



2019 Load Shape Analysis for NPCC Reliability Assessments

Introduction

Currently, the CP-8 Working Group uses the historical load shape based on the summer of 2002 for the months of May – September. The selection of the summer load shape assumption is reevaluated on a periodic basis.

This report compares the summer 2002 load shape currently in use with a corresponding representation of the 2019 load profile. Both profiles were scaled consistent with the load forecast assumptions used in the NPCC 2020 Summer Multi-Area Probabilistic Reliability Assessment.¹

Load Shapes

The 2019 load profiles were provided to GE by each of the 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 them in MARS for the 2020 NPCC Summer Multi-Area Probabilistic Reliability Assessment. The following shapes are compared.

2002 Shape

The 2002 current load shape is the result of the model from the 2020 NPCC Summer Multi-Area Probabilistic Reliability Assessment (i.e., each month's Area peak loads scaled to match the Area's year 2020 demand and energy forecasts).

2019 Shape

The 2019 Annual shape is the resulting shape from the NPCC Area's, with each Area's sub-areas (or zones) scaled by a consistent ratio in order to achieve the same coincident peak as modeled in the 2020 NPCC Summer Multi-Area Probabilistic Reliability Assessment when using the 2002 Shape². This represents the load shape methodology that would be used in the MARS program if the 2019 load shape was used in the 2020 Summer Assessment and the summer peak value was matched.

¹ See: <https://www.npcc.org/Library/Seasonal%20Assessment/Forms/Public%20List.aspx>.

² For New England, the 2019 load peak is matched using to the "2002 Shape" net load peak (as New England provides the gross load shape and an estimate of the BTM shapes). For other Areas, the load is matched to the "2002 Shape" gross load peak.



2019 Load Shape Analysis for NPCC Reliability Assessments

Daily Peaks

The current NPCC CP-8 model utilizes the 2002 load shape for the summer months, May through September. A plot of the daily peaks for the months of June through August as represented in the 2020 NPCC Summer Multi-Area Reliability Assessment is shown in Figure 1. Note that these plots show only the summer-peaking regions in NPCC: New England, New York, and Ontario, as well as PJM and NPCC (the latter includes the load for all NPCC areas).

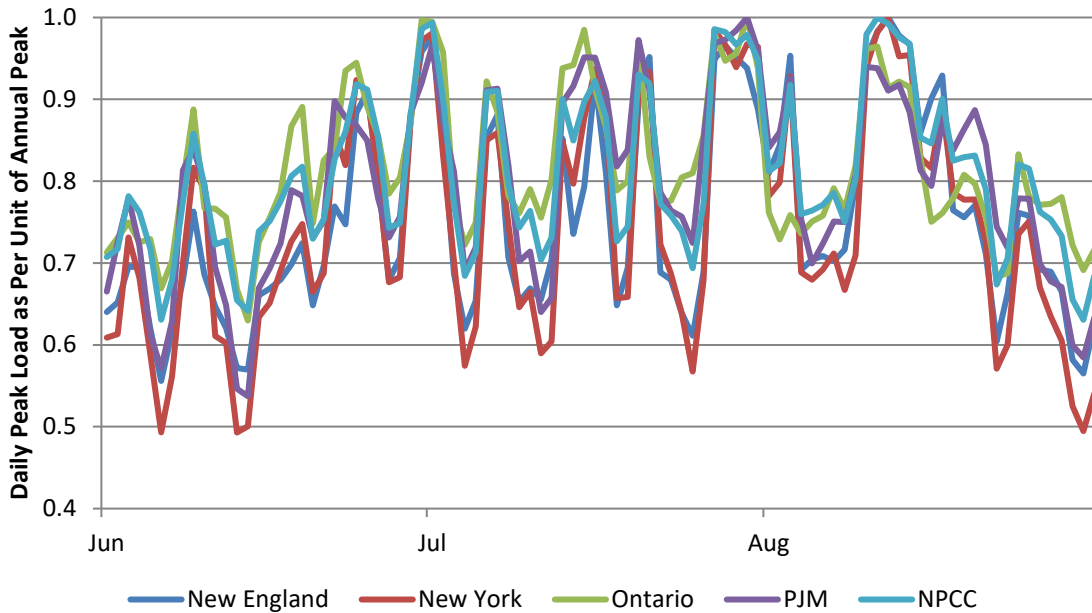


Figure 1 - Daily Peak Loads – 2002 Load Shape

Figure 2 shows the same plot, rendered for the 2019 load shape, after only scaling the sub-area non-coincident peaks to achieve the same Area annual coincident peaks as observed with the 2002 load shape. With this adjustment methodology and as Table 1 shows, 10 days during this period had a daily peak for NPCC higher than 95% of NPCC's peak, 24 days were at or above 90% and 44 days were at or above 85%. This is in comparison to the 2002 shape, where 11, 21 and 30 days were at or above 95%, 90% and 85% of the NPCC peak, respectively.



