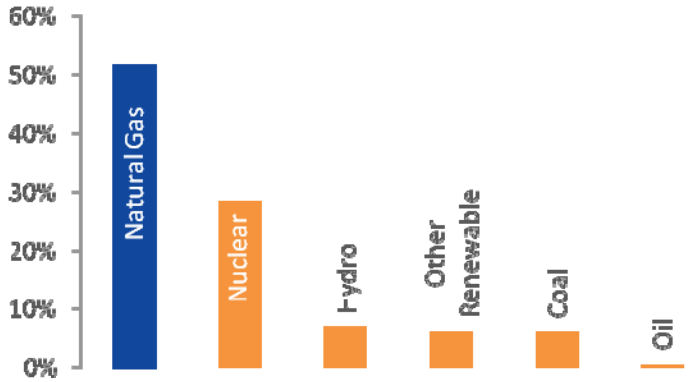
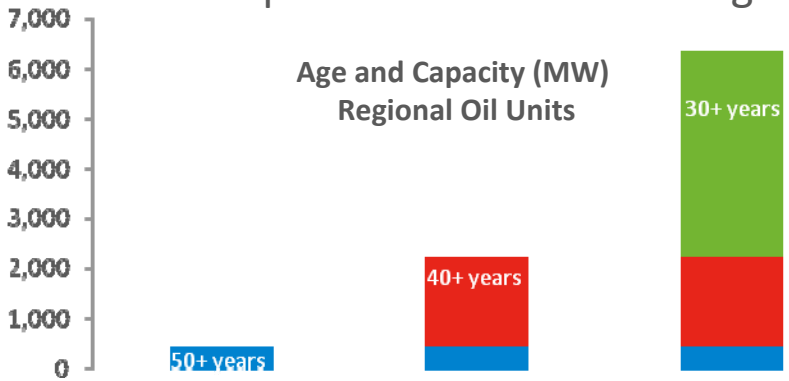
Region Significantly Relies on Natural Gas

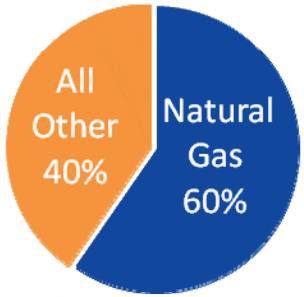
- Energy Production
  - 52% of region's energy derived from natural-gas-fired generators (2011)



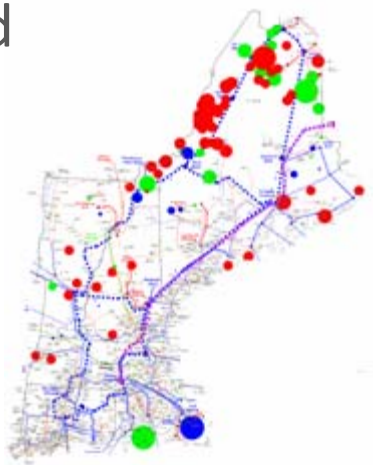
- Potential Oil Retirements
  - Older, less-utilized oil units may retire or be repowered to use natural gas



- Proposed Development
  - Natural gas predominant fuel proposed for region (April 2012)



- Balance for Wind
  - Large build-out of wind will require balancing by system operations



Examples: Gas-Related Operational Challenges

Date	Description
January 2004	**Cold Snap** • Extremely low temperatures • High demand for electricity • Nonfirm gas-fired power plants had limited electric power output due to a lack of gas transportation
December 2007	**Sable Island Contingency** • Diminished gas supply into Maine • Gas-fired plants in Maine went off line
March 2012	**Nonpeak Day** • Planned/unplanned transmission outages in Rhode Island and Southeast Massachusetts • High system demand and pipeline imbalances • Local generation ordered on line, without which load-shedding would have been likely

- ISO began focusing on winter gas-electric coordination issue in 2004
- Since then, operational issues beyond just winter months have occurred and not just during system peaks

Coordination and Communication Key

- Outages on electric power transmission system can affect gas flow and pressure on gas pipelines

