2024-2025 Winter Load Shape Analysis for 2025 NPCC Reliability Assessments

Introduction

Currently, the CP-8 Working Group (WG) uses the historical load shape based on the winter of 2013-2014 for the months of October - April in NPCC multi-area probabilistic reliability assessments. The selection of the winter load shape assumption is reevaluated on a periodic basis.

This report compares the winter 2013-2014 load shape currently in use with a corresponding representation of the 2024-2025 load profile. Both profiles were scaled consistently with the load forecast assumptions used in the NPCC 2025-2026 Winter Multi-Area Probabilistic Reliability Assessment. [1] The purpose of this evaluation is to determine if the load shape used in the Multi-Area Probabilistic Reliability Assessment is the most conservative for the NPCC Region. Since both the 2013-2014 and 2024-2025 load shapes are scaled to the Areas' 2025-2026 load forecast, the most conservative load shape for the probabilistic assessment may not be the season in which the most severe weather was observed.

Load Shapes

The 2024-2025 load profiles were provided to GE by each of the five NPCC Areas, as well as by PJM for their own representation. These profiles reflect the actual load; with any demand response added back into the hourly load provided.

Load Scaling Adjustment Methodology

This report illustrates what the loads would be if used to model in GE Multi-Area Reliability Simulations (MARS) for the 2025-2026 NPCC Winter Multi-Area Probabilistic Reliability Assessment. The 2013-2014 and 2024-2025 shapes are compared in this analysis.

2013-2014 Shape

The 2013-2014 current load shape is the result of the model from the 2025-2026 NPCC Winter Multi-Area Probabilistic Reliability Assessment (i.e., each month's Area peak loads scaled to match the Area's year 2025-2026 demand and energy forecasts). For Québec, and the Maritimes, monthly demand values are provided for the 2025-2026 Winter Assessment. For New York, New England, and Ontario the winter peak for the season is provided, and the monthly values are determined by scaling the 2013-2014 load shape to match the expected 2025-2026 winter peak.

2024-2025 Shape

The 2024-2025 shape is the resulting shape from the NPCC Area's, with each Area's sub-areas (or zones) scaled by a consistent ratio to achieve the same coincident peak as modeled in the 2025-2026 NPCC Winter Multi-Area Probabilistic Reliability Assessment when using the 2013-2014 Shape. This represents the load shape methodology that would be used in the MARS program if the 2024-2025 load shape was

[1] See: https://www.npcc.org/library/reports/seasonal-assessment

used in the 2025-2026 Winter Assessment and the winter peak value was matched. The sub-areas' monthly peak ratio that is provided or calculated for the 2025-2026 Winter Assessment is kept constant.

For a consistent evaluation across the two years, the shapes in this analysis for most of the NPCC Areas correspond to gross load values, i.e., the load without the effect of distributed energy resources (DER) applied to it. For Québec, Maritimes and Ontario, the amount of DER is currently negligible and both years utilized gross load values. New York provided the load shape for the year 2024-2025 with an estimate of DER generation added back in, which represents the gross load in 2024-2025. For New England, the 2024-2025 shape represents the net load (i.e., gross load minus DER). For consistency, New England estimated what the hourly generation would have been **with** the amount of DER present in the 2023-2024 Winter Assessment. That estimated DER generation was netted from the 2013-2014 observed load to obtain the load shape for that year.[2]

Daily Peaks

The current NPCC CP-8 WG model utilizes the 2013-2014 load shape for the winter months, October through April. A plot of the daily peaks for the months of November through February as represented in the 2025-2026 NPCC Winter Multi-Area Reliability Assessment is shown in **Figure 1.** Note that these plots show the Areas and the aggregated shape for the NPCC Region.

