



Winter 2022/23 Analysis

Assessment and Recommendations

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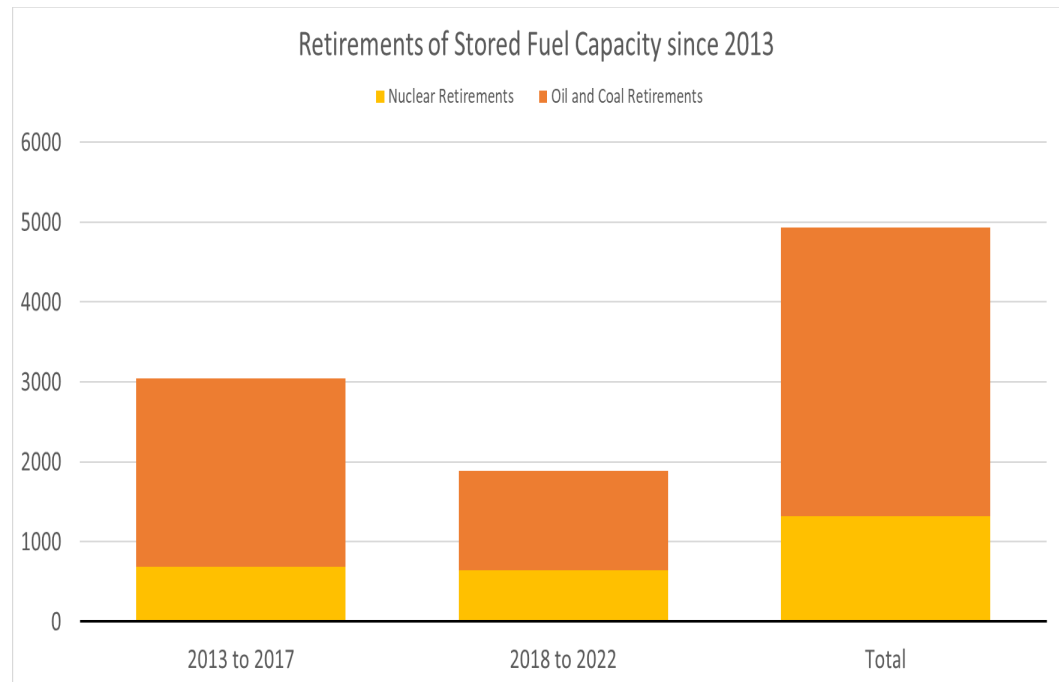


Assessment and Recommendations Specific to Winter 2022/23

- Over the past several weeks, in order to inform recommendations for the region in advance of winter 2022/23, the ISO performed an assessment summarized in today's presentation
- ISO's assessment included:
 - Operational analysis of information obtained from recent fuel surveys and discussions with resource owners about expected fuel inventories and replenishment strategies for facilities with stored fuel capabilities
 - Scenario modeling to evaluate regional energy adequacy under various operating conditions and assumptions
 - Evaluation of the Winter Reliability Program (WRP), last used in 2017/18, and the Inventoried Energy Program (IEP) approved for 2023/24 and 2024/25 winters, including updated indicative program rates and costs

The Region's Power System Continues to Change

- A number of factors continue to impact the operation and energy adequacy of the New England power system including, but not limited to, changing weather norms and more extreme weather conditions, fuel infrastructure capabilities, and most notably, the resource mix
- The region continues to see retirement of resources with significant stored fuel capacity
- ~3,000 MW of dual-fuel capability has been added since 2013, however on-site fuel storage capability at these facilities is typically smaller than that of the retired resources and there are often environmental permit limitations on fuel-oil usage



ISO Has Taken a Variety of Steps To Enhance Regional Energy Adequacy

- ISO has worked with stakeholders over the past few years to implement a number of measures that enhance regional energy adequacy and situational awareness, including:
 - Market enhancements such as Energy Market Opportunity Cost mechanisms
 - State-of-the-art operational situational awareness measures and energy forecasting techniques, including the implementation of, and on-going refinements to, the 21-day energy assessment
 - Retaining Mystic 8 & 9 under a Cost-of-Service agreement when retirement of that facility posed unacceptable energy adequacy risk to the region
- With these significant enhancements, the region has not employed a winter program since 2017/18



