Assessment of New England's Natural Gas System to Satisfy Short- and Near-Term Power Generation Needs

Consumer Liaison Group
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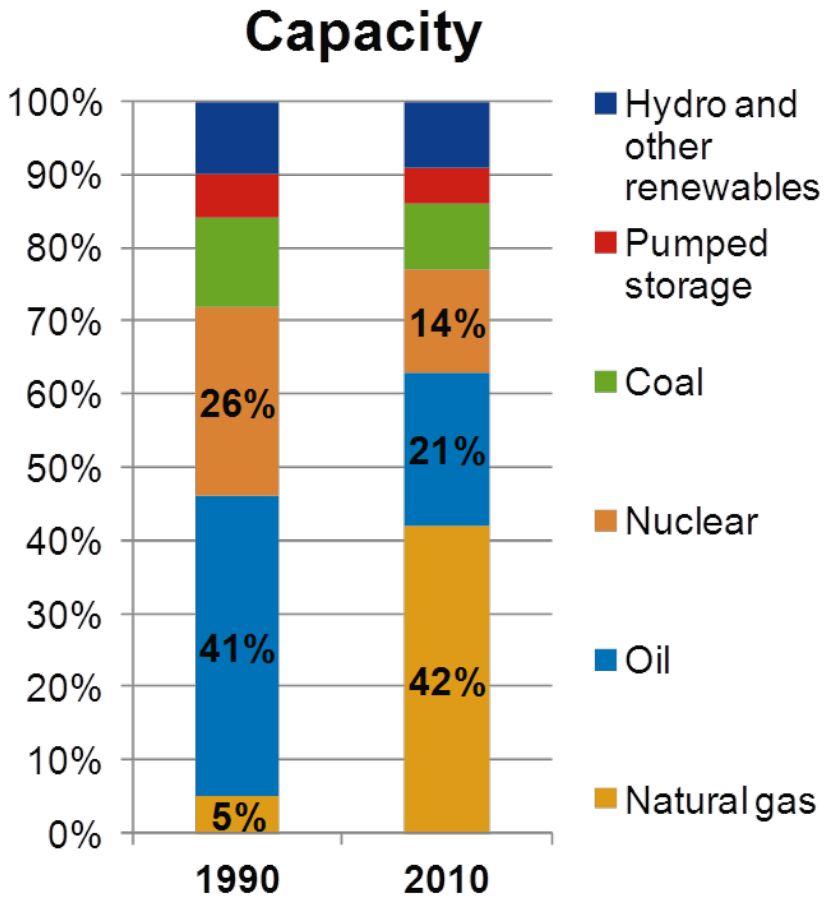
Preliminary Results & Findings – Subject to Revision

Table of Contents

Power Sector Fuel Mix – Past & Present

Generating Capacity Shift

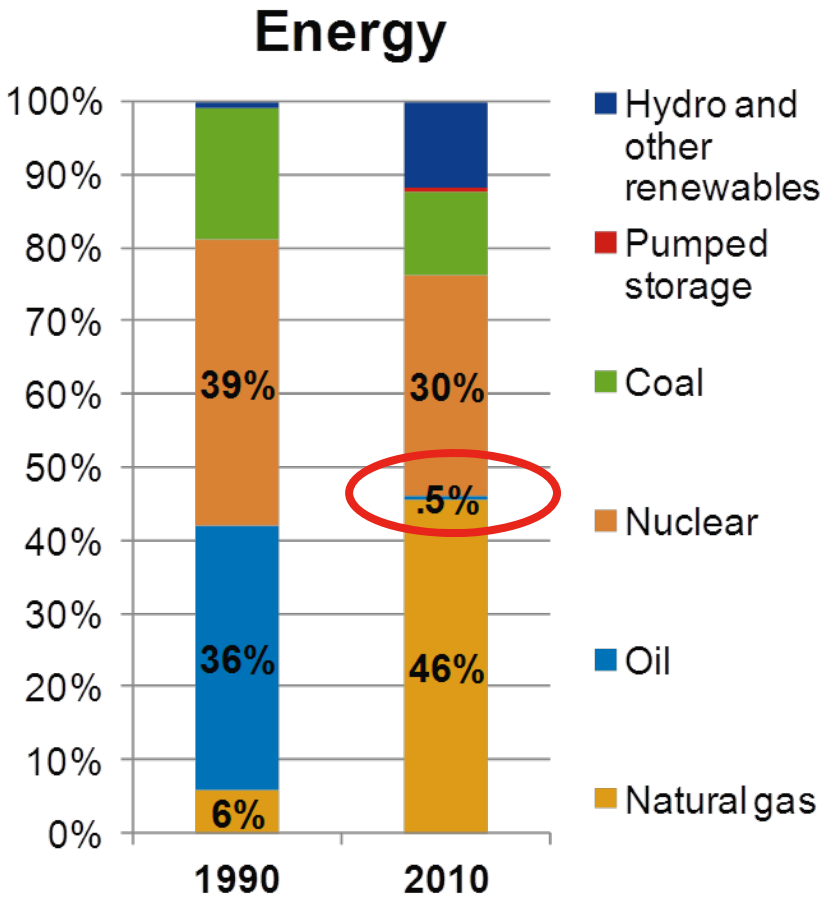
- Region largely dependent on oil and nuclear through mid 90's
- Shift a result of:
  - FERC opening access to transmission system
  - Deregulation
  - Implementation of wholesale electric markets (i.e. SMD, FCM)
  - Shut down of nuclear power plants and a move to new combined-cycle generation