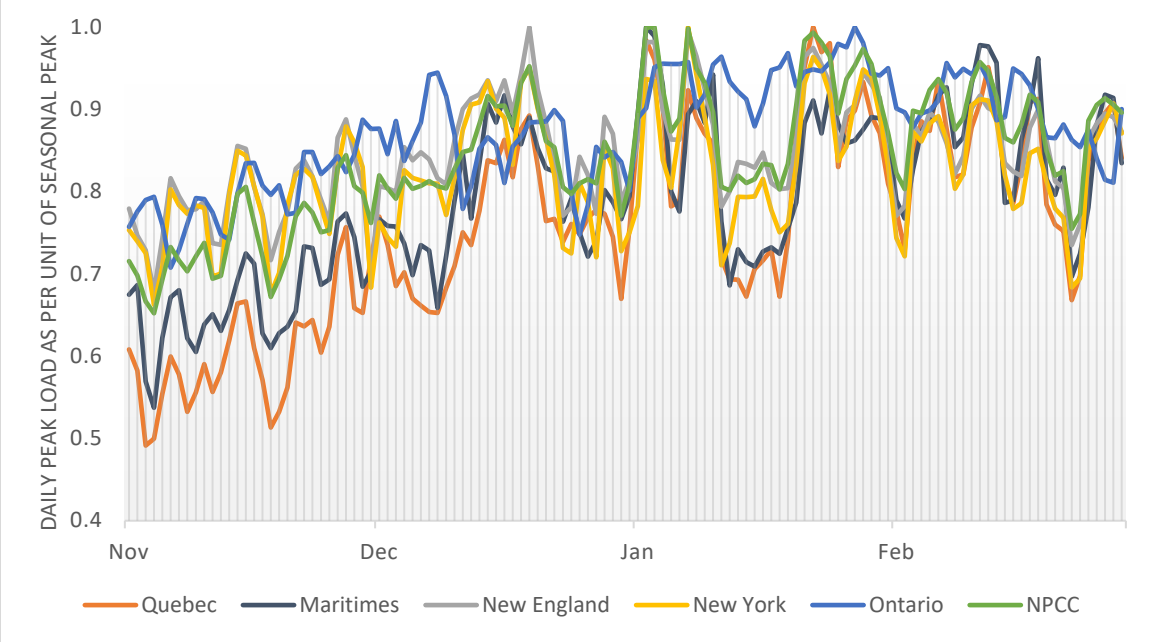

Figure 1 - Daily Peak Loads – 2013-2014 Load Shape

Figure 2 shows the same plot, rendered for the 2024-2025 load shape, after only scaling the sub-area non-coincident peaks to achieve the same Area annual coincident peaks as observed with the 2013-2014 load

[2] To make the New England 2013-2014 load shape consistent with the 2024-2025 net load shape, the modeled DER from the 2025-2026 winter assessment is subtracted out of the 2013-2014 load profile.

shape. **Table 1** below shows the number of days above a percent of Area winter peak using this adjustment methodology.

For the 2024-2025 shape, 7 days during this period had a daily peak for NPCC higher than 95% of the peak, with 30 and 65 days at or above 90% and 85% of the NPCC peak respectively. This is in comparison to the 2013-2014 shape, where 12, 34, and 55 days were at or above 95%, 90%, and 85% of the NPCC peak, respectively.