2019 Load Shape Analysis for NPCC Reliability Assessments

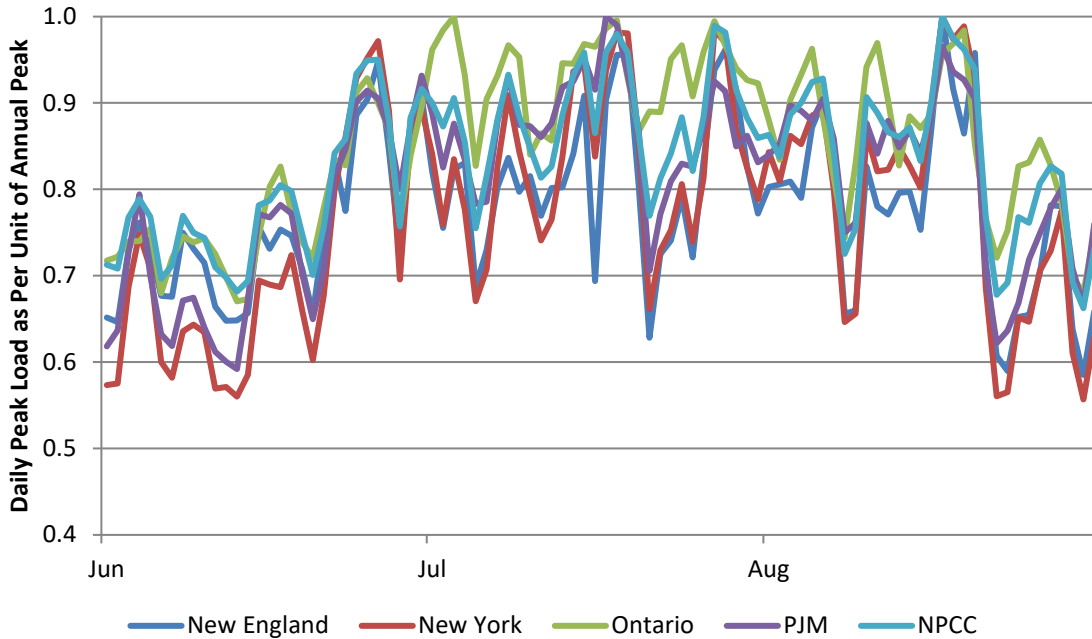


Figure 2 - Daily Peak Loads - 2019 Load Shape

Table 1 - Number of days above percent of summer peak

Region	2002 Shape			2019 Shape		
	95%	90%	85%	95%	90%	85%
New England	11	17	26	5	14	19
New York	10	18	25	9	15	27
Ontario	10	21	30	19	35	50
PJM	9	20	32	4	19	40
NPCC	11	21	30	10	24	44

Statistics for the two profiles are shown in Table 2. This table shows peak load and load factor for NPCC and the summer-peaking areas. The statistics are shown for June, July and August and provides a simple comparison of the monthly peaks across the two shapes.



