Tailored Availability Metric

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ICAPWG/MIWG

November 21st, 2019

Agenda

- Background
- Proposal for all performance-based resources
- Next Steps/Schedule
- Appendix

Background

2019 Commitment: Q3 Market Design Concept Proposal

Working Group Meeting	Topic of Discussion
April – July 2019	Analysis for availability-based resources that use the EFORd for the derating factor, and Market Design Concept Proposed for availability-based resources
August 23rd, 2019	Begin discussion of performance-based resources
October 18th , 2019	Continue discussion of analysis of wind and solar resources, begin discussion of analysis of Limited Control RoR Hydro and SCRs
November 21st, 2019	Market Design Concept Proposed for performance-based resources

Recap

- March 7th, 2019: The NYISO discussed expanding the project scope to include all availability-based and performance-based resources
  - https://www.nyiso.com/documents/20142/5375692/Tailored%20Availability%20Metric.pdf/92ef1b5d-0ec3-cee5-df69-e2130934ec0e
- May 9th, 2019: The NYISO presented initial analysis for availability-based resources that use the EFORd
  - https://www.nyiso.com/documents/20142/6474763/Tailored%20Availability%20Metric%20050919.pdf/2c86f002-0fe5-b3cb-05d8-f118e4dd392f
- July 24th, 2019: The NYISO presented the Market Design Concept Proposal for availability-based resources that use the EFORd as their derating factor
  - As a result of the analysis conducted, the NYISO proposes to weight peak months of the current calculation
  - https://www.nyiso.com/documents/20142/7674442/Tailored%20Availability%20Metric.pdf/e28df5c2-6994-ba5c-7ca2-05abeba9daeb
- August 23rd, 2019: The NYISO began discussion of analysis options for performance-based resources
  - https://www.nyiso.com/documents/20142/8040247/tailored%20availability%20metric%20082319.pdf/ada7cacf-97aa-699a-7ead-e1e39b1a51f8
- October 18th , 2019: The NYISO continued discussion of analysis for performance-based resources
  - https://www.nyiso.com/documents/20142/8783504/Tailored%20Availability%20Metric.pdf/7a9c6c65-f218-b685-a2d5-16f491276d29

Purpose of Discussion

- **The purpose of this presentation is to discuss the Market Design Concept Proposal for all performance-based resources**
  - Performance-based resources include wind and solar resources, Limited Control Run of River Hydro, and SCRs

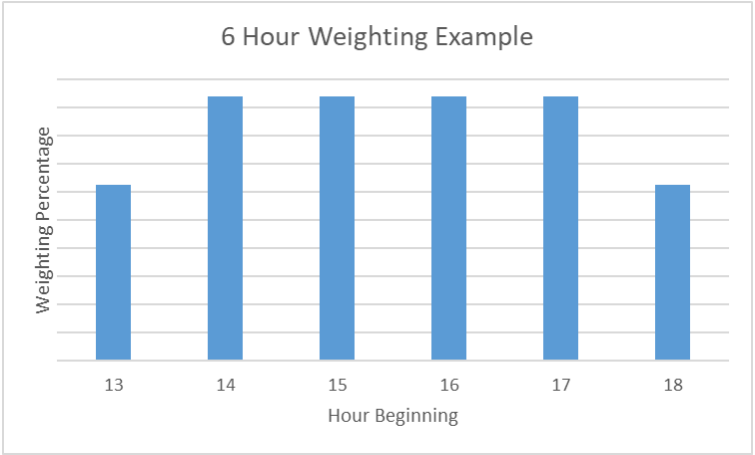
Proposal

Proposal for Wind and Solar Resources

- **Based off analysis done thus far, the NYISO is proposing a reoccurring study for wind and solar resources**
  - The study will run concurrently with the Capacity Value Study and will be conducted every 4 years
  - The Capacity Value Study and this study will use a similar base case
    - The base case built on will be from the IRM Study
    - For this base case, additional wind and solar resources could potentially be added to establish relative capacity value weightings for wind and solar resources
- **The proposal would be effective in 2021**
  - An initial study would be conducted in the Market Design Complete stage (Q2 of 2020)

Proposal for Wind and Solar Resources

- **The relative capacity value weightings will be shaped across the Peak Load Window hours**
  - A subset of Peak Load Window hours will be weighted higher than the remaining shoulder hours
    - Preliminary weightings will be established as a part of the Market Design Complete
- **Summer and Winter Capability Period months will receive the same set of weightings, within its respective Peak Load Window hours**



