New York ISO
Independent System Operator

Load Shapes Comparison Analysis - High Load Hours

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NYISO

ICS Meeting #288

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Agenda

- Background
- Comparison Analysis
- Next Steps

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Background

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Background

- **During the ICS meeting on 2/27/2024, ICS decided to temporarily halt the efforts to modeling Behind-the-Meter (BTM) solar explicitly as generation in the Installed Reserve Margin (IRM) study model**
  - ICS indicated that a comprehensive improvement of the load modeling should be developed before proceeding with the BTM solar modeling
- **The load modeling improvement, to capture seasonal peak, and energy forecast as well as potential synthetic load shapes, has been identified as a priority for 2025 in the Resource Adequacy Modeling Improvement Strategic Plan**
- **During the ICS meeting on 2/27/2024, the NYISO presented the load shape adjustment procedure that is currently being used in the IRM study, and ICS expressed interest in exploring a comparison between the high load hours of actual load shapes, and the high load hours of modeled load shapes that are used in the IRM study**
  - Loss of load expectation (LOLE) distribution during high load hours in the 2024-2025 IRM study
  - Comparison analysis of top 50 load hours between modeled and actual load shapes observed in operations

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Load Shapes used in the IRM Study

- The NYISO considers historical New York Control Area (NYCA) and zonal load shapes, weather conditions and other characteristics to determine appropriate load shapes used in the IRM study
- Load shapes capture parameters such as the duration of the peak, number of hours/days near the annual peak, and total energy served by the system
- Currently, in the IRM study, 2013, 2017, and 2018 BTM solar adjusted net load shapes are being used at different Load Forecast Uncertainty (LFU) bins
  - 2013 load shapes: LFU bins 1 – 2
  - 2017 load shapes: LFU bins 5 – 7
  - 2018 load shapes: LFU bins 3 – 4
- The current selection of the load shapes is based on LFU Phase 2 Study Analysis* presented during the ICS meeting on 3/29/2022

*: https://www.nysrc.org/wp-content/uploads/2023/05/A.I.10-LDC_Recommendation_ICS4098.pdf

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Comparison Analysis

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LOLE During High Load Hours

- **The NYISO analyzed the top 50 load hours of the load shapes in different LFU bins for LOLE distribution based on the final Tan45 technical study case of 2024-2025 IRM database with a 23.1% IRM**

❖ LOLE by LFU Bin

LFU Bins	Expected Hours
Bin 1 [1 in 160 years]	26.98
Bin 2 [1 in 15 years]	2.47
Bin 3 [90/10 Forecast]	0.20
Bin 4 [50/50 Forecast]	0.03

❖ Percent Distribution of Loss of Load Event During Top Load Hours

	Bin 1	Bin 2	Bin 3	Bin 4
Top 1 - 10 Load Hours	34.6%	60.3%	40.2%	40.0%
Top 11 - 20 Load Hours	26.6%	19.9%	13.4%	11.6%
Top 21 - 30 Load Hours	20.6%	13.3%	10.4%	7.3%
Top 31 - 40 Load Hours	12.6%	3.7%	8.2%	15.8%
Top 41 - 50 Load Hours	3.8%	0.9%	5.4%	4.2%

- **The top 50 load hours of LFU bins 1 or 2 account for ~98% of respective event hours cumulatively (see right side table above)**
- **The top 50 load hours of LFU bins 3 or 4 account for ~79% of respective event hours cumulatively (see right side table above)**
  - 2018 load shape (LFU bins 3 and 4) has relatively flat slope compared to the 2013 load shape (LFU bins 1 and 2), hence the loss of load expectation is relatively more dispersed
  - LFU bins 1 and 2 represent more severe weather conditions, hence the greater proportions of the top load hours trigger loss of load event
- **Top 50 load hours of bin 1 and top 50 load hours of bin 2 combined are responsible for more than 97% of the total loss of load events**

$$\left(\frac{26.98 + 2.47}{26.98 + 2.47 + 0.2 + 0.03}\right) \times 0.98 \approx 0.992 \times 0.98 \approx \mathbf{0.972}$$