2019 Load Shape Analysis for NPCC Reliability Assessments

Table 2 - Statistics for Existing 2002, 2019 scaled to Annual and Monthly Peaks

		Month	June	July	August
New England	2002 Shape	Peak (MW)	26,260	26,756	27,398
		Energy (GWh)	11,621	13,324	13,211
		Load Factor (%)	61.5	66.9	64.8
	2019 Shape	Peak (MW)	25,970	26,343	27,398
		Energy (GWh)	12,492	13,478	12,945
		Load Factor (%)	66.8	68.8	63.5
New York	2002 Shape	Peak (MW)	31,430	31,852	32,348
		Energy (GWh)	13,377	15,437	14,896
		Load Factor (%)	59.1	65.1	61.9
	2019 Shape	Peak (MW)	31,430	31,852	32,348
		Energy (GWh)	13,446	15,548	15,064
		Load Factor (%)	59.4	65.6	62.6
Ontario	2002 Shape	Peak (MW)	23,576	23,652	22,818
		Energy (GWh)	11,756	13,107	12,065
		Load Factor (%)	69.3	74.5	71.1
	2019 Shape	Peak (MW)	21,966	23,652	23,269
		Energy (GWh)	11,461	13,997	12,752
		Load Factor (%)	72.5	79.5	73.7
PJM	2002 Shape	Peak (MW)	137,447	149,379	140,366
		Energy (GWh)	66,560	78,630	73,865
		Load Factor (%)	67.3	70.7	70.7
	2019 Shape	Peak (MW)	139,143	149,379	144,225
		Energy (GWh)	66,035	78,649	73,872
		Load Factor (%)	65.9	70.8	68.8
NPCC	2002 Shape	Peak (MW)	104,388	105,161	105,854
		Energy (GWh)	51,375	57,066	55,544
		Load Factor (%)	68.4	72.9	70.5
	2019 Shape	Peak (MW)	100,607	104,760	105,895
		Energy (GWh)	51,890	58,196	55,971
		Load Factor (%)	71.6	74.7	71.0



2019 Load Shape Analysis for NPCC Reliability Assessments

Comparison to Other Years

Figure 3 shows the results using the Annual Load Scaling Adjustment methodology. This represents the load shape methodology that would be used in the MARS program.

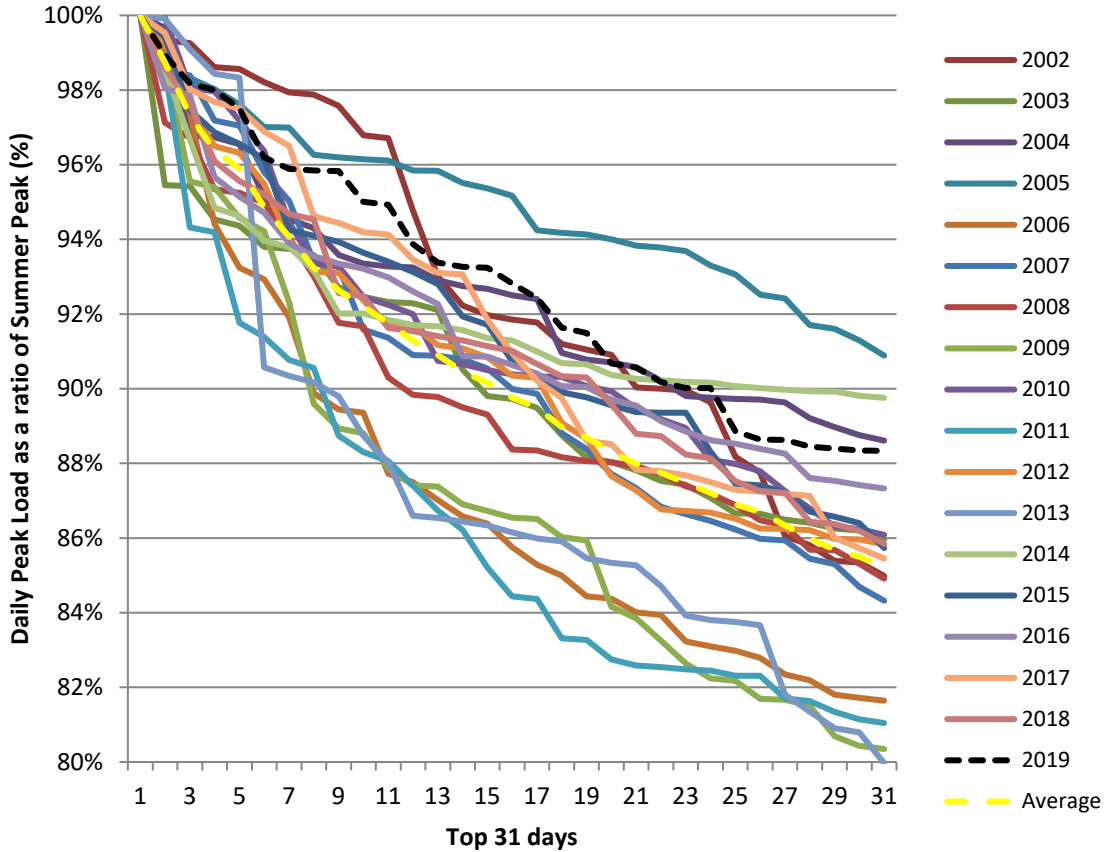


Figure 3 - Comparison of NPCC Summer (May-Sep) Peak Loads for 2002 through 2019

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 annual peak, as these are the days when a loss of load event is most likely to occur. Figure 3 shows a duration plot of the NPCC peak loads for the top 31 days of the summer periods of the years 2002 through 2019³.