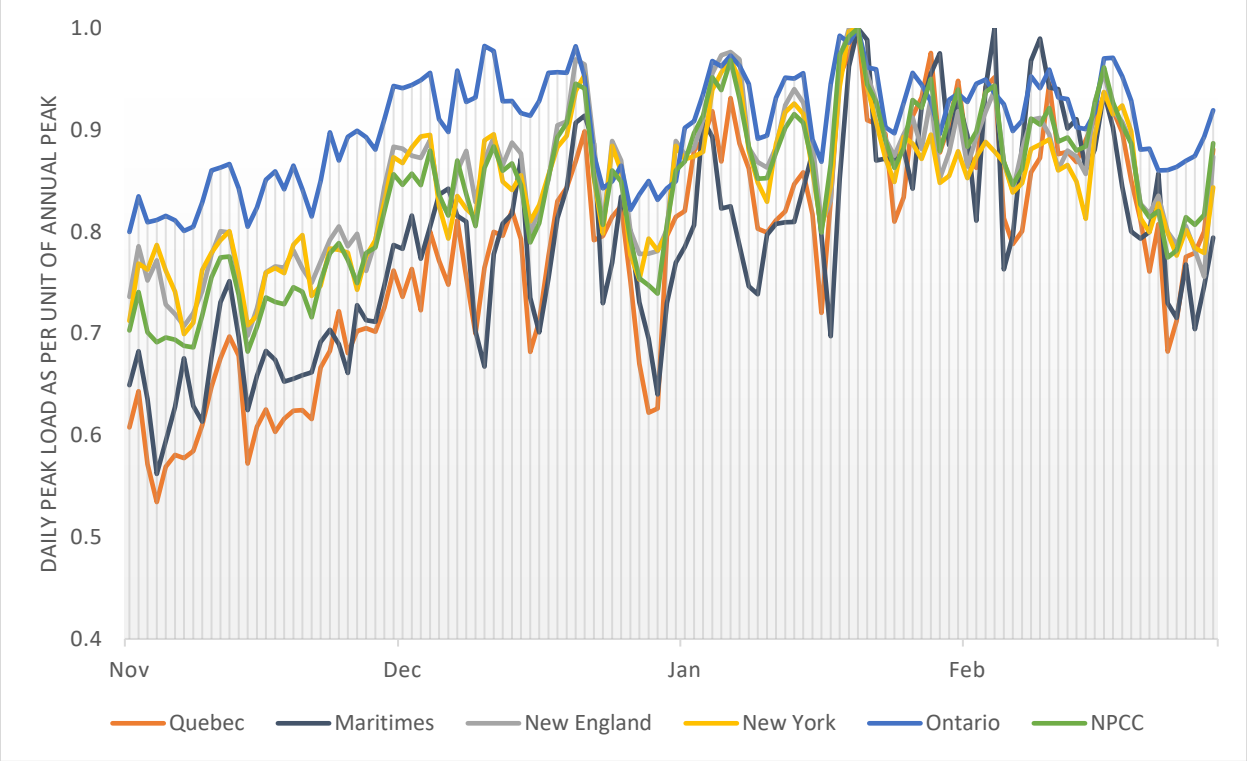

Figure 2 - Daily Peak Loads – 2024-2025 Load Shape

Table 1 - Number of days above a percent of Area winter peak

	2013-2014 Shape			2024-2025 Shape		
Region	**95%**	**90%**	**85%**	**95%**	**90%**	**85%**
Quebec	7	16	34	5	18	39
Maritimes	6	19	42	8	20	35
New England	8	25	56	11	28	69
New York	3	22	43	5	17	57
Ontario	17	45	77	27	66	96
NPCC	12	34	55	7	30	65

Statistics for the two profiles are shown in **Table 2** below. This table shows the peak load and load factor[3] for NPCC and its member Areas. The statistics are shown for November through February and provide a simple comparison of the monthly peaks across the two load shapes.

Table 2 - Statistics for 2013-2014 and 2024-2025 shapes, scaled to seasonal and monthly peaks [4]

		Month	November	December	January	February
Quebec	2013-2014 Shape	Peak (MW)	30,827	36,363	40,736	38,753
		Energy (GWh)	15,823	20,896	23,128	20,818
		Load Factor (%)	71.3	77.2	76.3	79.9
	2024-2025 Shape	Peak (MW)	31,034	36,608	40,736	38,777
		Energy (GWh)	16,976	21,567	24,356	21,202
		Load Factor (%)	76.0	79.2	80.4	81.4
Maritimes	2013-2014 Shape	Peak (MW)	4,666	5,533	6,033	5,900
		Energy (GWh)	2,527	3,154	3,353	3,103
		Load Factor (%)	75.2	76.6	74.7	78.3
	2024-2025 Shape	Peak (MW)	4,749	5,516	6,033	6,033
		Energy (GWh)	2,600	3,191	3,465	3,081
		Load Factor (%)	76.1	77.8	77.2	76.0
New England	2013-2014 Shape	Peak (MW)	17,809	20,056	19,948	18,379
		Energy (GWh)	8,778	10,296	10,712	9,442
		Load Factor (%)	68.5	69.0	72.2	76.4
	2024-2025 Shape	Peak (MW)	17,721	19,447	20,056	19,194
		Energy (GWh)	9,444	11,155	11,953	10,322
		Load Factor (%)	74.0	77.1	80.1	80.0

[3] Monthly load factor calculated by (Energy)/ (Peak * hours in month)

[4] Highlighted Area values represent the non-coincident summer peak. The NPCC highlighted values represent the coincident peak for NPCC (which do not match because the values are matched at the individual Area level).

New York	**2013-2014 Shape**	**Peak (MW)**	21,283	22,998	24,200	22,082
		Energy (GWh)	10,887	11,985	12,763	11,187
		Load Factor (%)	71.0	70.0	70.9	75.4
	2024-2025 Shape	**Peak (MW)**	21,132	23,098	24,200	22,684
		Energy (GWh)	11,457	13,426	14,278	12,271
		Load Factor (%)	75.3	78.1	79.3	80.5
Ontario	**2013-2014 Shape**	**Peak (MW)**	20,153	21,447	22,706	21,713
		Energy (GWh)	11,270	12,532	13,795	12,045
		Load Factor (%)	77.7	78.5	81.7	82.6
	2024-2025 Shape	**Peak (MW)**	21,423	22,310	22,706	22,045
		Energy (GWh)	12,123	13,646	14,173	12,608
		Load Factor (%)	78.6	82.2	83.9	85.1
NPCC	**2013-2014 Shape**	**Peak (MW)**	92,015	103,794	108,990	104,360
		Energy (GWh)	49,285	58,863	63,751	56,595
		Load Factor (%)	74.4	76.2	78.6	80.7
	2024-2025 Shape	**Peak (MW)**	95,238	105,137	111,173	106,904
		Energy (GWh)	52,600	62,985	68,225	59,484
		Load Factor (%)	76.7	80.5	82.5	82.8

Table 3 shows the day of the NPCC peak load for winter 2025-2026 and the corresponding Area's **percentage** of peak load for that day when using the 2013-2014 and 2024-2025 load shapes.