Summary: ISO Recommends No Additional Fuel Program for Winter 2022/23

- Considering prior measures taken to enhance regional energy adequacy, information gathered from recent discussions with resource owners, evaluation of fuel inventory trends, and completion of scenario modeling, ISO's winter 2022/23 assessment indicates that:
 - The ISO expects to be able to operate through a mild winter reliably
 - The ISO expects to be able to operate through a moderate winter reliably, but may rely on established capacity deficiency procedures (OP-4)
- ISO recommends against pursuing either the WRP or IEP for winter 2022/23
 - Neither is expected to provide significant benefits under extreme weather conditions as their incremental reliability benefits are minimal given prevailing market conditions
 - The costs are significant
 - They may undermine the performance of the market and other resources' performance incentives
- The region continues to consider longer-term solutions that may provide more material reliability benefits as system and market conditions evolve - that is work still to be continued by the ISO, regulators, and stakeholders

OPERATIONAL ANALYSIS



Fuel-Oil Capability and Inventory

- New England has significant fuel-oil fired generating capability
 - Approximately 12,700 MW total (based on winter capability)
 - A majority, ~70%, uses lighter distillate fuel-oil (DFO) while the balance, ~30%, uses heavier residual fuel-oil (RFO)
 - Approximately half (6,600 MW) is dual-fuel capable (natural gas is primary fuel and DFO as an alternate)
- Regional fuel-oil storage capacity is approximately 240M gallons
 - New England's six RFO stations account for ~70% of all fuel-oil storage capacity, but only ~30% of all oil-fired generating capability
- Current aggregate fuel-oil inventory in the region is approximately 81M gallons
 - RFO inventory is ~48M gallons and DFO inventory is ~33M gallons



Fuel-Oil Risks

- A majority of all fuel-oil storage capacity and inventory is located at a small number of generating stations
- Significant percentages of fuel-oil inventory may become unavailable in the event of an unplanned outage of even a couple of those infrequently operated resources
 - The five stations with the largest fuel-oil storage capacities account for ~54% of all fuel-oil inventory currently in the region
 - A single RFO station accounts for ~21% of all fuel-oil storage *capacity* and another RFO station accounts for ~21% of all current fuel-oil *inventory*
- Generating capability of DFO resources, which have smaller fuel-oil storage tanks, is likely to diminish very quickly if those resources are operated continuously without replenishment



Fuel-Oil Replenishment Is Expected Prior to Winter 2022/23

- Some fuel-oil replenishment has taken place since the end of last winter
- Based on recent replenishment activities and discussions with resource owners, ISO anticipates more replenishment prior to winter
 - Additional fuel-oil replenishment is expected to increase the region's aggregate fuel-oil inventory from ~81M gallons (~34% of max) to ~110M gallons (~46% of max) prior to winter
- Due in large part to declining forward prices for fuel-oil through summer/fall, many stations are (understandably) waiting until fall to procure and finalize replenishment
- Minimal concerns have been expressed with regard to the fuel-oil supply chain; fuel-oil is domestically sourced/supplied
 - There is some potential for trucker shortages, which may impact facilities that replenish by truck, in the event of extreme weather

Fuel-Oil Replenishment Expected During Winter 2022/23

- Prior to winter 2021/22, the region's aggregate fuel-oil inventory was ~54% of maximum storage capacity
 - Approx. 80M gallons of fuel-oil was burned last winter
 - ISO observed some replenishment of RFO inventories and significant replenishment of DFO inventories, particularly from DFO stations with direct pipeline connections to fuel-oil storage terminals
- In-season replenishment of fuel-oil inventories will be necessary in the event that fuel-oil stocks become significantly depleted
- Given current market conditions, ISO expects that such replenishments will be profitable for resources that have depleted their initial fuel inventory
- Similar to fuel-oil replenishment activities observed last winter, ISO expects resource owners will take necessary steps to ensure their resources are available to provide energy to the region

LNG Capabilities and Expectations

- Unlike fuel-oil, which can serve only the generators where it is stored, vaporized LNG can reach many (gas-fired) resources since the gas flows counter to prevailing pipeline constraints
 - This makes LNG storage more versatile than equivalent oil
- Each 3 Bcf LNG tanker has the energy equivalent of 20M gallons of fuel-oil
 - ISO expects ~110M gallons of fuel-oil for winter (*see slide 9*)
- Over the past ten winters (Dec-Feb), the region has averaged ~31.7 Bcf of LNG usage; the highest usage was ~42.9 Bcf in 2012/13, lowest usage was ~20.0 Bcf in 2021/22
- For winter 2022/23, the ISO expects LNG availability to be close to recent historical averages