Power Sector Fuel Mix – Past & Present

Energy Production Shift

- Environmental restrictions and cheaper sources of fuel forced oil to become uneconomic
- Efficient combined-cycle gas units displacing the operation of the older oil-fired steam turbine generators
- Emergence of renewable (and variable) sources of energy



Increased Reliance on Natural Gas

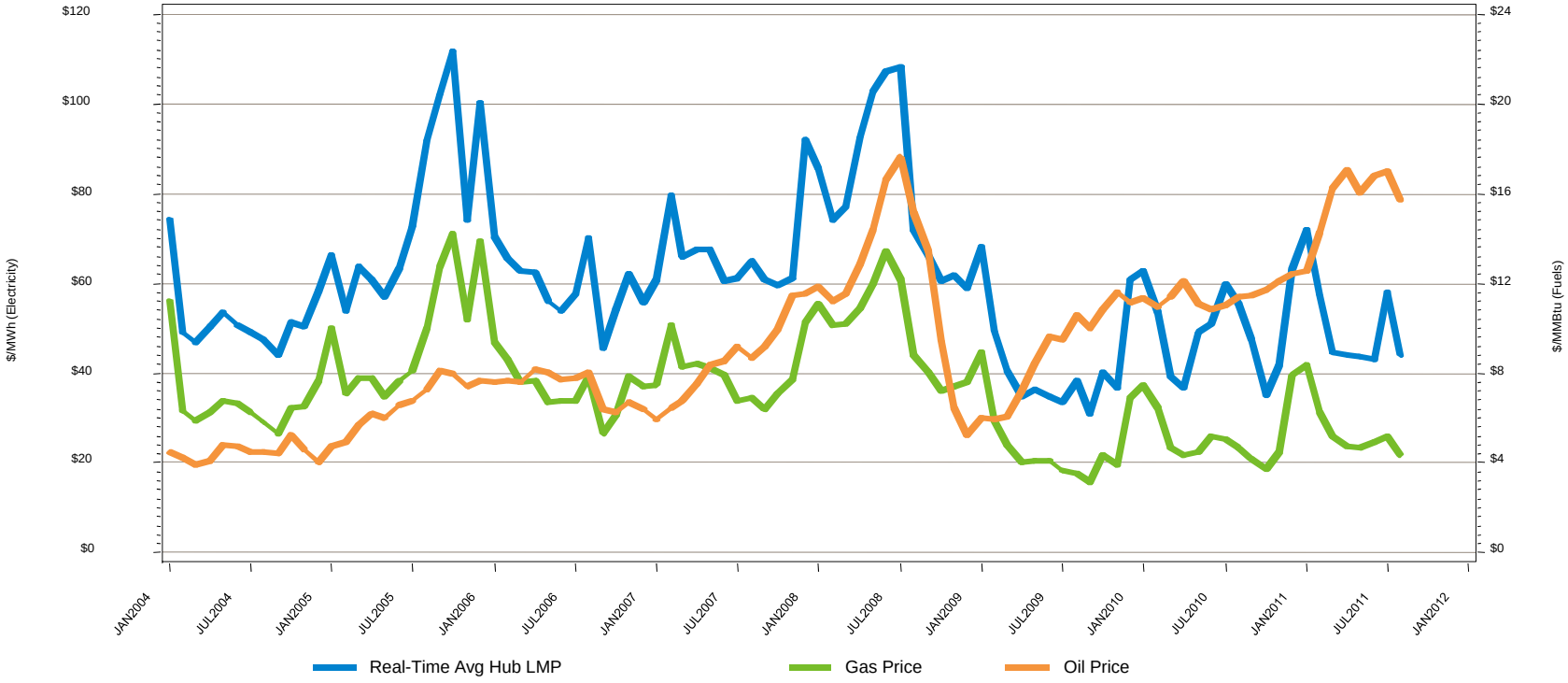
Key Issues

- Gas-fired generators generally do not have firm fuel contracts for delivery of natural gas