Table 3 – NPCC Peak Load Day

	Date	Québec	Maritimes	New England	New York	Ontario
2013-2014 Shape	03-JAN-2026	96%	99%	98%	93%	95%
2024-2025 Shape	20-JAN-2026	100%	100%	100%	100%	100%

Comparison to Historical Years for the Top 31 Days of the Winter Period

One of the factors affecting the "stress" a load shape puts on the system is to consider the number of days where the load was at or near the seasonal peak, as these are the days when a loss of load event is most likely to occur. **Figure 4** isolates the 2013-2014 and 2024-2025 shapes for a more direct comparison. The curves have been normalized to the respective seasonal peak.

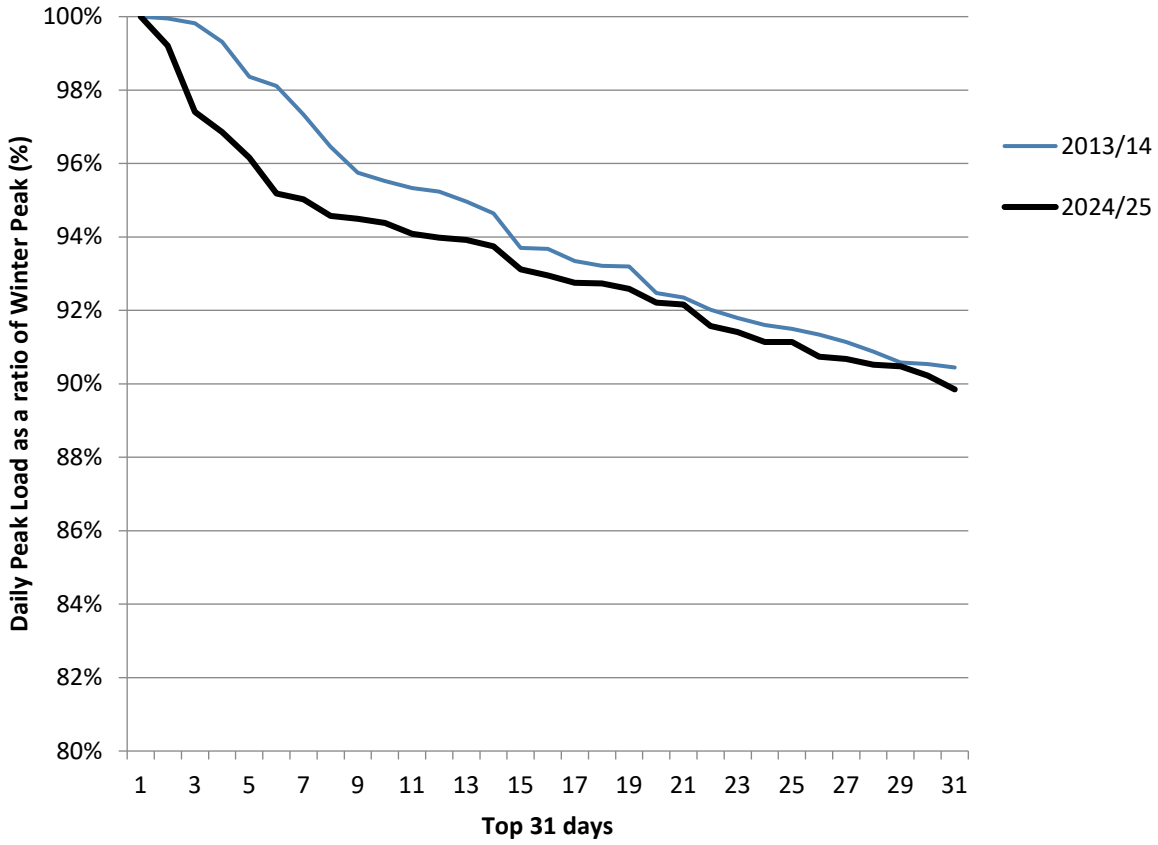

Figure 4 - Comparison of Normalized NPCC Winter Peak Loads for 2013-2014 and 2024-2025

Figure 5 also shows the 2013-2014 and 2024-2025 shapes, but the curves have not been normalized. The figures show the actual MW of peak daily load for the highest 31 days.