ENERGY ANALYSIS SUMMARY WINTER 2022/23

2022/23 Winter Scenarios – Assumptions

- The ISO assessed (and continues to assess) scenarios to prepare for the upcoming winter
 - Mild winter scenarios are represented by the 2021/22 winter season
 - Moderate winter scenarios are represented by the 2017/18 winter season
- Key assumptions:
 - All scenarios assume a certain level of outages, but no major or long-duration unplanned generator or transmission contingencies
 - Fuel-oil replenishment assumptions range from minimal to moderate
 - Minimal assumes replenishment activity similar to last winter and moderate assumes additional incremental replenishment (up to 1.2 times expected starting inventories)
 - No LNG injections are assumed beyond current projections (*see slide 11*)

Scenario Results

- ISO expects to be able to operate reliably through a mild winter with no capacity deficiency or load shed events
- The ISO expects to be able to operate reliably through a moderate winter, but may rely on established capacity deficiency procedures (OP-4)
 - The use of capacity deficiency procedures may range from 0 to 16 days, depending on replenishment and contingency assumptions
 - ISO anticipates that actual use of capacity deficiency procedures over a number of days would result in market responses, such as greater energy imports (at external interfaces) and stored fuel replenishment
- Independent of a winter program, load shedding may be required if the region experiences sustained cold weather and multi-day major source-loss contingencies
 - E.g.: nuclear units, external ties to HQ or NYISO, or the LNG terminals

WINTER POWER & FUEL MARKET OUTLOOK

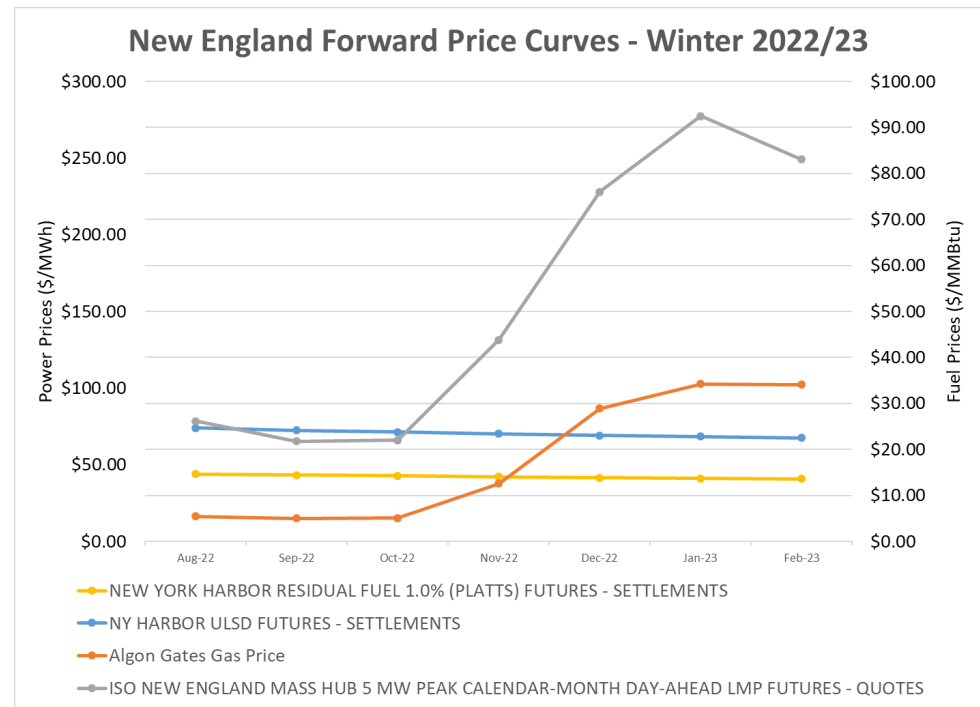
Indicative Energy Commodity Forwards and Futures Prices for Winter 2022/23

Fuel and Energy Prices Suggest Market Signals Will Incent Fuel Procurements for Upcoming Winter