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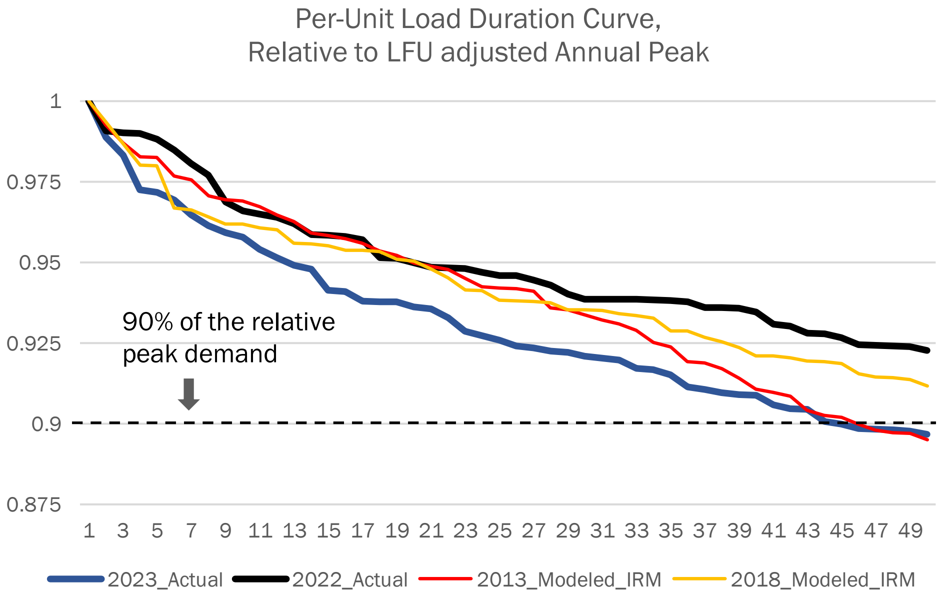
Load Duration Curve (LDC) Comparison

- **The LDC comparison analysis is based on the per-unit loads (relative to LFU adjusted annual peak) of top 50 hours**
  - 2013 and 2018 net load shapes are adjusted to 2024-2025 summer peak forecasts and LFU multipliers are applied
- **Both LDCs of modeled 2013 and 2018 load shapes are relatively flatter than the LDC of 2023 actual load shape**
  - 2018 LDC is relatively flatter than 2013 LDC
  - 2013 LDC intersects with LDC of 2023 actual load shape at ~90% of the relative peak demand level and decreases with steeper slope thereafter
    - Between the modeled 2013 load shape and 2023 actual load shape, there are a similar number of load hours that are ≥ 90% of the relative peak demand
  - Load hours that are ≥ 90% of the peak demand represent approximately top 50 load hours of 2013 load shape
    - Top 50 load hours of 2013 load shape is responsible for more than 97% of the total loss of load events
- **The LDC of 2022 actual load shape is relatively flatter than both LDCs of modeled 2013 and 2018 load shapes**
  - The current load shape adjustment procedure does not necessarily overrepresent the high load hours compared to the actual load



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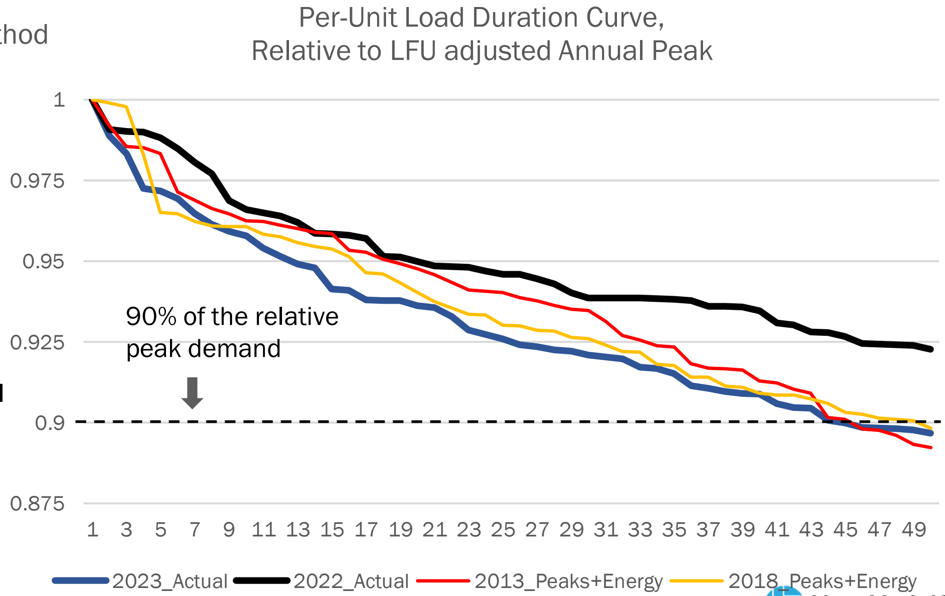
Load Duration Curve Comparison (Alternative Load Shapes Adjustment)