  - Natural gas heating market (firm fuel contracts) takes priority over electricity generation when demand for natural gas is high
- High demand for natural gas can result in potential delivery restrictions to power plants when pipelines are running full
- New gas-fired generation additions will exacerbate the situation

Increased Reliance on Natural Gas

Impact

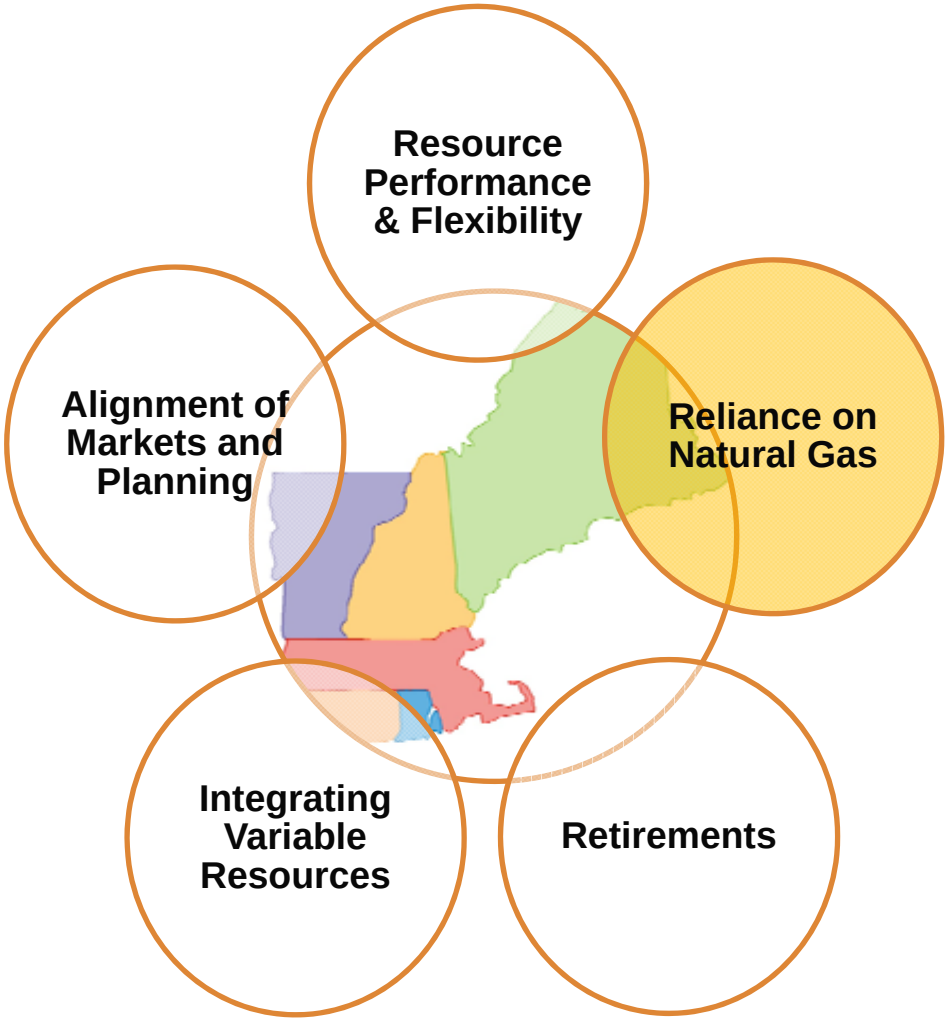
- Natural gas often sets wholesale electricity prices, which could subject region to price fluctuations