- The spread between forward electricity and fuel prices for winter 2022/23 is sufficiently high that oil-fired units could ‘lock-in’ winter margin by selling electricity forward and buying fuel for the winter now (and likely through fall)
- These incentives exist without any program in place for winter 2022/23 that provides further revenues associated with the procurement of fuel
- This indicates that an out-of-market fuel program may largely compensate resources for holding fuel that they will procure anyway
- *Next:* Figures showing forward energy and fuel prices, and forward spark spreads for representative oil and gas units

Winter 2022/23 Forward Markets Outlook

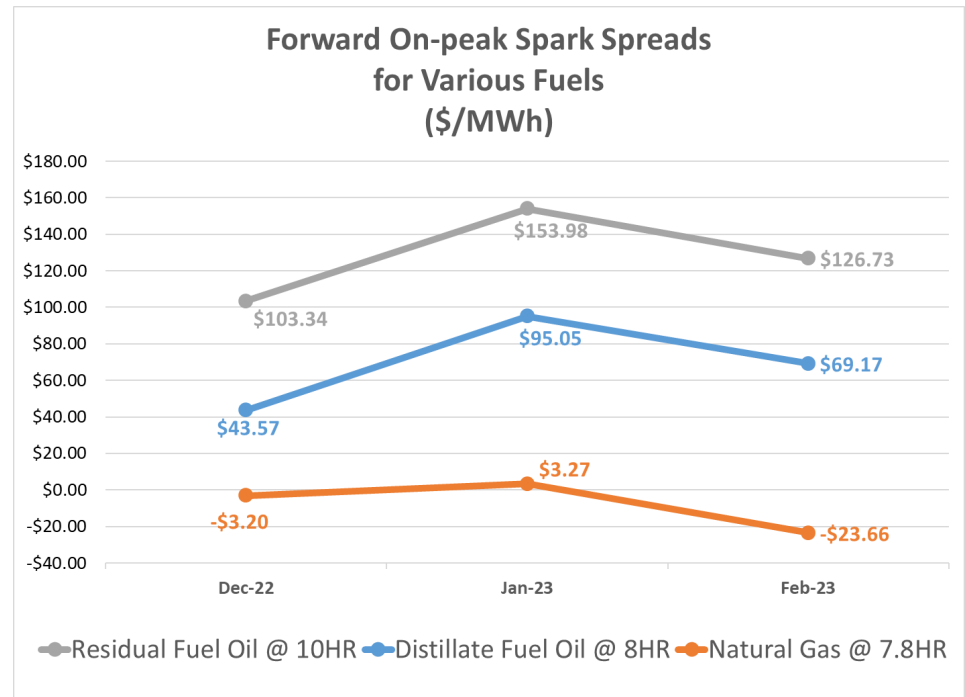
- On-peak, winter, Day-Ahead LMP's are currently trading above \$250/MWh
- Winter Algonquin City Gate Natural Gas is trading above \$35/MMBtu
- Fuel-oil is currently a less expensive winter fuel than natural gas in the forward markets



Source: NYMEX/CME Group via S&P Global Market Intelligence, accessed July 6, 2022

Winter 2022/23 Forward On-peak Spark Spreads

- Strong market signals for generators **to acquire fuel-oil ahead of winter** even without an out-of-market winter program:
 - Fuel-oils are “in the money” at typical New England plants heat rates in the current forward market
 - E.g., an 8 MMBtu/MWh heat rate unit would realize a gross margin of \$95/MWh buying distillate fuel-oil and selling on-peak power at current January forward prices
 - Current forward markets allow DFO/RFO generators to hedge price risk and lock-in healthy gross margins for the upcoming winter
- Forward spark spreads also suggest that gas units will be marginal over the winter during on-peak hours



Notes: 1. In the above chart, HR = Heat Rate, expressed in MMBtu/MWh
2. Spark spreads are calculated based on forward pricing obtained on July 6, 2022

WINTER RELIABILITY PROGRAM AND INVENTORIED ENERGY PROGRAMS

Assessment of Out-of-Market Programs for Winter 2022/23

2022/23 Winter Fuel Security: Options Considered

- ISO assessed potential programs that could be designed, discussed with stakeholders, and implemented in time to be effective for winter 2022/23 and meaningfully impact resource owners' fuel decisions
- Only programs that have previously been designed and discussed with stakeholders were considered
 - Designing a new program to be in place solely for the upcoming winter is not practical given the temporary nature of the options and limitations on implementation time
- ISO evaluated two options:
 - Re-activating the 'Winter Reliability Program' last used in 2017/18
 - Accelerating the implementation date of the 'Inventoried Energy Program' to start this winter (with limitations per recent Appellate Court review)
- *Next:* Further discussion of each of these programs, updated program rates and costs, and key pros and cons of each