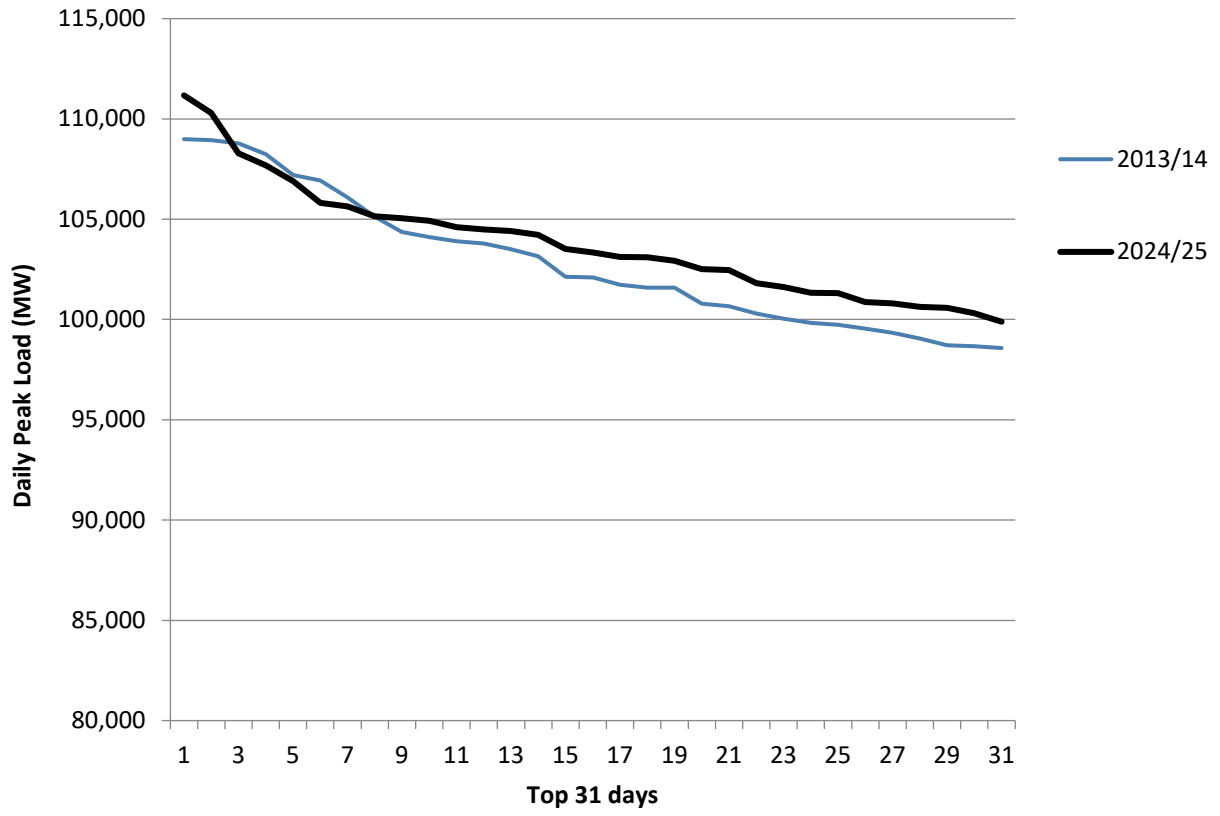

Figure 5 - Comparison of MW NPCC Winter Peak Loads for 2013-2014 and 2024-2025

Conclusion

On a region-wide basis, the shape of 2024-2025 and 2013-2014 seems to be equally stressful based on the analysis. The number of days above 95% and 90% of the peak load for the 2013-2014 shape compared to the 2024-2025 load shape shown in **Table 1** is similar for the winter season. The NPCC actual peak with the 2024-2025 load shape is higher than with the 2013-2014 load shape, as shown in **Table 2** and **Figure 4**. To assess the reliability impacts of each load shape on an interconnected system, it's crucial to consider the number of days when the load was at its annual peak or near peak, as these are the days when a loss of load event is most likely to occur.

Recommendation

For the reasons concluded above, the CP-8 WG recommends simulating the forthcoming 2025-2026 NPCC Winter Multi-Area Probabilistic Reliability Assessment with both the 2013-2014 and 2024-2025 load shapes, to understand which is the most conservative option.