Proposal for Wind and Solar Resources

- **The relative capacity value weightings established as a part of the Market Design Complete phase will align with the Peak Load Windows proposed in the Expanding Capacity Eligibility project**
  - For resources with duration limitations of less than 1000 MW penetration, a 6 hour Peak Load Window is applicable
    - Summer: HB 13 – HB 18
    - Winter: HB 16 – HB 21
  - For resources with duration limitations equal to or greater than 1000 MW penetration, an 8 hour Peak Load Window is applicable
    - Summer: HB 12 – HB 19
    - Winter: HB 14 – HB 21

Proposal for Limited Control RoR Hydro

- At this time, the NYISO is proposing no changes to the existing methodology used to measure Limited Control Run of River Hydro resources
- Preliminary analysis shows these resources already reflect the reliability needs of the system
  - Performance factors are dependent on top load hours
  - See Appendix for reference to analysis

Proposal for SCRs

- **At this time, the NYISO is proposing no additional changes to the existing methodology used to value SCRs beyond the changes proposed in the Expanding Capacity Eligibility project**
- **Following the implementation of the DER participation model, the NYISO could reevaluate what, if any, changes could be made to the current structure of SCRs**
  - The NYISO could reevaluate SCRs holistically based on the baseline method used in the DER model, and/or any incremental changes previously discussed at the October 18th working group meeting

Next Steps/Schedule

Next Steps/Schedule

- **The 2020 Commitment for this project is a Q2 Market Design Complete**
- **The NYISO will continue analysis based off of the proposal for wind and solar resources and availability-based resources that use the EFORd**
  - The proposal for units that use the EFORd calculation for their derating factor was proposed at the July 24th working group meeting

Feedback/Questions?

The NYISO will consider input received during today's Working Group meeting and further input sent in writing to deckles@nyiso.com and econway@nyiso.com

Appendix

Performance Factors

Wind and Solar Resources

- **The current performance factor for performance-based Installed Capacity Suppliers is based on actual performance over peak periods**
  - For wind and solar resources, performance factors are calculated based on the current 4-hour window in the respective peak months
    - Summer:
      - HB 14 – HB 17
      - June, July, and August
    - Winter:
      - HB 16 – HB 19
      - December, January, and February
  - Performance factors are calculated by dividing the output performance by the nameplate capacity of the resource

Limited Control Run of River Hydro Resources

- **The current performance factor for performance-based Installed Capacity Suppliers is based on actual performance over peak periods**
  - The current metric used to calculate the performance factors for Limited Control RoR Hydro units uses a rolling average of the hourly net energy provided by the resource
    - Values are calculated separately for both Summer and Winter Capability Periods
    - Data looks at the 20 highest NYCA real-time peak load hours in each of the previous 5 Summer or Winter Capability Periods (for a total of 100 hours)
    - Performance factors are calculated based on an hourly average performance (MW) of the 100 hours

Background – SCRs

- **The current performance factor for performance-based Installed Capacity Suppliers is based on actual performance over peak periods**
  - The current metric to calculate performance factors for SCRs is based on values from the Prior Equivalent Capability Period and the Capability Period preceding the Prior Equivalent Capability Period
    - Data is based off of the best 4 consecutive hours in each mandatory event of 4 hours or more
    - Mandatory events less than or equal to 4 hours use all hours
    - All resources are required to perform a 1-hour performance test
  - Performance factors are calculated based off of the average of the best 4 consecutive hours in all of its mandatory events and required 1-hour test