- **Although the current load shape adjustment procedure does not show immediate issues, the NYISO acknowledges that exploration of potential enhancements is warranted**
  - Changes in future load profiles are expected due to heating electrification and electric vehicle demand
- **As a potential alternative method, NYISO adjusted 2013 and 2018 net load shapes to seasonal peak forecasts with the energy forecast distributed at monthly and zonal level**
  - NYISO's Reliability Needs Assessment (RNA) team's method
- **The LDCs of seasonal peaks and energy adjusted 2013 and 2018 load shapes are relatively steeper than the 2024-2025 IRM study modeled load shapes and more closely resemble the 2023 actual load shape**
  - Both 2013 and 2018 load shapes have similar number of load hours that are ≥ 90% of the relative peak demand to the 2023 actual load shape
    - This alternative method of adjustment could help address the concern for potential overrepresentation of the near peak hours due to the use of a single zonal non-coincident peak (NCP) ratio being applied to all hours in respective zones
- **The LDC of 2022 actual load shape remains flatter than both LDCs of 2013 and 2018 load shapes using this alternative adjustment method**



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Observations

- **In the 2024-2025 IRM study, the top 50 load hours of bin 1 and top 50 hours of bin 2 combined are responsible for more than 97% of the observed LOLE event hours**
- **The current IRM load shape adjustment procedure does not necessarily overrepresent the high load hours compared to the actual load observed in operations**
  - Based on the results of the load duration curve analysis, both modeled 2013 and 2018 load shapes are relatively flatter than 2023 actual load shape, but steeper than 2022 actual load shape
  - The LDC of modeled 2013 load shape intersects with LDC of 2023 actual load shape at ~90% of the relative peak demand level and decreases with steeper slope thereafter
    - Load hours that are ≥ 90% of the peak demand represent approximately the top 50 load hours in 2013 load shape
- **The potential alternative load shape adjustment method analyzed could remedy the concern for potential over-representation of the near peak hours**
  - The alternative method captures the seasonal peaks and annual energy distributed at monthly and zonal levels
  - The load shapes using the alternative adjustment method are relatively steeper than the modeled 2013 and 2018 net load shapes used in the 2024-2025 IRM study
  - The load shapes adjusted with the alternative adjustment method more closely resemble the 2023 actual load shape, representing similar number of load hours that are ≥ 90% of the peak demand

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Next Steps

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Next Steps

- **The NYISO will continue to explore methods to improve the current load shape adjustment procedure and bring subsequent impact assessment results for ICS review**
  - Should the NYISO conduct sensitivity analysis using RNA's load shape adjustment method?

- **Future work:**
  - Develop a methodology to model BTM solar resource explicitly in the IRM model
    - Contingent upon the approval/adoption of the improved load shape adjustment method

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Proposed Timeline

Milestone	Timeline
Present load shapes comparison analysis and solicit inputs for potential improvements	04/03/2024
Develop recommendations for the improved load shape adjustment method, and conduct sensitivity analysis on 2024-2025 IRM Final Base Case (FBC)	May/June 2024
Conduct sensitivity analysis on 2025-2026 IRM Preliminary Base Case	July 2024
Subject to NYSRC's approval, implement recommended improvement enhancements in the 2025-2026 IRM FBC	August 2024 (implementation pending NYSRC's approval)
Contingent upon the approval/adoption of the improved load shape adjustment method, revisit modeling BTM solar explicitly in the IRM study (for future IRM study cycles)	September-December 2024

- **As this project proceeds, the NYISO will provide ongoing updates to the ICS to share progress and solicit feedback**

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Questions?

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Our Mission & Vision

Mission

Ensure power system reliability and competitive markets for New York in a clean energy future

Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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