³ The 2002 and 2013-2019 data were provided by the NPCC Areas. NPCC loads for 2003 through 2012 were sourced from ABB – Velocity Suite.



2019 Load Shape Analysis for NPCC Reliability Assessments

Figure 4 isolates the 2002 and 2019 shapes for a more direct comparison of the two. Those curves have been normalized to the respective annual peak.

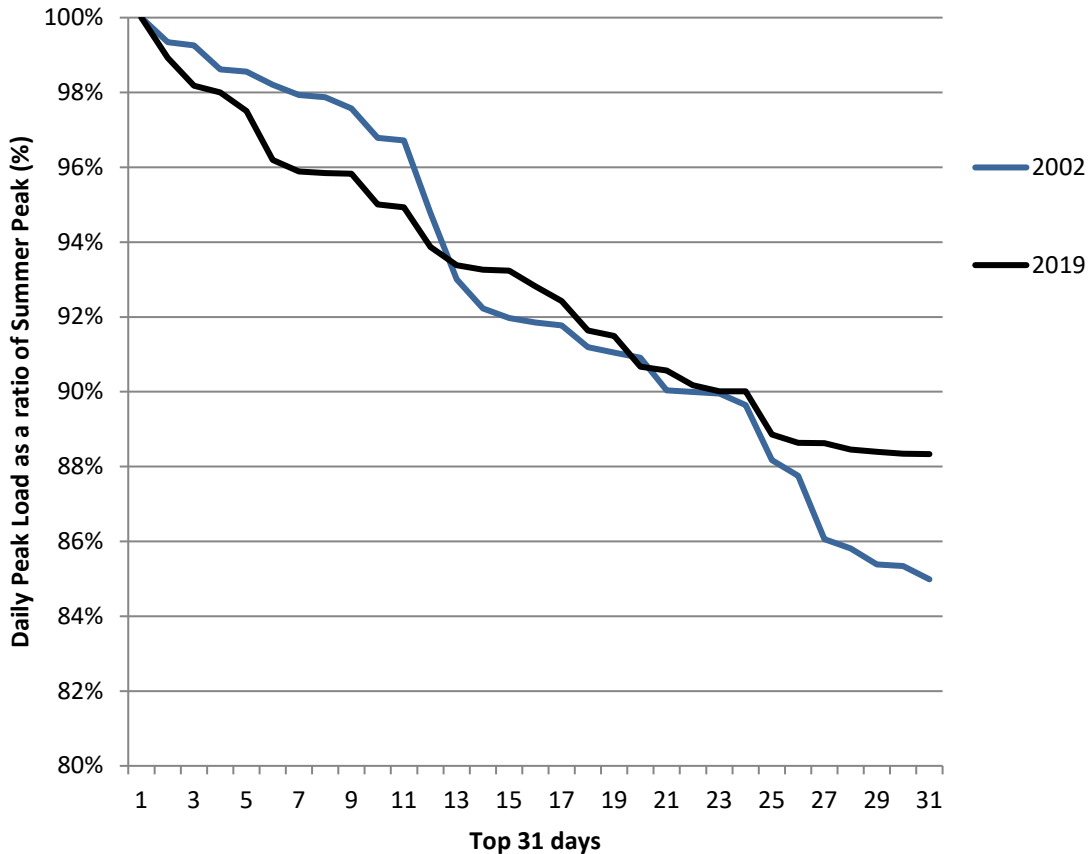


Figure 4 - Comparison of Normalized NPCC Summer Peak Loads for 2002 and 2019

Conclusion

On a region-wide basis, the 2019 shape appears to be less stressful, and therefore a less conservative assumption than the 2002 load shape. The number of days above 95%, 90% and 85% of the peak load for the 2002 shape compared to the 2019 load shape shown in Figures 3 and 4 and quantified in Table 1 supports this conclusion.

Recommendation

For the reasons concluded above, the CP-8 Working Group recommends continue assuming the 2002 shape for the months of May – September in future NPCC Probabilistic Assessments.