Net Loss of Load Analysis

Net Loss of Load Analysis

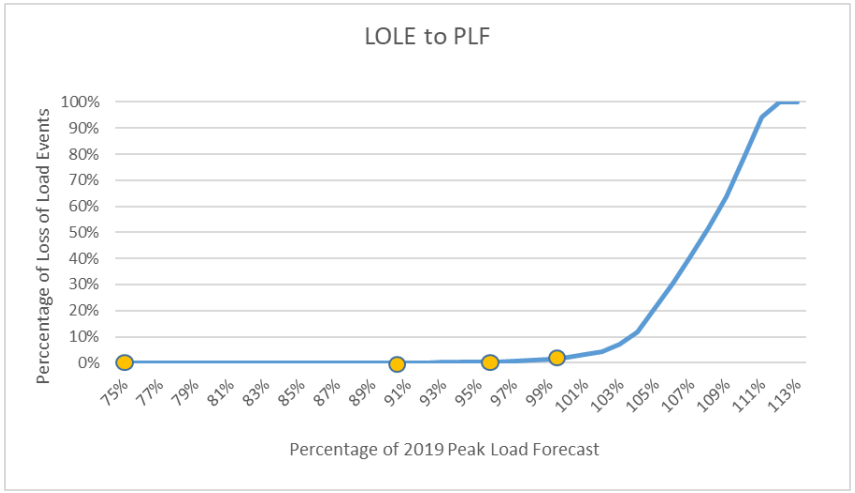
- **The Loss of Load Events analyzed are based off of the final base case of the 2019 IRM Study**
  - Analysis matches the net load levels to each respective Loss of Load Event
  - Net load analysis uses load levels used in the 2019 IRM Study, and removes wind and solar penetration
- **Analysis shows the relationship between the loads of the Loss of Load Events to the percentage of the 2019 Peak Load Forecast**

Net Loss of Load Analysis

		Percentage of LOLE			
2019 Peak Load Forecast		Rounded	1 decimal	2 decimal	Count of LOLE: 54665
100%	32488	98%	97.9%	97.93%	53534
96%	31188.48	100%	99.6%	99.58%	54433
91%	29564.08	100%	100.0%	99.95%	54638
75%	24366	100%	100.0%	100.00%	54664

- **Results of the analysis shows 100% of Loss of Load Events occur at or above 75% of 2019 Peak Load Forecast**
  - At 75% of 2019 Peak Load Forecast, the net load is 24366 MW, which may not be an accurate representation of when a typical Loss of Load Event occurs
- **Results shows 99.95% of Loss of Load Events occur at or above 91% of 2019 Peak Load Forecast,**
  - At 91% of 2019 Peak Load Forecast, the net load is 29564 MW, which is a better representation of load levels where a loss of load event would occur

Net Loss of Load Analysis



- The cumulative number of Loss of Load Events that recorded load at or above the specified Peak Load Forecast value determined the threshold
- 99.95% of all Loss of Load Events occur at or above load levels of 91% of 2019 Peak Load Forecast
  - Using the 91% as the threshold, weightings can be established

Historic Net Load Analysis

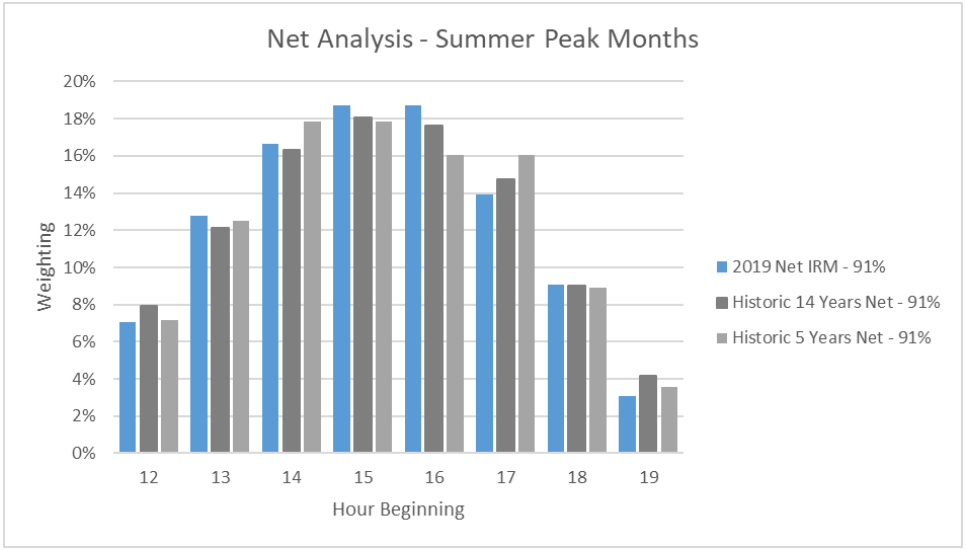
- **Net load curves have been analyzed to assess trends in the previous 14 years and the previous 5 years**
  - Historic net load data removes wind and solar production and adds back NYISO Demand Response
- **Applying the net load analysis done from the Net 2019 IRM LOLE statistics, the loads that are at or above the 91% and 96% threshold of Peak Load Forecasts are identified**
  - For example, all Summer hours in 2005 recording load at or above 91% of the Summer 2005 Peak Load Forecast were counted

