Tailored Availability Metric

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ICAPWG/MIWG

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Agenda

- Background
- Current Performance Factors for Wind, Solar, and Limited Control RoR Hydro
- Load Analysis
- Gross Loss of Load Analysis
- Net Loss of Load Analysis
- SCRs
- Next Steps and Schedule

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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 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

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Purpose of Discussion

- **The purpose of this presentation is to continue discussion of analysis of performance-based resources, which include wind, solar, Limited Control Run of River Hydro resources and SCRs**
  - Today's meeting will discuss the methodology and initial results of load analysis using gross and net load
- **At this time, the NYISO is still evaluating what, if any, tailored metric for performance-based resources would look like**
  - The NYISO is seeking stakeholder feedback on the analysis and results of analysis done thus far
  - Continued discussion and Market Design Concept Proposed will be presented at a future working group meeting

Current Performance Factors for Wind, Solar and Limited Control Run of River Resources

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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

Load Analysis

Load Analysis

- At the previous working group meeting, the NYISO proposed load analysis options
- Based off of stakeholder discussion, the NYISO is evaluating load analysis methodologies
  - Separate analysis has been done for gross and net load

Load Analysis

- **Proposed methodology of analysis focuses on the correlation of Loss of Load Events to load forecast values**
  - Better aligning performance to the load conditions that cause a loss of load event to occur in the GE MARS IRM could better account for the reliability needs of the bulk power system
- **For wind and solar resources, performance factors could be weighted to the hourly percentages established based on the load analysis**
- **For Limited Control RoR Hydro resources:**
  - The number of top hours of LOLE risk could change the count used to measure performance (i.e. top 30 hours rather than top 20 hours)
  - The weighting of the top hours could change based on the frequency of Loss of Load Events

Gross Loss of Load Analysis

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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%

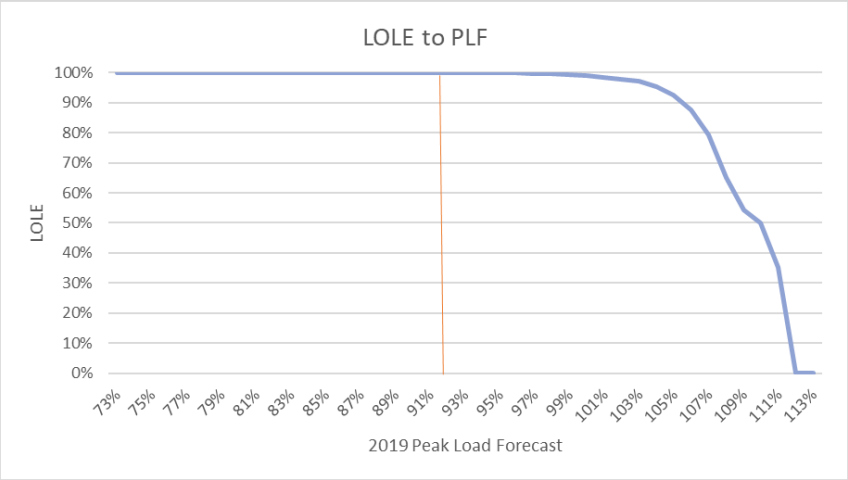
- **The 2019 IRM Load Forecast Uncertainty Values reflect the 7 different bins used in the study**
  - Probabilities are broken down by zones
  - For example, there is a 0.62% probability of the load in Zone A – E to be 84.31% of its original value

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

- The 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

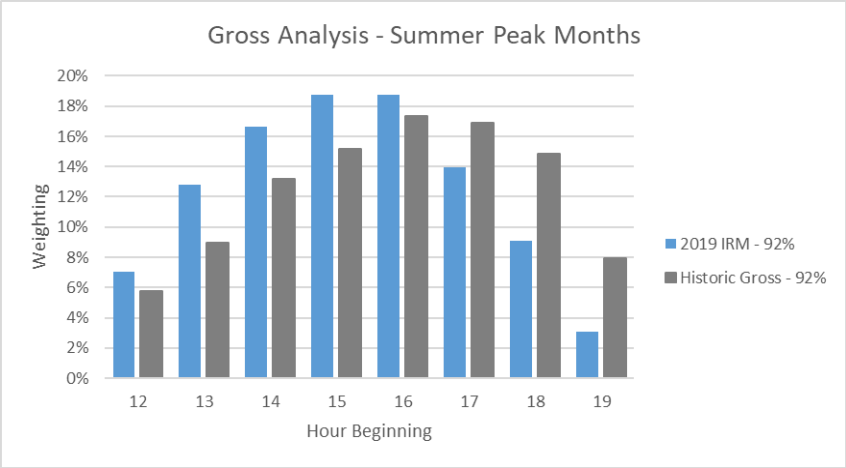
- **Actual gross load curves from the previous 18 years have been analyzed to assess trends**
  - Historic curves can capture a larger sample size and could be more representative of realistic load levels
- **Gross load is the NYISO load established in the real-time market without any adjustments**
  - Already reflects behind the meter solar and all Demand Response
- **The count of load that was at or above the 92% threshold of the Peak Load Forecasts for each respective year was compiled**
  - For example, all hours in 2005 recording load at or above 92% of the 2005 Peak Load Forecast were counted
- **All data compiled reflected peak months**
  - Summer: June, July, and August
  - Winter: December, January, and February
  - Separate Peak Load Forecast values were used for Summer and Winter months

