Fuel Security for the Region’s Generators

The dependable performance of New England’s fleet of power plants is the cornerstone of a reliable supply of electricity, but that performance hinges on their access to fuel. Fuel-security challenges have been a growing concern, particularly for generators that run on natural gas, but also for others, such as those that either run primarily on oil or use it as an alternate fuel. To help the ISO and the region better understand the fuel-security risk and discuss how to address it, the ISO conducted a study to quantify the future risk. The findings of the Operational Fuel-Security Analysis are documented in a report issued for regional discussion in January 2018.

Download the *Operational Fuel-Security Analysis* (January 2018), the *Addendum to the Operational Fuel-Security Analysis* containing additional scenarios and sensitivities requested by stakeholders, or visit the *Operational Fuel-Security Analysis Key Project page* to see additional related materials.

Overview of the Region’s Fuel-Security Risk

Fuel security—ensuring that power plants have or can get the fuel they need to run, particularly in winter—is

the foremost challenge to ensuring a reliable power grid in New England. Past operating experiences and current industry trends raise concerns about the future power system. New England has no indigenous fossil fuels and therefore, fuels must be delivered by ship, truck, pipeline, or barge from distant places. A dependable fuel supply for the region requires a fuel-delivery system that has the appropriate physical capability to transport all the fuel needed, the contractual arrangements secured in advance to ensure timely deliveries, and power plants that have fuel storage on site.

The region's fuel-security risk has been evident to the ISO since a 2004 cold snap when more than 6,000 MW of natural-gas-fired generation was unavailable, due to pipeline constraints, economic outages, and operational issues. Similar challenges have continued to crop up during cold spells in recent winters, including the most recent one in late December 2017 and early January 2018. Because the reliability of the power system was maintained throughout these events, the region's electricity consumers have been shielded from this growing risk, apart from severe price spikes some winters that eventually showed up in retail rates. However, there is a real risk that the region's fuel-security risk could worsen to the point that the ISO would be required to take more severe emergency actions to keep the lights on and protect the power grid during winter. These actions could include public pleas for electricity conservation, voltage reductions (brownouts)—and, as a last resort, load shedding (rolling blackouts).

Several factors make fuel security a growing concern:

- The regional power system is increasingly dependent on natural gas for power generation.
- The capacity of the region's natural gas infrastructure is not always adequate to deliver all the gas needed for both heating and power generation during winter.
- Natural gas is the fuel of choice for a large segment of new power plant proposals.
- The region's coal, oil, and nuclear power plants, which have fuel stored on site and are essential for reliability when natural gas is in short supply, are

retiring under increasing economic and environmental pressures.

The region has limited dual-fuel generating capability—that is, generators that can use either natural gas or oil—and emissions restrictions on burning oil are tightening.

The Operational Fuel-Security Analysis

For its analysis, the ISO chose to study the effects of a wide range of possible future power resource combinations that could materialize by winter 2024/2025, as well as the outages of several key energy resources. Actual power grid conditions could change earlier or later than winter 2024/2025. However, that year was chosen because:

The outlook for power system reliability by winter 2024/2025 is uncertain, largely due to the expected retirements of non-gas-fired power resources in the next decade.

The years until winter 2024 give the region time to address these challenges.

> The study results should not be construed as precise predictions. Rather, they provide a basis for comparing the fuel-security risk of each of the hypothetical resource combinations modeled.

The following are some highlights from the ISO's analysis. Please read the full report for details.

ISO New England studied 23 possible future resource combinations and outage scenarios during winter 2024/2025 to determine whether enough fuel would be available to meet demand and to quantify the operational risks.

These scenarios, while not a precise prediction of the future system, seek to illustrate the range of potential risks that could confront a power system if fuel and energy were constrained during winter.

The goal is for the ISO and the region to better understand these risks and inform the ISO's subsequent discussions with stakeholders on how to mitigate them.

The study assumed that no additional natural gas pipeline capacity to serve generators would be added within the timeframe of this study and focused instead on five other variables that are likely to be key factors in power system reliability. Notable findings regarding each variable:

> Resource retirements—The retirements of coal-fired, oil-fired, and nuclear generators—resources with fuel stored on site—will have a significant impact on reliability and magnify the importance of other variables, particularly liquefied natural gas (LNG) supplies.
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> LNG availability—Improving generators' advance arrangements for timely winter deliveries of LNG could significantly reduce fuel-security risk, while reduced volumes of this global commodity would raise risk.
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> Oil tank inventories—The availability of oil stored in tanks on site is a key reliability factor and depends on the extent to which natural-gas-fired generators are able to add dual-fuel capability to burn oil, how often they can run on oil, and whether they have oil when needed.
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> *Imported electricity*—Expanding access to electricity from neighboring power systems would help mitigate fuel-security risk but would require investment in transmission infrastructure.
>
> Renewable resources—Accelerating the growth of renewable resources would enhance fuel security but would not eliminate reliance on LNG. It also would likely lead to more non-gas-fired resource retirements and require transmission investment.

Energy shortfalls due to inadequate fuel would occur with almost every fuel-mix scenario in winter 2024/2025, requiring frequent use of emergency actions to keep power flowing and protect the grid. Emergency actions that would be visible to the public range from requests for energy conservation to load shedding (rolling blackouts affecting blocks of customers).

The study's findings suggest six major conclusions:

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

2. Stored fuels: Power system reliability is heavily dependent on LNG and electricity imports; more dual-fuel capability is also a key reliability factor, but permitting for construction and emissions is difficult.

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

4. Risk trends: All but four scenarios result in fuel shortages requiring load shedding, indicating the trends affecting New England’s power system may intensify the region’s fuel-security risk.