Historic Net Load Analysis

Year	Number of Hours in the Historic 14 Years			
	Summer Peak Months		Winter Peak Months	
	96% of PLF	91% of PLF	96% of PLF	91% of PLF
2005	33	126	11	71
2006	32	55	0	2
2007	0	33	3	44
2008	0	13	4	45
2009	0	3	0	48
2010	14	54	14	72
2011	17	57	4	77
2012	5	35	1	14
2013	31	53	8	55
2014	0	0	20	87
2015	0	8	1	49
2016	2	13	0	15
2017	0	0	2	23
2018	2	52	2	33
Total	136	502	70	635

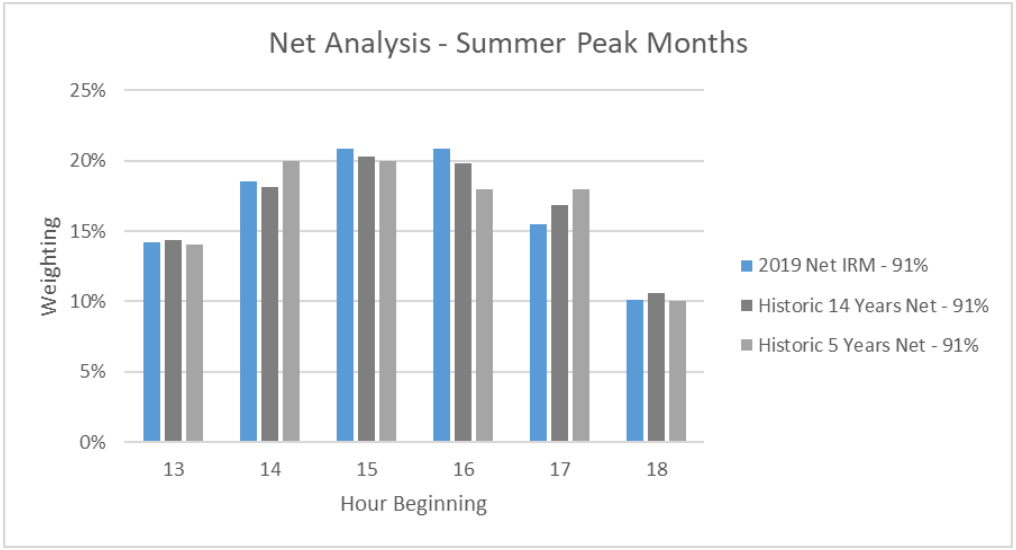
- **Using the net load analysis done from the Net 2019 IRM LOLE statistics, the number of hours that recorded load at or above the 91% or the 96% threshold are counted**
  - The number of Loss of Load Events with loads at or above the 91% threshold is a more representative data set
  - Within the historic 14 years, 91% of Peak Load Forecast captures significantly more hours at risk of a Loss of Load Event than 96%

Historic Net Load Analysis – 8 Hour Window



	Summer Net		
	2019 IRM Net	Historic Net 14 Years	Historic Net 5 Years
HB	**91%**	**91%**	**91%**
12	7%	8%	7%
13	13%	12%	13%
14	17%	16%	18%
15	19%	18%	18%
16	19%	18%	16%
17	14%	15%	16%
18	9%	9%	9%
19	3%	4%	4%
Top 4 Hours	68%	67%	68%
Outside 4 Hours	32%	33%	32%
Outside 4 Equally	16%	17%	16%

Historic Net Load Analysis – 6 Hour Window



	Summer Net		
	2019 IRM Net	Historic Net 14 Years	Historic Net 5 Years
HB	**91%**	**91%**	**91%**
13	14%	14%	14%
14	19%	18%	20%
15	21%	20%	20%
16	21%	20%	18%
17	15%	17%	18%
18	10%	11%	10%
Top 4 Hours	76%	75%	76%
Outside 2 Hours	24%	25%	24%
Outside 2 Equally	12%	12%	12%