Strategic Planning Initiative

Five Interrelated Risks

- Energy landscape is changing rapidly
  - Regulatory and policy goals
    - Emissions control and environmental restrictions
    - Renewable
    - Energy Efficiency
  - Economic challenges for some older fossil-fueled resources
  - Advances in technology
- Addressing these risks will help ensure a reliable system and efficient marketplace in the long-term



Strategic Planning Initiative

Major Studies Already Underway

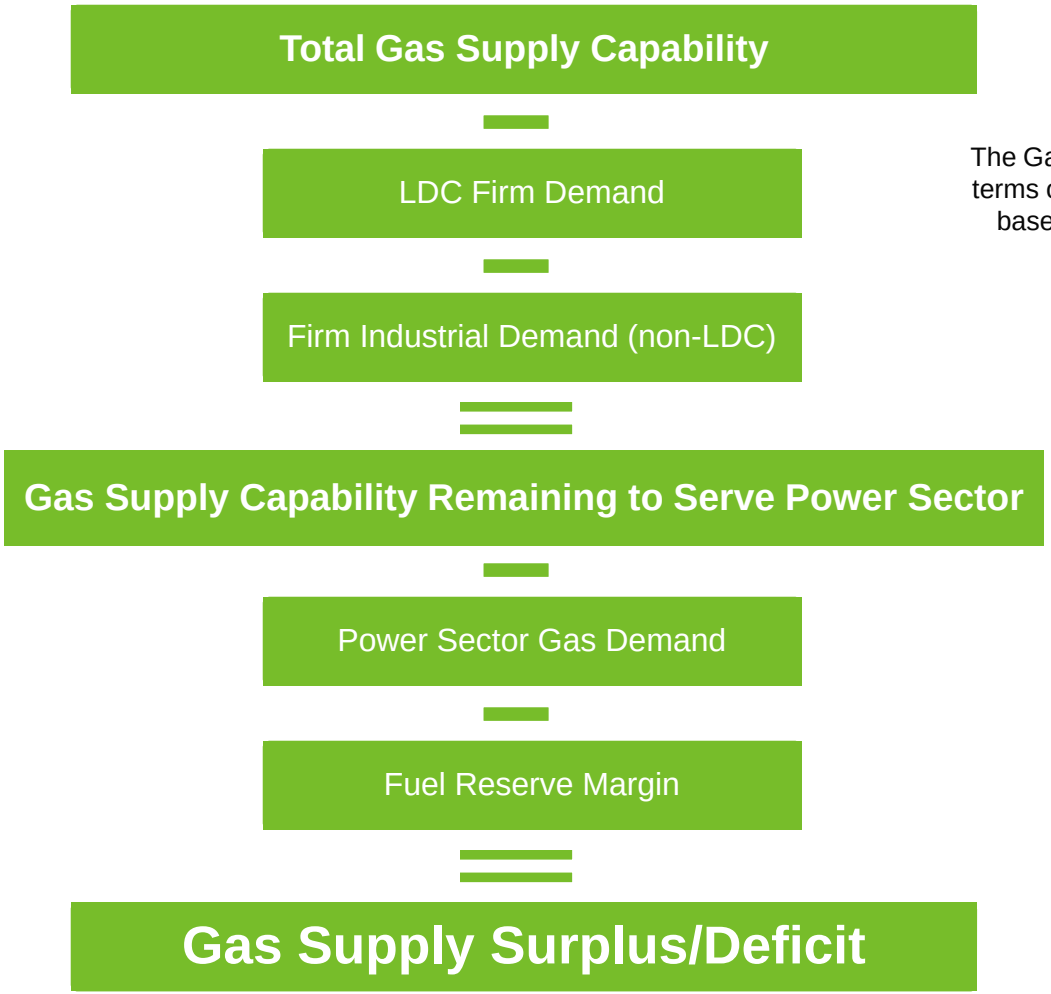
- Generation Retirement Studies
  - Study of units expected to face significant capital investments due to regulatory requirements, and potential impact on transmission system operations
- Strategic Transmission Studies
  - Implication of generator retirements on transmission system requirements and integration of renewables
- **Natural Gas Assessment**