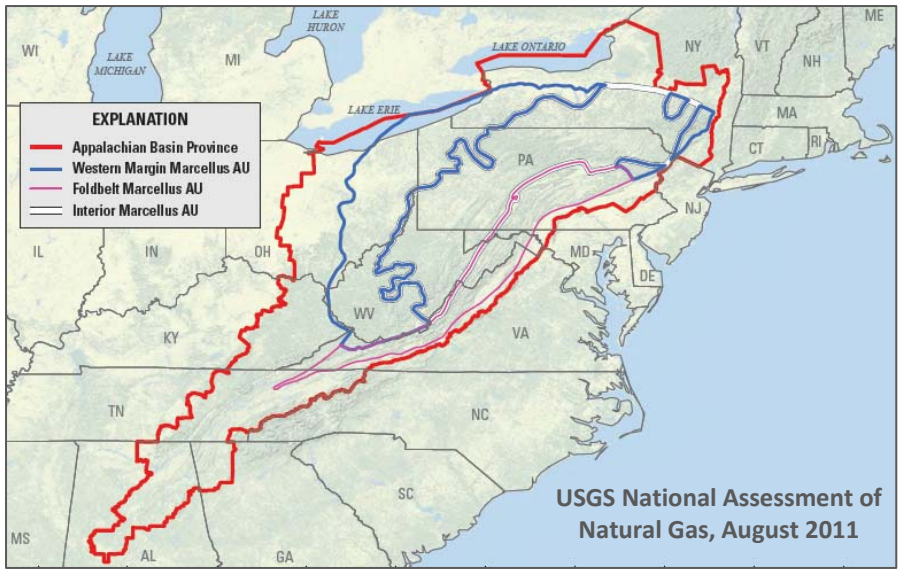
- Outages of interstate and intraregional pipelines can cause regional reliability problems

- ISO New England is continually working with the gas industry to better understand and coordinate systems

ISO Studies Pipeline Capacity to Serve Generators

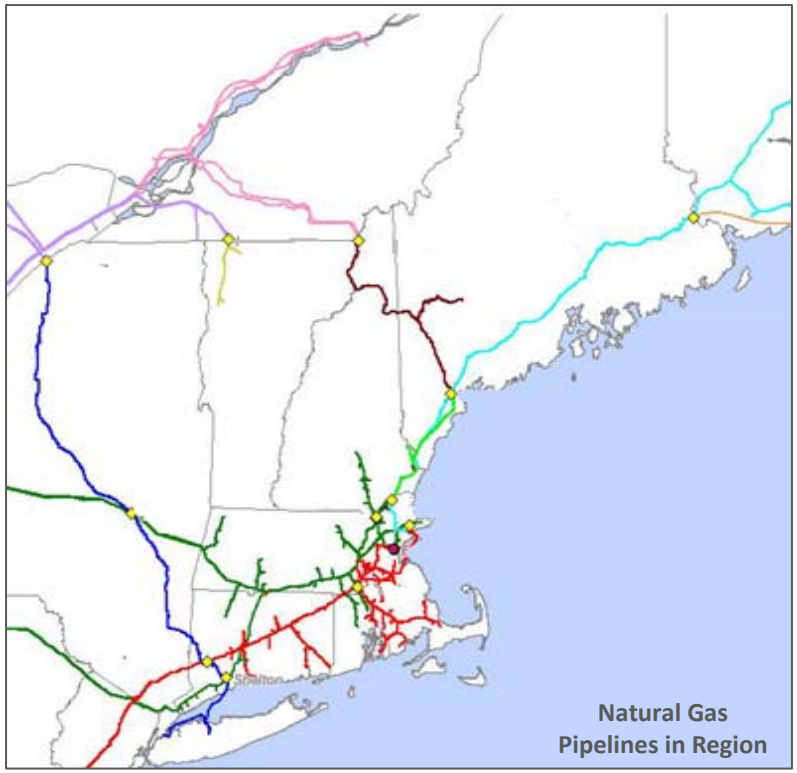
- As 2020 approaches, gas demand by power generators could exceed pipeline capacity, creating challenge for electric system reliability
  - Pipelines are designed to serve firm customers, and most gas-fired generators contract for interruptible supply
  - Potential shortfall worse in scenarios where older generators repower with gas and natural-gas system contingencies occur
- Study will soon be available by visiting “Reports” section of the “Planning Advisory Committee” section of ISO website
  - http://www.iso-ne.com/committees/comm_wkgrps/prtcpnts_comm/pac/reports/index.html