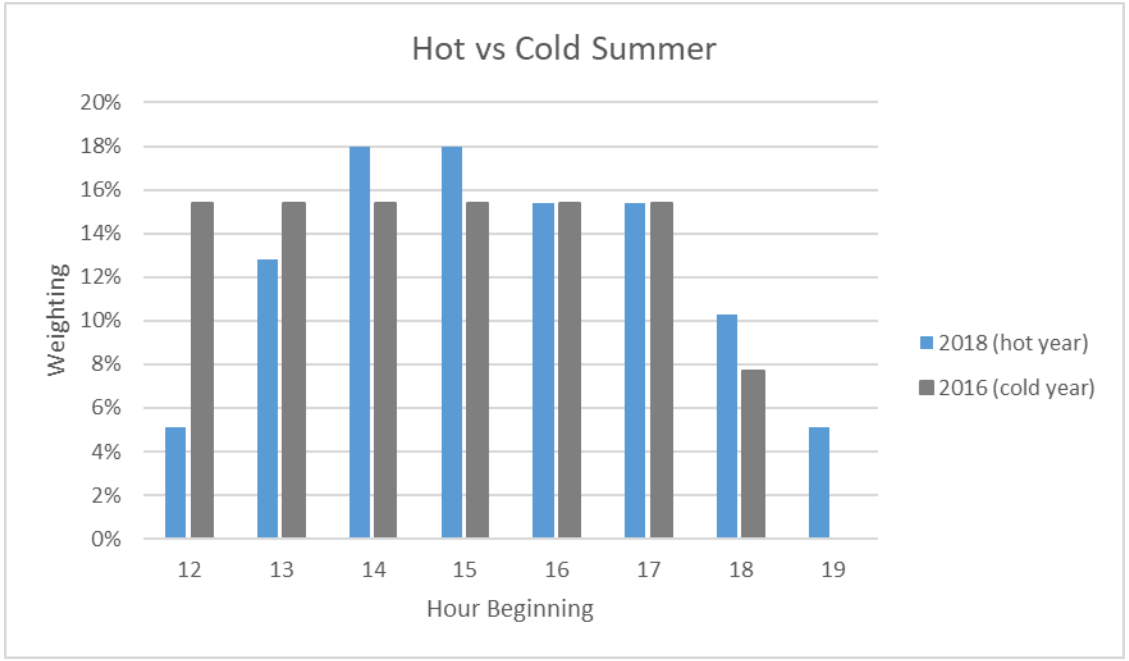
Additional Net Load Analysis – Wind and Solar

Historic Net Load Analysis – 5 Years

Year	Number of Hours in the Historic 5 Years			
	Summer Peak Months		Winter Peak Months	
	96% of PLF	91% of PLF	96% of PLF	91% of PLF
2014	0	0	20	87
2015	0	8	1	49
2016	2	13	0	15
2017	0	0	2	23
2018	2	52	2	33
Total	4	73	25	207

- **Using the net load analysis done from the Net 2019 IRM LOLE statistics, hourly weighting percentages could be established based on the 91% or the 96% threshold**
  - The number of Loss of Load Events with loads at or above the 91% threshold is a more representative data set
  - Within the historic 14 years, 91% of Peak Load Forecast captures significantly more Loss of Load Events than 96%

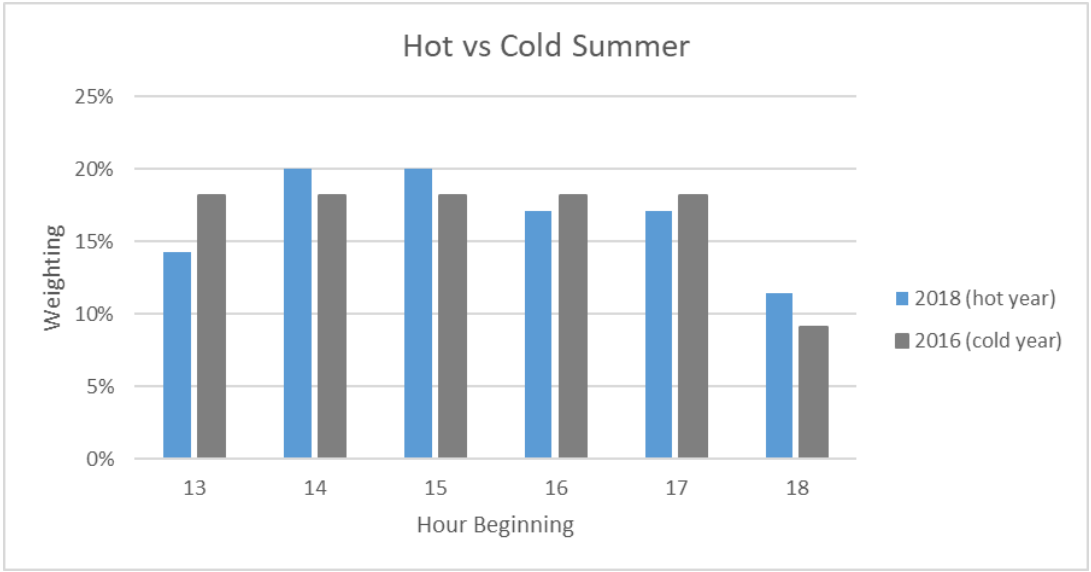
Historic Net Load Analysis – 8 Hour Window