Winter Reliability Program: Overview

- Compensates resources for unused fuel at the end of winter
 - On site fuel-oil that was unused at the end of the winter;
 - Unused LNG contract volumes; and
 - Supplemental demand response (unclear if DR could participate going forward based on market changes since 2018)
- Program payment rate determination:
 - Conceptually, set so that a resource with unused oil at the end of the winter does not lose money on that unused oil
 - Specifically, set using a formula that estimates (in advance of winter) the dollar-value of this “no lose” proposition based on, among other factors, the present and future costs of purchasing and storing fuel-oil

Winter Reliability Program: Indicative Rate and Costs are Greater than in Earlier Years' Program

- Indicative program base payment rate for winter 2022/23 would be \$61.10/bbl for fuel-oil for winter 2022/23
 - This is roughly six times as large as the 2017/18 rate of \$10.33/bbl (and also much larger than other WRP payment rates employed in earlier iterations of this program)
 - Indicative program base payment rate increases similarly for LNG
- Assuming similar program participation rate to that observed in prior winters, the estimated program cost is **\$170 million**
 - Significantly higher than the 2017/18 program cost of \$25 Million
- *Next:* Determinants behind increased program payment rate and costs

Winter Reliability Program: Key factors driving program costs

- Total cost to consumers depends on costs of acquiring and holding fuel-oil through winter's end
- This cost has increased substantially from prior program years (2015 – 2018):
 - Oil prices are significantly higher today than prior program years, thus making it more costly to purchase and hold the fuel-oil
 - Forward markets show the expected oil spot price drops significantly after the winter of 2022/23
 - That drop makes it far more costly to buy the fuel-oil today and hold it as inventory through the winter, when it will have far lower future value
 - This downward price trend in regional (and global) fuel-oil market pricing was not present in earlier winters

Winter Reliability Program: Pros and Cons

- **Pro 1: *Region has experience with WRP*** – ISO and stakeholders have experience implementing and participating in a WRP
- **Pro 2: *Incremental Oil*** – May incent incremental oil, though it is not possible to accurately quantify the incremental amount prospectively
- **Con 1: *Speculative benefits, high costs*** – Forward fuel and power prices show oil is ‘in the money’ for winter 2022/23 with no program, implying there are strong incentives to maintain inventory without the program
 - Program may largely pay for fuel that would already be available
 - Potential for incremental fuel incented by program may be limited by short time between program’s potential approval and winter
- **Con 2: *May Undermine LNG procurement*** – The fuel-oil subsidy may adversely impact LNG contracting by suppressing the energy market’s prices and reducing LNG-procurement profitability
- **Con 3: *Timing*** – Program incents fill-ups at the end of the season, when there is relatively little cold-weather risk

Inventoried Energy Program: Overview

- Approved for winters 2023/24 and 2024/25, though the ISO will need to narrow program eligibility to comply with a recent court ruling (details remain to be determined)
- Compensates resources for up to three days of inventoried energy that can be converted to electric energy, as measured following any cold ('trigger temperature') winter days
- Administrative forward payment rate is set to make a gas-only resource 'break even' when purchasing a winter-season (10-day option) contract for vaporized LNG from an LNG importer, and holding 3 days as inventory for the program duration

Inventoried Energy Program: Key differences from WRP

- Rate is set based on estimated cost of an LNG contract, and may thereby incent more gas-from-LNG than the WRP
- IEP's two-settlement structure improves incentives to have inventoried energy available when it provides greatest reliability benefit (trigger days)
- Originally introduced before the FCA for corresponding Capacity Commitment Period, meaning resources with inventoried energy capability could account for possible program revenues in entry/exit decisions
 - Supports continued operation of key resources that provide region with inventoried energy that improves winter reliability

