Interregional Study Update: Increasing New England Loss of Source Limit

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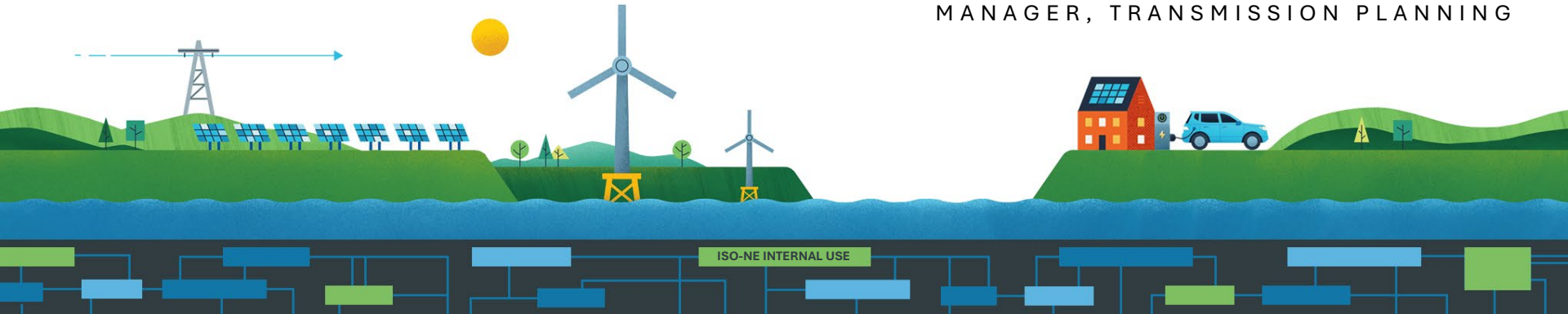


Purpose

- Provide an update on the ongoing joint study between ISO New England (ISO-NE), New York ISO (NYISO) and PJM to evaluate raising the New England loss of source limit
  - Discuss results of transfer analysis seen to date
  - Update on steady-state and stability analysis
- Discuss challenges with raising the loss of source limit that are beyond the scope of the current joint study
  - Operational/implementation challenges, reliability risks and potential costs

Background

- Today, in planning studies New England must respect a 1,200 MW loss of source limit to recognize potential historically-identified reliability issues in both PJM and NYISO's areas
  - This 1,200 MW limit has the potential to constrain system design in New England, especially in the context of offshore wind (OSW) resources
- On March 27, 2023, ISO-NE sent a request for an interregional study to JIPC
- ISO-NE requested:
  - Evaluation of the loss of source limit in today's system to see if the limit can be raised above 1,200 MW
  - If the limit on today's system remains below 2,000 MW, identification of upgrades necessary to support a 2,000 MW loss of source limit
- On August 23, 2023, the JIPC agreed to participate in the study
- In April 2024, ISO-NE selected a consultant to perform the loss of source study
- ISO-NE, NYISO, and PJM received a letter from multiple states requesting the interregional study be completed by September 2024
  - A response was provided, stating that September was not achievable
- An update was provided to IPSAC on December 6, 2024 on the study efforts

UPDATE ON CURRENT STUDY

High-level Scope of Study

- The study has been divided into two stages:
  - Stage 1 - Identify the maximum level of source loss in New England that leads to reliability concerns in the PJM or NYISO system for the planned system conditions (Ongoing Work)
    - A parallel effort is underway to understand the appropriate governing documents that would need to be updated to codify any increase in the maximum loss of source in New England
  - Stage 2 – If the maximum level of source loss in New England is less than 2,000 MW, determine the transmission upgrades necessary to raise the loss of source limit to 2,000 MW (Future Work)

Background: Study Status as-of December 2024

- Study in Stage 1, with Step 1 complete and Steps 2 and 3 in progress

- Planned work for Q1 and Q2 of 2025:
  - Complete Steps 2 and 3 noted above
  - Determine the maximum loss of source limit in New England without any transmission upgrades
  - Develop scope of work for identifying high-level transmission upgrades in the PJM and NYISO system needed to raise the loss of source limit in New England to 2,000 MW, if needed