	Summer	
	Net	
	2018 (hot year)	2016 (cold year)
12	5%	15%
13	13%	15%
14	18%	15%
15	18%	15%
16	15%	15%
17	15%	15%
18	10%	8%
19	5%	0%

	2018	2016
No. of Hours	39	13

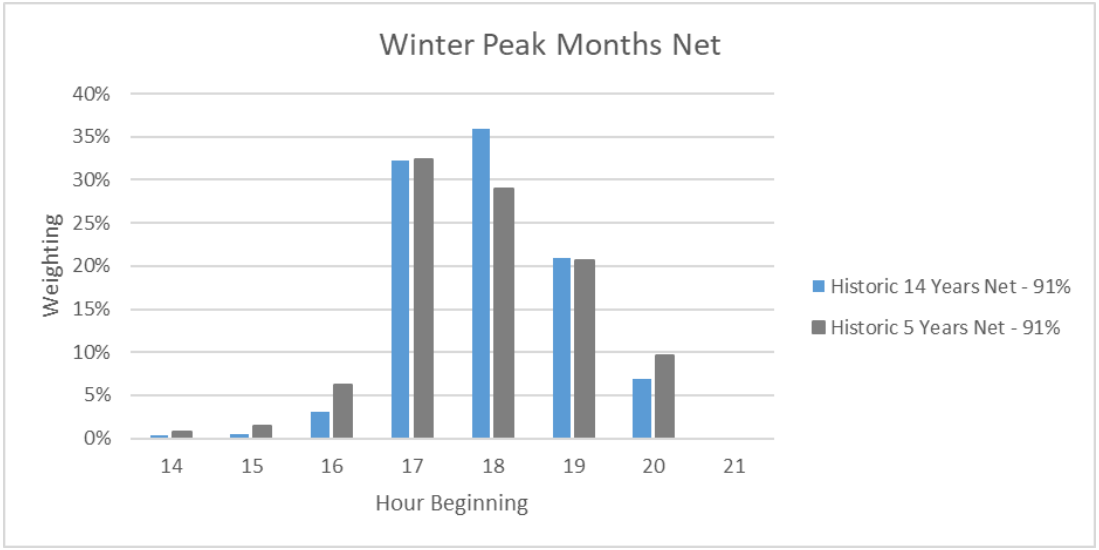
Historic Net Load Analysis – 6 Hour Window



	Summer Net	
	2018 (hot year)	2016 (cold year)
HB	**91%**	**91%**
13	14%	18%
14	20%	18%
15	20%	18%
16	17%	18%
17	17%	18%
18	11%	9%

	2018	2016
No. of Hours	35	11

Historic Net Load Analysis – Winter, 8 Hour Window



	Winter	
	Historic Net - 91%	
HB	14 Years	5 Years
14	0%	1%
15	0%	1%
16	3%	6%
17	32%	32%
18	36%	29%
19	21%	21%
20	7%	10%
21	0%	0%

Gross Load Analysis – Wind and Solar

2019 IRM Study

- **The Loss of Load Events are based off of the final base case of the 2019 IRM Study, which uses load profiles from 3 specific years to determine the probability of the events**
  - The model uses the load shapes from 2002, 2006, and 2007 for the Load Forecast Uncertainty (LFU) bins
    - Bin 1 – 2006 load shape, which represents a peaked shape
    - Bin 2 – 2002 load shape, which represents a flatter shape
    - Bin 3 - 7 – 2007 load shape, which represents the average load shape
  - Each load level is scaled to the 2019 forecasted peak load and the respective bin it is in
    - Each load shape is scaled such that its peak load equals the 2019 forecasted peak load value, and the entire load shape is multiplied by this value to forecast the load shape for 2019
    - Each load shape is then multiplied by its respective Load Forecast Uncertainty Multiplier

