
Guild of Gas Managers

Peter Brandien

VICE PRESIDENT, SYSTEM OPERATIONS
KEY MESSAGES

• The New England power system is changing rapidly
  – New England is shifting away from resources with stored fuels (coal, oil, nuclear) toward resources with just-in-time fuel (natural gas) and resources that are weather dependent (wind and solar)

• ISO’s *Operational Fuel-Security Analysis* shows the region trending in a negative direction with regard to fuel-security risk

• ISO’s operating experience during the recent cold weather period reinforces fuel-security analysis
New England Has Seen Dramatic Changes in the Energy Mix: *From Coal and Oil to Natural Gas*

Percent of Total **Electric Energy** Production by Fuel Type (2000 vs. 2017)

Source: ISO New England [Net Energy and Peak Load by Source](https://www.iso-ne.com"

Renewables include landfill gas, biomass, other biomass gas, wind, grid-scale solar, municipal solid waste, and miscellaneous fuels. This data represents electric generation within New England; it does not include imports or behind-the-meter (BTM) resources, such as BTM solar.
Natural Gas Is the Dominant Fuel Source for New Generating Capacity in New England

Cumulative New Generating Capacity in New England (MW)

- Natural Gas
- Nuclear (uprate)
- Wind
- Solar
- Biomass
- Hydro
- Fuel Cell
- Oil

Note: New generating capacity for years 2017 – 2020 includes resources clearing in recent Forward Capacity Auctions.
But the Natural Gas Delivery System Is Not Keeping Up with Demand

- Few interstate pipelines and liquefied natural gas (LNG) delivery points
- Regional pipelines are:
  - Built to serve heating demand, not power generation
  - Running at or near maximum capacity during winter

Source: ISO New England
Natural Gas and Wholesale Electricity Prices Are Linked

Monthly average natural gas and wholesale electricity prices at the New England hub

Wholesale Electricity at New England Hub (Real-Time LMP)  Natural Gas

- Hurricanes hit the Gulf
- Before the Recession and Marcellus Shale gas boom
- Winter 2012/2013
- Winter 2013/2014
- Winter 2014/2015
- Winter 2017/2018
Since 2013, More Than 4,600 MW of Generation Have Retired or Announced Plans for Retirement in the Coming Years

- More than 5,000 MW of remaining coal and oil are at risk of retirement
- These resources have played a critical role in recent winters when natural gas supply is constrained in New England
FUEL SECURITY

• Ensuring adequate fuel for generators is the most pressing challenge to future grid reliability

• Launched in the fall of 2016, ISO New England’s Operational Fuel Security Analysis shows the region is trending in a negative direction with regard to fuel-security risk
Study Seeks to Understand the Future Effects of Trends Already Affecting Power System Operations

- The analysis examines **23** possible fuel-mix combinations during the 2024-2025 winter, and quantifies each case’s **fuel-security risk** – *i.e.*, the number and duration of energy shortfalls that would require implementation of emergency procedures to maintain reliability

- The study assumed **no** additional natural gas pipeline capacity to serve generators would be added during the study timeframe

- The study seeks to illustrate the **range of potential risks** that could confront the power system if fuel and energy were constrained during the winter – The scenarios, in aggregate, show the region trending in a **negative direction** with regard to fuel-security risk
Study Modeled Wide Range of Resource Combinations Considering Five Key Fuel Variables

1. Retirements of coal- and oil-fired generators
   (the study assumes that New England will have no coal-fired power plants in winter 2024/2025)

2. Imports of electricity over transmission lines from New York and Canada

3. Oil tank inventories (i.e., how often on-site oil tanks at dual-fuel power plants are filled throughout the winter)

4. Level of liquefied natural gas (LNG) injections into the region’s gas delivery and storage infrastructure

5. Level of renewable resources on the system
Study Suggests Six Major Conclusions

1. **Outages**: The region is vulnerable to the season-long outage of any of several major energy facilities.

2. **Key Dependencies**: As we retire more resources, reliability becomes heavily dependent on LNG and electricity imports; more dual-fuel capability is also a key reliability factor.

3. **Logistics**: Timely availability of fuel is critical, highlighting the importance of fuel-delivery logistics.

4. **Risk**: All but four of 23 scenarios result in load shedding, indicating a trend towards increased fuel-security risk.

5. **Renewables**: More renewables can help lessen fuel-security risk but are likely to drive oil- and coal-fired generator retirements, requiring high LNG imports to counteract the loss of stored fuels.

6. **Positive Outcomes**: Higher levels of LNG, imports, and renewables can minimize system stress and maintain reliability; delivery assurances for LNG and imports, as well as transmission expansion, will be needed.
22 of the 23 Scenarios Led to Emergency Actions

Load shedding was required to protect the grid in 19 of the 23 scenarios

Hours of Emergency Actions under Modeled Scenarios, Ordered Least to Most

Note: This chart does not include the two boundary cases, both of which are unlikely to develop. The low (i.e., positive) boundary case was the only scenario requiring no emergency actions. The high (i.e., negative) boundary case resulted in the most hours of emergency actions by far.
ISO New England Will Continue to Discuss the Results of the Study with Stakeholders

• As the region’s grid operator responsible for reliability, the ISO must independently assess the level of risk to reliable power system operations

• A key question to be addressed will be the level of fuel-security risk that the ISO, the region, policymakers, and regulators are willing to tolerate

• Discussions with stakeholders on potential solutions to address the region’s fuel-security risks are targeted to begin later in 2018
Recent Cold Weather Period Reinforces Findings in *Operational Fuel-Security Analysis*

- During the recent cold weather period (from December 26 to January 8), gas and oil **fuel price inversion** led to oil being in economic merit and base loaded, leading to rapid depletion of the region’s oil supply.

- Fuel delivery **logistics** became a concern:
  - Heating customers get priority for oil and gas
  - Storms can delay trucked oil and LNG tankers
  - Truck drivers face restrictions on driving time

- With oil being base loaded, **emissions** limitations became a concern for several oil-fired generators.
Frigid Cold Drove Up Regional Demand for Natural Gas

This led to spikes in natural gas prices, which then led to spikes in wholesale electricity prices; with natural gas at a premium, oil generation became economic.
Generators Burned 2 Million Barrels of Oil in 2 Weeks

That’s more than twice the amount of oil used in all of 2016

Barrels of Oil

2,000,000

1,000,000

0

2016

Cold Weather Period (12/26/17 – 1/9/18)
Generators’ Oil Inventories Declined Rapidly

Several large oil units were left with only enough fuel for a few more days, forcing the ISO to posture (hold back) units to conserve this fuel.

Note: This chart is the ISO’s best approximation of usable oil, discounting unit outages, reductions, or emissions.
Closing Thoughts...

• We see significant challenges ahead for **fuel security**

• There will be a **cost** associated with alleviating fuel constraints and a **cost** associated with inaction
  
  – The ISO can take action through its market design and tariff to procure ‘insurance’ to alleviate, but not eliminate, fuel-security risk
  
  – The states can weigh the costs and environmental trade-offs and take action to shape infrastructure solutions that significantly mitigate fuel-security risk
Questions