With New Supply at Region's Doorstep …



Source: http://pubs.usgs.gov/fs/2011/3092/

… Investments in Additional Infrastructure Needed



Potential Solutions to Help Operational Challenges

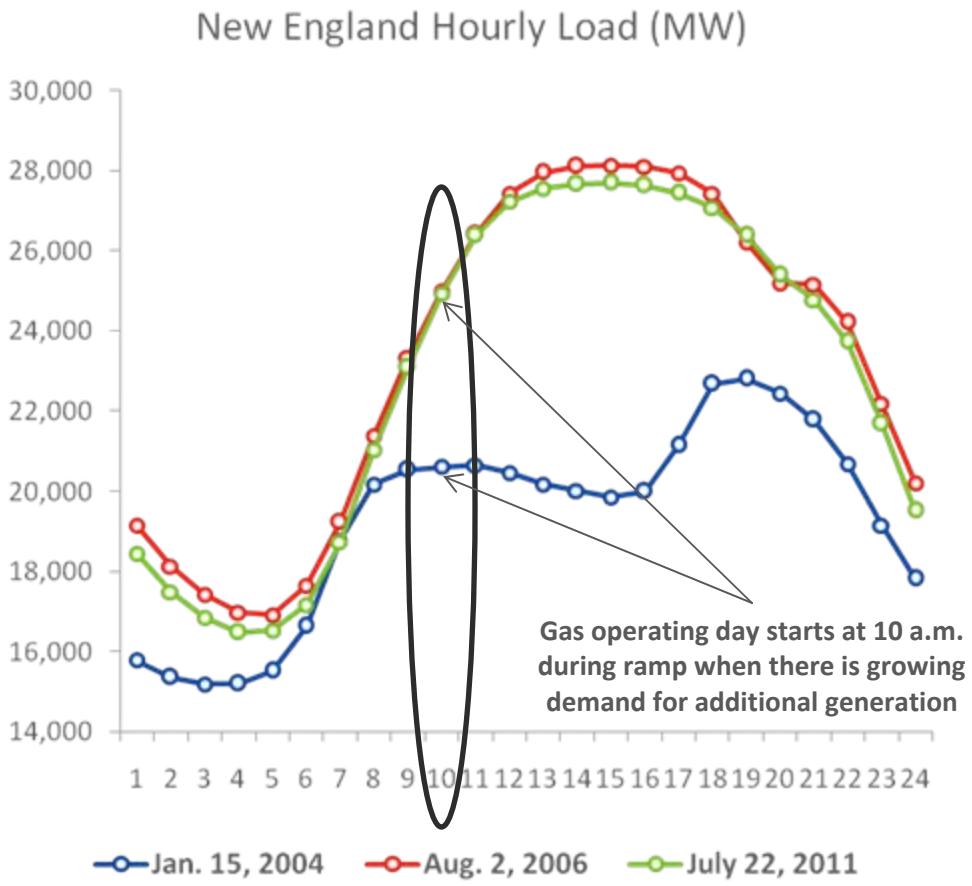
- Increased pipeline capacity
- Firm pipeline capacity
- Dual-fuel generation
- Local fuel storage to serve peak needs
- Enhance ability to manage electricity load
  - Dispatching demand resources
  - Energy efficiency
- Potential market changes
  - Improve coordination between the gas and electric power scheduling cycles
  - Adding reserves in Forward Reserve Market to help generator performance

These potential solutions will require investment in infrastructure and time to implement

Gas and Electricity Markets Not Coordinated

Gas sector operating day starts during electric power morning-ramp; Gas units have been curtailed during morning ramp until start of new gas sector day

- Market-alignment issues can have significant impact on energy industry
  - Natural gas-fired generation
    - Differences in the natural gas and electric power operating days make it difficult for gas-fired generators to satisfy scheduling requirements in electric and gas markets
  - Operators
    - Need to provide reliability during various contingencies
    - Need to know what units are really available intraday



Hourly Day-Ahead and Intraday Reoffers

- ISO is evaluating energy market design changes
  - Allow dispatchable resources to submit hourly energy offers into Day-Ahead Market
  - Modify the commitment cost components (i.e., start up and no-load costs) and the incremental energy offer components of supply offers during the operating day
  - These types of market changes will take time and will include a comprehensive stakeholder process