2019 Load Forecast Uncertainty Values

Table A.5 2019 Load Forecast Uncertainty Models

2019 Load Forecast Uncertainty Models						
Bin	Probability	A-E	F&G	H&I	J	K
B7	0.62%	84.31%	80.67%	79.78%	83.88%	76.59%
B6	6.06%	89.44%	86.74%	86.24%	88.87%	83.51%
B5	24.17%	94.74%	93.03%	92.49%	93.71%	91.75%
B4	38.30%	100.00%	99.33%	98.17%	98.21%	100.00%
B3	24.17%	105.02%	105.41%	102.93%	102.19%	106.95%
B2	6.06%	109.59%	111.07%	106.39%	105.47%	112.06%
B1	0.62%	113.51%	116.08%	108.22%	107.86%	115.86%

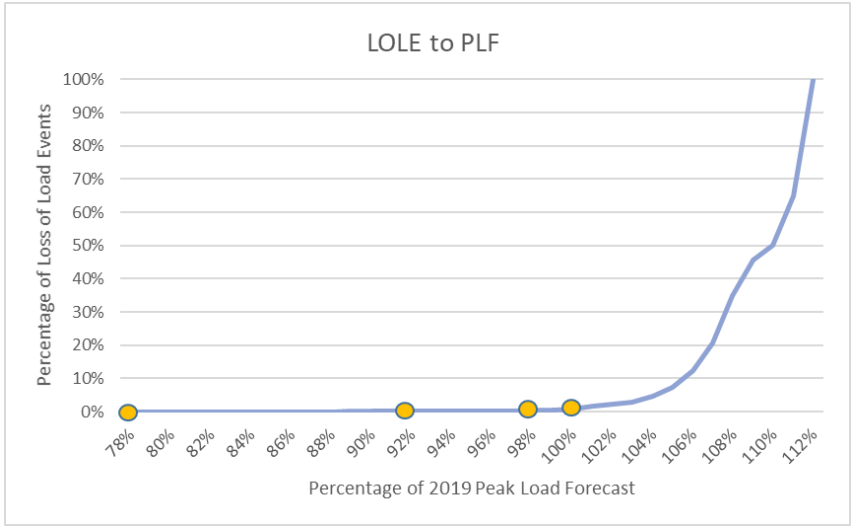
- **The 2019 IRM Load Forecast Uncertainty Values reflect the 7 different bins used in the study**
  - Probabilities are broken down by zones
  - For example, there is a 0.62% probability of the load in Zone A – E to be 84.31% of its original value

http://www.nysrc.org/pdf/Reports/2019%20IRM%20Study%20Appendices%20-Final%20Report[6816].pdf

Loss of Load Analysis Methodology

- **Each Loss of Load Event from the 2019 IRM Study can be matched to its respective load value from the 7 bins**
  - Analysis does not take into account the probability weightings of the different bins
- **Initial analysis will show the relationship between the Loss of Load Events to the percentage of the Peak Load Forecast**
  - The load for each Loss of Load Event was pulled from its respective bin
  - The loads for each Loss of Load Events were compared to the percentage of 2019 Peak Load Forecast
  - For example: the loads of 99% of LOLE were at or above 100% of Peak Load Forecast

Loss of Load Analysis Methodology



		Percentage of LOLE			
2019 Peak Load Forecast		Rounded	1 decimal	2 decimal	Count of LOLE: 54665
100%	32488	99%	99.2%	99.17%	54214
98%	31838.24	100%	99.5%	99.53%	54406
92%	29888.96	100%	100.0%	99.97%	54649
78%	25340.64	100%	100.0%	100.00%	54665

- The cumulative number of Loss of Load Events that were at or above the specified Peak Load Forecast value determined the threshold
- 100% of all Loss of Load Events occur at or above 92% of 2019 Peak Load Forecast
  - Using the 92% as the threshold, weightings can be established