Inventoried Energy Program: Key factors driving costs

- Program's payment rate is not based on the *total* cost of signing a gas contract, but rather the incremental cost that the resource incurs from executing the LNG-supply contract *and* preserving 3 days of contracted energy to winter's end
- Analysis Group has estimated an updated indicative program rate for winter 2022/23 of \$118/MWh, or approximately forty percent higher than the previously approved rate of \$82/MWh (from 2018)
- Estimated winter 2022/23 program costs would be **~\$157 million**, similar to the Winter Reliability Program
 - This estimate is similar to the prior IEP cost estimate because the higher payment rate is offset by the limited eligibility now imposed by the court

Inventoried Energy Program: Pros and cons

- **Pro 1: *Broader reach*** – Provides comparable incentives to both LNG and fuel-oil
- **Pro 2: *Timing aligned with winter risk*** – Relative to the WRP, the IEP's settlements improve incentives to have fuel when it provides the most reliability benefit (i.e., cold weather days)
- **Con 1: *Speculative benefits, high costs*** – ISO cannot quantify incremental reliability benefits, despite the (potentially) high consumer costs
 - The potential for incremental fuel incented by program may be limited by the short time available to secure “spot” LNG cargoes from program approval and this winter
- **Con 2: *Will not support entry/exit decisions that increase region's inventoried energy capability (a principal goal of the program)*** – An IEP for this winter, long after the FCA was run, means fuel secure resources have already made entry/exit decisions this year without considering potential program revenues
- **Con 3: *It may impact energy market prices*** – While an improvement relative to WRP due to inclusion of IEP opportunity cost, if the IEP incents incremental fuel procurements this winter, this can reduce energy market prices and therefore non-eligible resources' revenues

Summary: ISO recommends the region not pursue a winter fuel program for 2022/23

- Based on the ISO's assessment, the costs associated with the WRP and IEP are high (approx. \$160M), and the expected reliability benefits are limited
 - Also, neither program is expected to provide significant benefits under extreme weather conditions as their incremental reliability benefits are minimal
- The limited reliability benefits associated with the programs are driven by expected fuel inventories leading for this winter, the current market fundamentals that make such fuels 'in the money' this winter, and ISO and regional initiatives to improve winter reliability including PFP, opportunity cost offers, and the 21-day energy assessment
- The high program costs for winter 2022/23 are driven by a number of factors, primarily current fuel market conditions

ACTIONS AVAILABLE TO ISO FOR WINTER 2022/23 AND BEYOND

Actions Available to ISO and the Region

- The ISO expects its 21-day energy forecasting tool will signal potential energy emergencies, thereby alerting the market to procure fuel replenishments
- In addition to implementing actions prescribed by ISO's OP-21, if energy emergencies are forecasted or are occurring within the 21-day duration, ISO will pursue a number of measures to alleviate the need for extreme measures such as load shedding (*see next slide*)

Actions Available to ISO and the Region, cont.

- ISO and resource owners may request state and federal government assistance
- To minimize the need for extreme measures such as shedding of firm load, the ISO, government officials, and/or resource owners may request:
 - Jones Act waivers to facilitate additional LNG cargoes
 - Waivers of emissions and/or air permit limitations (if alternate fuel is available) under 202(c) of the Federal Power Act, or state regulations
 - Waivers of DOT restrictions on drivers for fuel deliveries
 - Activation of military staff and equipment to move fuel supplies
 - Potential release of LNG stored at gas LDCs
- ISO may also request long-term emergency conservation measures under OP-4 and request states to assist with cross-sector energy appeals for conservation of liquid fuels and natural gas

Looking Ahead

- This winter:
 - Continue with pre-winter preparation activities, assessments, scenario analysis, and continued discussions with resource owners
 - Update market participants on the scenario analysis closer to winter when NOAA's winter forecast is available



Looking Ahead

- Beyond this winter:
 - Energy Adequacy will continue to be a concern beyond this winter because of limited infrastructure and vulnerability to large source-loss contingencies, which short-term programs will not address
 - Discussions are underway in the region and with FERC on winter energy adequacy issues that may involve decisions outside of ISO New England's authority, such as non-electric infrastructure and upstream supply chain concerns
 - FERC's September 8, 2022, Winter-Gas Electric Forum ([Docket No. AD22-9](#)) will likely address the scope of the issues and better inform the future longer-term solution space
 - As a longer-term effort, the ISO is assessing the risks of extreme weather via the Operational Impacts of Extreme Weather study, which is being conducted in collaboration with EPRI and discussed with stakeholders
 - With those study results, the region then can consider various options for addressing identified risks (from infrastructure investments to wholesale market designs)