APPENDIX: BACKGROUND INFORMATION

Examples of operational challenges and disconnection in timing between markets

Examples: Cold Snap

- January 14–16, 2004 (aka “Cold Snap”)
  - Extremely low temperatures
  - High demand for electricity
  - Tight conditions in gas market
    - High and volatile gas prices
    - Fuel curtailments at some gas plants
    - Nonfirm gas-fired power plants had limited output due to a lack of gas transportation
  - Operational problems reported for all types of units due to weather
  - *Appendix H – Operations During Cold Weather Conditions*
    - Improved communication between pipeline operators and generators during cold-weather events
- January 19 – 23, 2011
  - Similar cold-weather-related issues

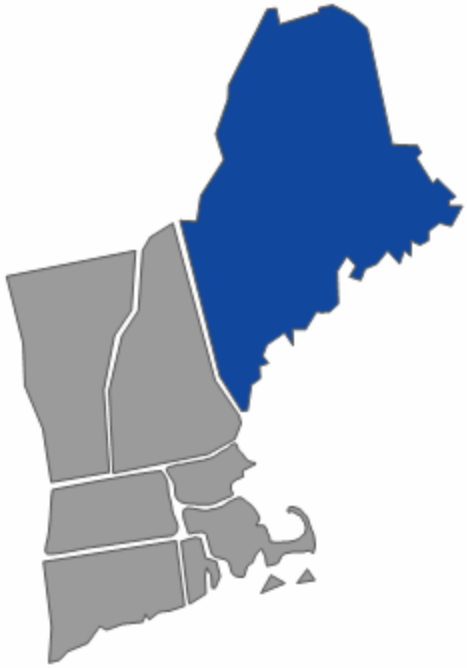
The Cold Snap highlights vulnerability of system due to capacity limitations of regional gas pipeline network

Cold Snap has regionwide implications

Examples: Sable Island

- November 30, 2007 – December 5, 2007
  - Unexpected gas contingency at Sable Island significantly diminished natural gas supply injections into Maine
  - Gas-fired generation in Maine went off line due to loss of supply
  - *Operating Procedure No. 4* was implemented regionally; Power Watch was implemented for Maine to ensure electric system reliability
  - Operating procedures (No. 8 and No. 21) to proactively address future supply issues were reexamined
    - Communications between gas industry and electric power industry improved

Sable Island gas disruption highlights how a gas supply interruption can impact natural gas generation in region

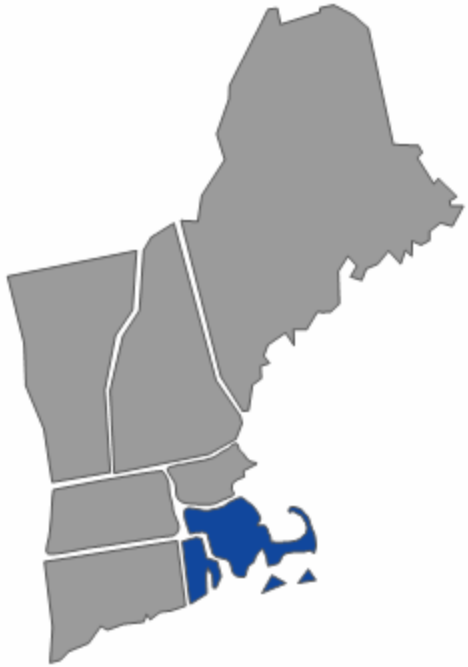


Power Warning declared for Maine – request for conservation

Examples: Rhode Island/Southeast Massachusetts

- March 2, 2012
  - Nonpeak winter day
  - Planned and unplanned transmission outages in Rhode Island (RI) and Southeast Massachusetts (SEMA)
  - Gas pipeline issues
    - Critical capacity constraints because of high system demand and pipeline imbalances
    - Operating flow balancing alert for region
  - Non-gas-fired generation ordered on line in RI
  - Gas-fired generation in RI and SEMA called on line
    - Had this generation not been available, load-shedding probably would have occurred
- December 10, 2010, and June 6, 2011
  - Similar to March 2, 2012, pipeline maintenance outages and gas restrictions occurred

Events in RI/SEMA highlight how pipeline and transmission service and interruptions can have local impacts