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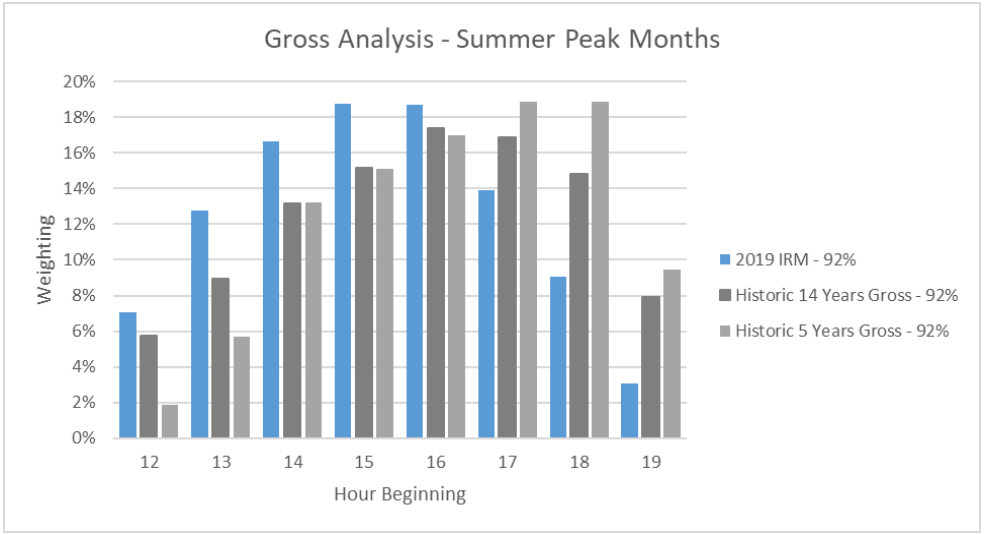
Historic Gross Load Analysis Methodology

Year	Number of Hours in the Historic 18 Years			
	Summer Peak Months		Winter Peak Months	
	98% of PLF	92% of PLF	98% of PLF	92% of PLF
2000	-	-	1	55
2001	13	56	0	28
2002	25	126	0	34
2003	0	11	5	87
2004	0	0	20	141
2005	17	107	2	56
2006	14	51	0	0
2007	0	27	0	39
2008	0	12	2	37
2009	0	2	0	49
2010	12	40	6	69
2011	16	61	3	82
2012	0	31	0	17
2013	20	50	6	66
2014	0	0	22	124
2015	0	3	5	84
2016	0	15	2	35
2017	0	0	2	34
2018	0	37	11	63
Total	117	629	87	1100

- **Using the load analysis done from the 2019 IRM LOLE statistics, hourly weighting percentages could be established based on the 92% threshold**
  - The number of Loss of Load Events with loads at or above the 92% threshold is a more representative data set
  - Within the historic 18 years, 92% of Peak Load Forecast captures significantly more Loss of Load Events than 98%

Results of Gross Analysis



	Summer Gross		
	2019 IRM	Historic Gross 14 Years	Historic Gross 5 Years
HB	**92%**	**92%**	**92%**
12	7%	6%	2%
13	13%	9%	6%
14	17%	13%	13%
15	19%	15%	15%
16	19%	17%	17%
17	14%	17%	19%
18	9%	15%	19%
19	3%	8%	9%

Top 4 Hours	68%	63%	64%
Outside 4 Hours	32%	37%	36%
Outside 4 Equally	16%	19%	18%

RoR Hydro Analysis

RoR Hydro – Gross Load Analysis

	Gross			
	Summer		Winter	
	92%	98%	92%	98%
Historic 18 Years Average	36.4	6.5	62.4	4.8
Historic 5 Year Rolling Average	34.6	6.5	62.1	4.9

- **Historic analysis shows the average number of hours load was recorded at or above the two thresholds**
  - Historic data looks back 18 years to capture a larger data set,
  - Historic 5 Year Rolling Average data captures a rolling average for each of the previous 14 Capability Periods
    - See charts and table in Appendix for more detail
- **Results of the data shows the average number of load hours at a risk of loss of load**
  - For averages greater than the 20 count used today, the window could be expanded
    - For example, expanding the count to 30 hours rather than 20
  - For averages less than the 20 count used today, higher weightings could be applied
    - For example, the top 5 hours could be weighted more than the remaining 15 hours

RoR Hydro – Net Load Analysis

	Net			
	Summer		Winter	
	91%	96%	91%	96%
Historic 14 Years Average	35.9	9.7	47.1	5.2
Historic 5 Year Rolling Average	30.4	8.8	53.0	6.1

- **Historic analysis shows the average number of hours load was recorded at or above the two thresholds**
  - Historic data looks back 14 years to capture a larger data set,
  - Historic 5 Year Rolling Average data captures a rolling average for each of the previous 14 Capability Periods
    - See charts and table in Appendix for more detail
- **Results of the data shows the average number of load hours at a risk of loss of load**
  - For averages greater than the 20 count used today, the window could be expanded
    - For example, expanding the count to 30 hours rather than 20
  - For averages less than the 20 count used today, higher weightings could be applied
    - For example, the top 5 hours could be weighted more than the remaining 15 hours

Our mission, in collaboration with our stakeholders, is to serve the public interest and provide benefit to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policymakers, stakeholders and investors in the power system