Natural Gas Assessment

- ISO-NE developed a *Scope-of-Work* for a Natural Gas Study and contracted ICF International to provide an assessment of the amount of natural gas supply available to satisfy New England's gas-fired power generation through 2020
  - Analysis focuses on the availability of gas supplies during peak gas (winter) and peak electricity (summer) demand periods
  - Analysis considers two different power sector scenarios:
    - Reference case: assumes existing fleet continues to operate
    - Repowering case: assumes that a designated amount of non-gas-fired electric capacity is replaced with new gas-fired technologies over time

Gas Supply Surplus/Deficit Calculation

Calculated for each year of the projection

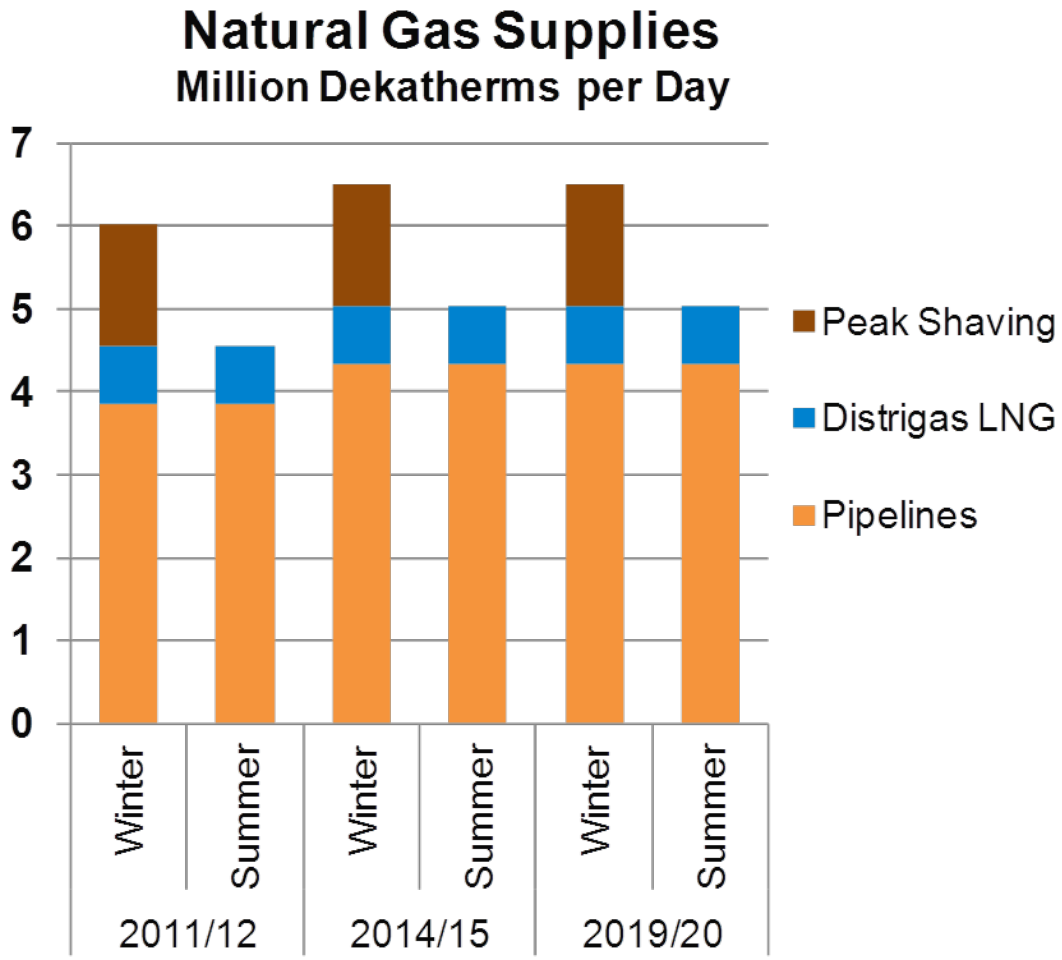


The Gas Supply Surplus/Deficit is also shown in terms of generating capacity ("MW equivalent"), based on an assumed marginal heat rate of 10,000 Btu/kWh