RI/SEMA affected

Examples: 2011 Heat Wave

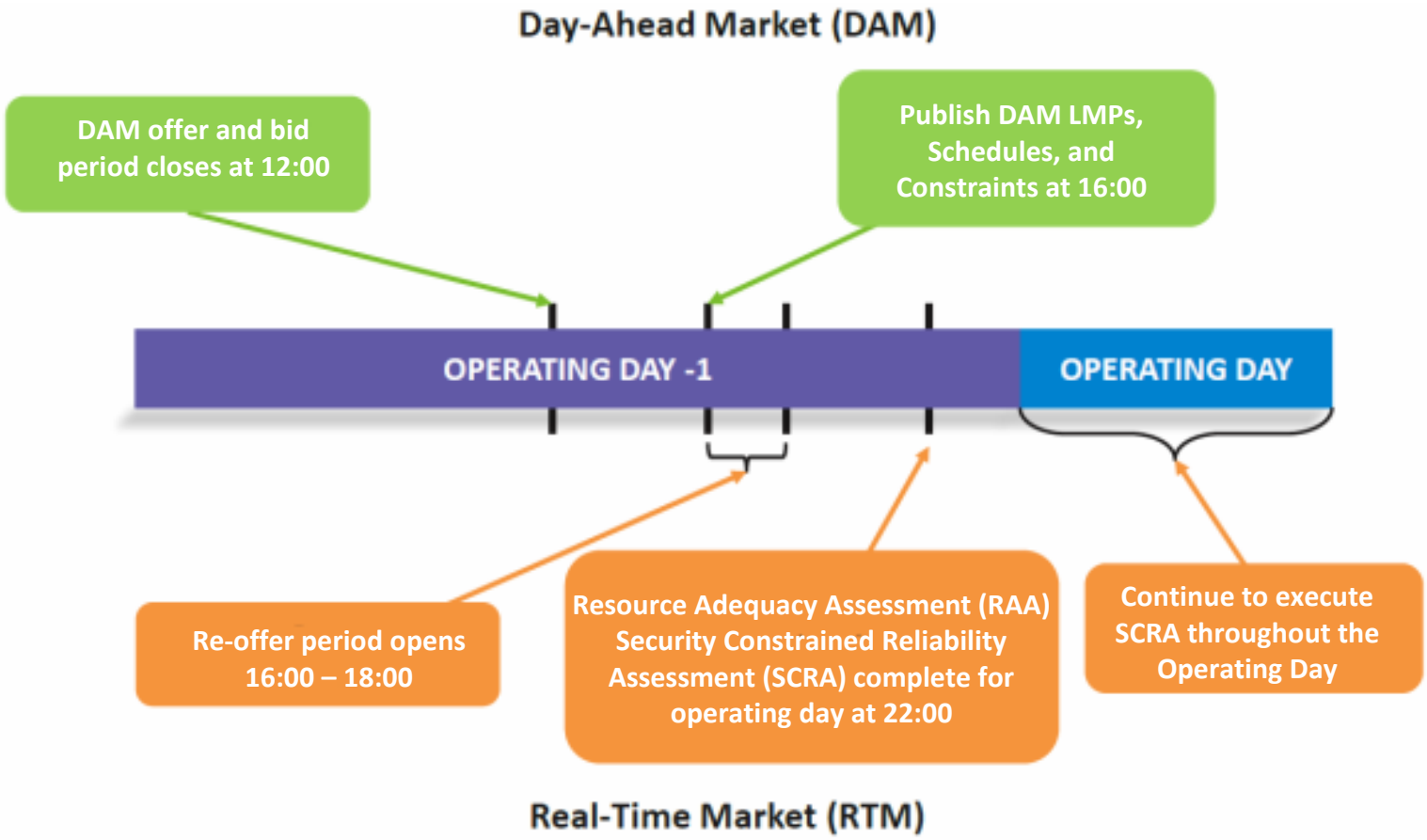
- July 22, 2011
  - Historic temperatures
  - Second-highest demand – 27,702 MW
  - Demand response was strong
  - About 3,400 MW of forced outages and reductions
  - Continued communications between ISO, gas industry, and generation

July 22 MW Generation Peak Hour			
Gas	12,577	Hydro Pump Storage	1,148
Nuclear	4,608	Other Hydro	847
Oil	3,611	Wind	162
Coal	2,383	Other Renewable	830

Large amount of gas on system at time of annual system peak underscores importance and magnitude of natural gas in region

Peak use had regionwide implications

Day-Ahead and Real-Time Electricity Market Process



Disconnect between Gas and Electric Days