Transfer Analysis/Interface Review Scope

- Objective of the transfer analysis is to understand whether loss of source contingencies in New England limit the maximum interface transfer capability on key interfaces in PJM and NYISO
  - If loss of source contingencies in New England do limit the interface transfer capability, the level of source loss (up to 2,000 MW) at which interface constraints were observed was also determined
- Four interfaces were evaluated:
  - NYISO: Central – East Interface
  - PJM/NYISO : PJM – NYISO Interface
  - PJM: PJM Eastern Interface
  - PJM: PJM Western Interface
- The New York – New England (NY-NE) interface was added as an additional interface to evaluate
  - Results of the NY-NE interface evaluation are not yet available

Transfer Analysis/Interface Review Preliminary Results

- The steady-state transfer analysis performed to date identifies the following for the planned study assumptions:
  - For the PJM Western and PJM Eastern interfaces, the interface transfer limit analysis indicated that a loss of a single source in New England up to 2,000 MW does not limit voltage-based interface transfer limits
  - For the PJM-NY interface, the interface transfer limit analysis indicated that a loss of a single source in New England up to 2,000 MW does not limit thermal-based interface transfer limits
  - For the Central-East interface (inside NYISO), the preliminary interface transfer limit analysis based on the study conditions evaluated indicated that a loss of a single source in New England could be up to 1,800 MW
- In addition to transfer analysis, the feasible maximum loss of source limit will further be investigated in next steps as discussed later in this presentation

Next Steps Beyond Transfer Analysis/Interface Review

- The preliminary findings on the previous slide focused solely on the performance of the interfaces. Additional potential issues may be identified based on the subsequent steady-state/stability analysis.
- The steady-state and stability analysis in Step 3 will be performed as follows:
  - Use the identified transfer limits for the key interfaces to create cases that simultaneously assess multiple key interfaces that would be at a secure operating state for the existing 1,200 MW loss of source limit
  - From this starting point, evaluate impact of raising the loss of source in New England (NE) up to 2,000 MW

Modeling Large Sources in New England

- 2,000 MW sources were evaluated at:
  - Sandy Pond (existing Phase II facility)
  - Maine Yankee (potential future location for OSW in northern NE)
  - Brayton Point (potential future location for OSW in southern NE)
- All 2,000 MW sources were modeled as HVDC facilities for the stability testing
  - HVDC facilities are subject to a temporary reduction in power output during system faults that cause low voltages at the point of interconnection (POI)
  - Allows the evaluation of the potential for simultaneous temporary reduction in output of HVDC facilities on stability performance
- Note that the focus of the evaluation is on impacts on PJM, NY and on the NY-NE tie-lines
  - Full testing would be needed for individual proposals as a part of the interconnection process. Testing would consider the cumulative impact of additional resources

Results of Steady-State Analysis

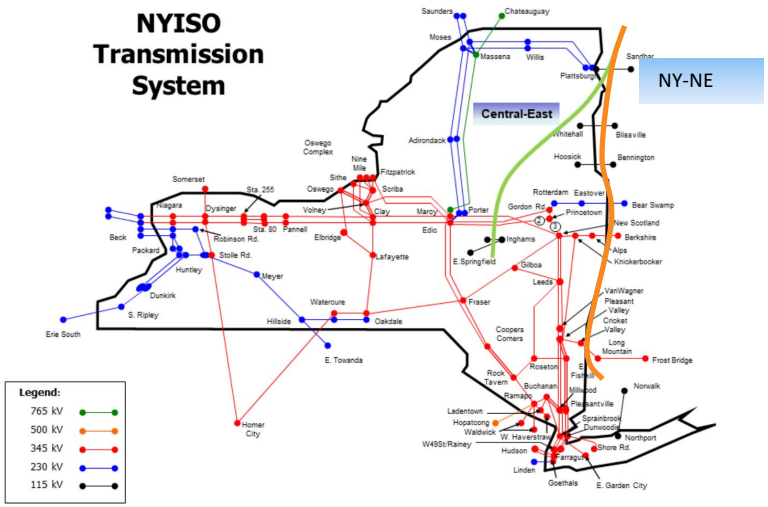
- Preliminary N-1 Testing indicates:
  - No thermal or voltage criteria violations in the PJM system for the loss of a 2,000 MW contingency in New England for summer conditions
    - A review of the winter results is in progress
  - Some thermal and voltage criteria violations observed in the NY system, near the NY-NE tie-lines, for the contingency loss of 2,000 MW in New England that are worse than the violations for internal NY constraint
  - Additionally, some thermal/voltage criteria violations are observed in the NE system, near the NY-NE tie-lines, for the contingency loss of 2,000 MW in New England that are worse than the violations for internal NE constraint including existing loss of source contingencies at 1,200 MW
- N-1-1 analysis is ongoing