5. Renewables: More renewable resources can help lessen the region’s fuel-security risk but are likely to drive coal- and oil-fired generation 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; to attain these higher levels, delivery assurances for LNG and electricity imports, as well as transmission expansion, will be needed.

The ISO has been discussing the study with regional stakeholders to determine the operational or market design measures that may be needed to address the region’s fuel-security risk. See the Operational Fuel-Security Analysis Key Project page.

Current Trends Are Pushing the Power System toward Greater Risk

The graph below from the report illustrates the hours of different emergency actions required to maintain power system reliability in the 23 modeled scenarios. These emergency actions were among the metrics used to quantify risk.

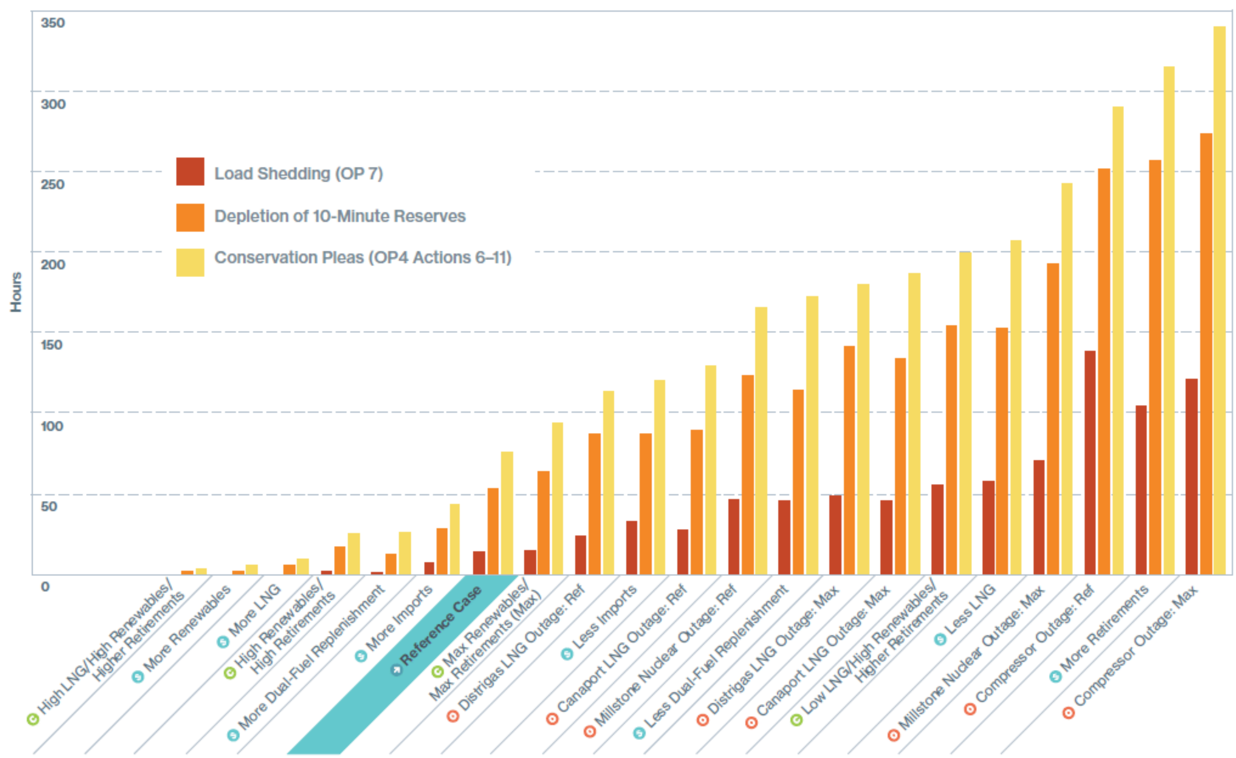
Operating Procedure No. 4 (OP 4), Action during a Capacity Deficiency, is the procedure used most often in the ISO control room to keep supply and demand in balance. Hours of OP 4 Actions 6–11 can include voltage reductions and urgent public appeals to conserve electricity.

If OP 4 actions aren't sufficient, the ISO could deplete the system's 10-minute reserves to keep the lights on. However, reserves are the system's "insurance policy." Without them, the system is vulnerable. To maintain system balance, controlled outages—rolling blackouts—could become necessary.

As a last resort to protect the grid, the ISO would implement Operating Procedure No. 7 (OP 7), Action in an Emergency. OP 7 involves load shedding, also known as rolling blackouts or controlled outages that disconnect blocks of customers sequentially.

One of the report's major conclusions is that the trends affecting the New England power system are moving in a negative direction. All but one of the 23 modeled scenarios (the high boundary case—that is, with all variables modeled at the most favorable levels—not shown here because it is unlikely to materialize) would lead to some level of emergency actions during winter 2024/2025, as well as hours when the ISO would have to deplete 10-minute reserves. All but four scenarios would require some level of load shedding. (The low boundary case—that is, with all variables modeled at unfavorable levels—resulted in even more hours of emergency actions but was omitted because it also is unlikely.) For more details, read the report and see Appendix A, which includes a matrix of the inputs to and results of each of the modeled scenarios.

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



Single-Variable Cases   Combination Cases   Outage Cases

Source: ISO New England, *Operational Fuel-Security Analysis* (2018)

Follow the Process

Read about all the measures taken to date by the ISO to mitigate the fuel-security risk.

Read the Addendum to the Operational Fuel-Security Analysis, which contains the results of additional scenarios and sensitivities run by the ISO, as requested by regional stakeholders.

Visit the Operational Fuel-Security Analysis Key Project page to see additional related materials.

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