Regional Gas Supply Assessment

With Planned Pipeline Capacity Expansions

- New England's winter peak day capability will increase from 6 million dekatherms (Dth) per day to almost 6.5 million Dth per day by 2015
- New England's summer peak day capability, which excludes peak shaving capacity, will rise from 4.5 million Dth per day to 5 million Dth per day



Projections for Power Sector Gas Demand

- Two basic scenarios for power sector gas demand - Reference and Repowering
  - The Repowering case assumes that a designated amount of non-gas-fired electric capacity is replaced with new gas-fired technologies over time

- For each scenario, ISO-NE created four different projections for power sector gas demand on winter and summer peak days:
  - **Nominal Gas Demand**
    - Based on 50/50 electricity demand projection
  - **Reference Gas Demand**
    - Based on 90/10 electricity demand projection
  - **Higher Gas Demand**
    - Based on 90/10 electricity demand projection, but with non-gas capacity outages and a high gas price
  - **Maximum Gas Demand**:
    - Based on 90/10 electricity demand projection, but with non-gas capacity outages and low gas prices to maximize gas demand

Gas Supply Surplus/Deficit Results

- **New England's gas delivery system is in much tighter balance on a winter peak (design) day than it is during a summer peak day**
  - Estimated deficit is generally between -100,000 and -200,000 Dth per day (-400 MW and -800 MW) in most years, except in the highest gas demand case where the deficit averages roughly -600,000 Dth per day (-2,500 MW)
  - The only period when there is a projected surplus on a winter design day is immediately following the completion of Algonquin's AIM pipeline expansion in 2014
- **Regional gas supply capability is inadequate to satisfy New England power sector gas demands on a winter peak (design) day over the next decade, barring additional incremental expansion of the region's gas supply capability beyond those assumed in this study**

Gas Supply Surplus/Deficit Results, *cont.*

- The Repowering cases generally increase gas use over their counterpart Reference cases, reducing surpluses and/or increasing deficits by between 50,000 and 200,000 Dth per day (200 MW and 800 MW)
  - **Suggests that the regional gas delivery system will become even more tightly balanced on a winter design day under the Repowering cases, and is in need of additional gas supply/transportation capability beyond the amounts estimated herein**
- **The summer peak day is not as tight and well above the fuel reserve margin**
  - Summer peak day surpluses range from about 500,000 to 1,500,000 Dth per day (2,100 MW to 6,250 MW)
  - This conclusion will not necessarily remain true with gas sector contingencies being considered

Gas Sector Contingency Cases

- Surplus/deficit values were also estimated for a number of gas sector contingency cases that consider outages at different gas facilities
- Most of contingency cases consider outages to single assets
- In each contingency case, the full capacity of the asset is assumed to be disrupted
  - Partial disruptions would be a variant with less severe impacts
- Firm gas demand remains unchanged from the projected amounts, as applied within both the Reference and Repowering cases
  - In reality, some firm gas demand, particularly industrial gas demand may be shed during such *"force majeure"* disruptions

Caveats for Surplus/Deficit Estimates

- The results provided suggest that the regional natural gas market will be in tight balance on a winter design day

- It is worth noting that it may be difficult for the gas market to balance even with slim surpluses in regional gas supply
  - There may be localized constraints that will make it difficult for the market to balance
  - There may be intraday changes in gas demands that create transient pressure changes on the pipelines, that make it difficult for the pipelines to operate within acceptable ranges
  - Flow restrictions tend to become more frequent when pipelines are highly utilized. That is, there is less flexibility to respond to market need
  - Interruptible transportation services are not likely to be available with such tight conditions. In short, the margin for error is much less

- Firm contract holders will not be impacted by electric sector deficits