Status of Stability Analysis

- The faults analyzed will initially be focused on the following types of contingencies:
  - Large loss of source contingencies in New England (existing and 2,000 MW locations discussed earlier)
  - Faults in New England that affect the NY-NE tie-lines
  - Faults in New England that may impact multiple large sources within New England (faults that may cause multiple HVDC facilities to block)
  - Faults in New York near Central-East and NY-NE interfaces
  - PJM Mid-Atlantic contingencies, near PJM-NY interface
- Stability analysis is ongoing

NY-NE Interface and Central-East

- The New York to New England (NY-NE) interface is electrically close to the Central-East interface
- Additionally, the results of the transfer analysis and the N-1 steady-state analysis indicated constraints that are in the electrical vicinity of an existing NY-NE tie line
- Analysis will be performed to see if thermal limits on NY-NE are impacted by increasing the loss of source limit to 2,000 MW
  - Additionally, ISO-NE and NYISO to review if there are any planned upgrades on the tie-line that may be impactful to the results



ADDITIONAL ANALYSIS

Comparison of Large Sources in each RTO Area

Increasing the Loss of Source Limit in all three RTOs (Looking Beyond New England)

- PJM and NYISO have indicated that while they currently do not have any 2,000 MW resources on their system, there is no limitation to the size of a new resource that is codified in their interconnection process
- A comprehensive evaluation of the impact of a 2,000 MW resource in NYISO or PJM areas was beyond the scope of the study
  - However, a limited analysis was performed to compare the impacts of the loss of resources in New York and New Jersey on the flow across the key interfaces studied
  - This is a simplified methodology where the increase in flow on the key interfaces for the loss of a large resource is representative of potential adverse impacts on the key interfaces

Comparative Analysis of Large Sources in PJM, NY and New England

- The following table compares the size of resource at two locations in New Jersey and two locations in NY that would have an equivalent flow impact (increase in MW flow) on the key interfaces as a 2,000 MW resource in New England
  - For example, a 2,000 MW single source loss in NE will have similar impact on Central East interface as a 3,525 MW source loss in Brooklyn
  - A number less than 2,000 MW indicates that a source in PJM or NY has a higher flow impact on the key interface than a source in New England

Resource Sizes (MW) in New England, PJM and NY with an Equivalent Flow Impact on Key Interfaces

Key Interface	NE Single Source	Central NJ Source	Southern NJ Source	Brooklyn Source	LI source
PJM Western	**2,000**	**1,878**	**1,740**	**2,192**	**2,125**
PJM Eastern	**2,000**	**1,732**	**1,616**	**2,142**	**2,094**
PJM-NY Interface	**2,000**	N/A*	N/A*	**2,270**	**2,175**
Central-East Interface	**2,000**	N/A*	N/A*	**3,525**	**2,947**

* The loss of resources in the PJM area have a negligible impact on the PJM-NY interface and the Central-East interface

Conclusions of Comparative Analysis

- Of all the key interfaces, the Central-East interface is the only interface where a New England source has a significantly higher flow impact than large sources in PJM or NY
- For the internal PJM interfaces (PJM Western and PJM Eastern), large resources in NJ have a greater flow impact than large sources in NY or New England
- For the PJM-NY interface, large resources in NY or New England have a comparable flow impact with the NE resources having a little higher impact

CHALLENGES WITH RAISING SINGLE SOURCE LIMIT IN NEW ENGLAND

Issues beyond tested network performance

Operational Impacts

- While planning studies (and this joint study) are focused on N-0/N-1/N-1-1 (covering all-lines-in through element out plus a contingency) conditions, system operations for all three RTOs may need to reliably operate the system through conditions with additional* elements out of service, or elements out of service that were not considered in this analysis
  - Specifically, NYISO and PJM may find real time operating conditions in which respecting a larger loss of source in New England may not be possible
  - There may also be internal constraints in New England under certain outage conditions that may prevent large sources from being online at full output
- If this study identifies that for the conditions assessed, a larger single source contingency than 1,200 can be sustained in PJM and NY, there may be some real-time conditions with multiple outages (i.e., beyond the studied conditions), where the loss of the larger resource (> 1,200 MW) may have an adverse impact on the PJM or NY system

* Additional elements out of service may be planned or unplanned outages

Reliability Risks for Unstudied Conditions

- If the system (in PJM, NYISO or ISO-NE areas) were to enter a multi-element outage state where the loss of source of 2,000 MW may not be achievable, the 2,000 MW sources in New England may need to be backed down to be prepared for subsequent contingencies
  - The reserves required to allow such a backdown will depend on the number of resources that are online at 2,000 MW as well as the reduced loss of source limit
    - Assume New England has six 2,000 MW resources, and the updated real-time loss of source limit for New England is 1,200 MW
    - To backdown all resources, 800 MW* x 6 = 4,800 MW of reserves are needed that are on the receiving end of the constraint that is limiting the loss of source limit
  - If enough reserves on the appropriate side of the system constraint are unavailable, then the only option for the operators would be to shed load
    - Amount of load shed = total backdown needed – available reserves

* Every 2,000 MW resource needs to be backed down to 1,200 MW, which requires 800 MW (2,000 MW – 1,200 MW) of reserves per resource

Risk of Load Shedding

- The risk of the system entering a state where large resources are restricted below 1,200 exists in the current system is extremely low. Given that New England has a limited number of large resources (>800 MW), it is likely that the reserves are sufficient to replace the resources being backed-down
- The risk of insufficient reserves and the potential amount of load shed needed can increase significantly if either the number of large resources in the system increases or the maximum size of resources increases in New England

Planning Considerations

- One way to reduce the risk is to consider additional scenarios, like two elements out, three elements out, etc., to ensure that the 2,000 MW loss(es) of source does not cause impacts; however,
  - This will make the study scope unmanageable
  - Even if all the analysis were performed, it is only valid if subsequent planning studies ensure that the maximum loss of source is not degraded – this will mean significant additional scope for all studies in all three RTO areas
- The three RTO areas do not consider this a feasible path forward

Additional Impacts in New England

- Besides the reliability impacts discussed earlier, there will be additional costs associated with increased reserve requirements in New England
- An increased loss of source limit will also potentially increase costs for future upgrades within New England, as designing the system for the larger loss of source contingency could utilize existing margin on the NY-NE interface and internal interfaces within New England

Additional Impacts in PJM and NYISO Areas

- Furthermore, PJM and NYISO would have to consider how they can operate their system to maintain the increased loss of source limit in New England for their day-to-day operations
  - Currently, the loss of source limit is an output from how each RTO operates their system and each RTO may need to consider potential changes to market rules and grid operations with an increased loss of source limit in New England
- If New England is the only RTO area with significantly larger resources compared to PJM and NYISO, then on an ongoing basis systems in these areas would need to be built around New England's increased loss of source limit
  - This has the potential to cause increased costs for future upgrades for these regions as considering a larger loss of source in New England will utilize existing margin on the system

NEXT STEPS

Next Steps

- The study team will look to complete the N-1-1 steady-state analysis, NY-NE transfer analysis and stability analysis by the end of Q2 2025
  - Publish a report of the analysis in Q3 of 2025
  - Present the conclusions at the next IPSAC meeting
- The findings to date indicate an opportunity to raise the limits from the current 1,200 MW value to a higher number
  - ISO-NE plans to work with PJM and NYISO on potential paths to increase the existing limit based on the results of the planned system before doing any additional work on the upgrades needed to raise the loss of source limit to 2,000 MW
  - PJM, NYISO and ISO-NE would need to update the appropriate governing documents to reflect the higher number
  - However, the additional system risks and associated costs need to be considered before moving forward

Questions