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



- Gross analysis results reflect the potential weightings at the 92% threshold of the 2019 IRM compared to Historic data

Net Loss of Load Analysis

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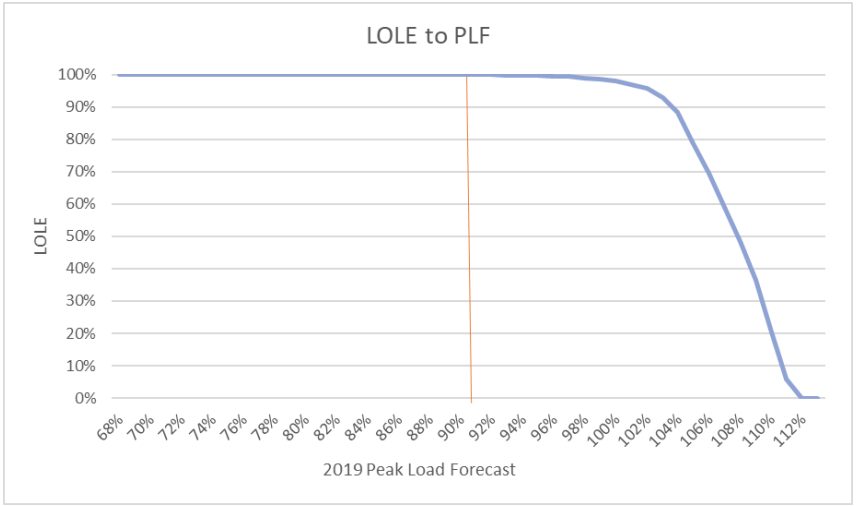
2019 IRM Net Load Analysis

- **Using the 2019 IRM LOLE statistics, the output shape data of the respective wind and solar penetration can be used to determine net statistics**
  - Output shape data used for the 2019 IRM refers to years 2013 - 2018
- **Following the same methodology as the 2019 IRM Gross Loss of Load Analysis, initial analysis will show the relationship between the Loss of Load Events to the percentage of the Peak Load Forecast**
  - Each Loss of Load Event can be matched to its respective net load value
  - Net load values remove wind and solar penetration

Net Loss of Load Analysis Methodology



		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

- The 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 91% of 2019 Peak Load Forecast
  - Using the 91% as the threshold, weightings can be established

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Historic Net Load Analysis Methodology

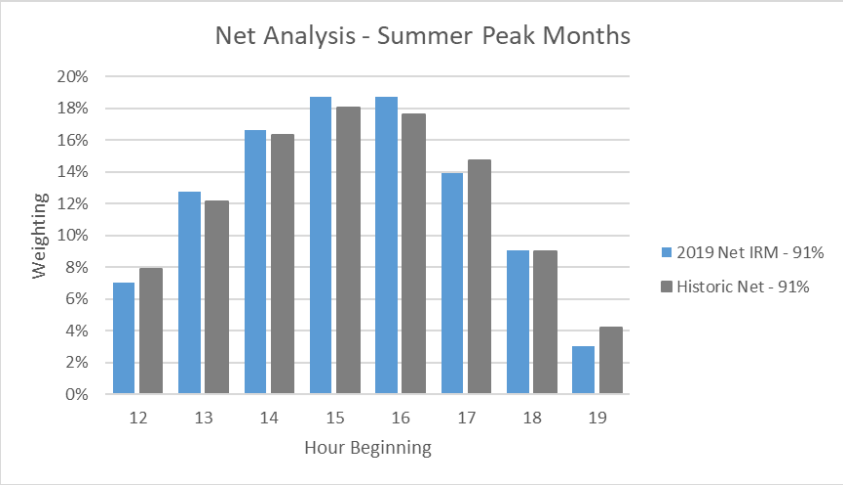
- Similar to the historic gross load analysis, net load curves have been analyzed to assess trends in the previous 14 years
  - Historic net load data removes wind and solar production and adds back NYISO Demand Response
- Using the net load analysis done from the Net 2019 IRM LOLE statistics, the loads that are at or above the 91% threshold of Peak Load Forecasts are identified

Historic Net Load Analysis Methodology

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, hourly weighting percentages could be established based on the 91% 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%

Results of Net Analysis



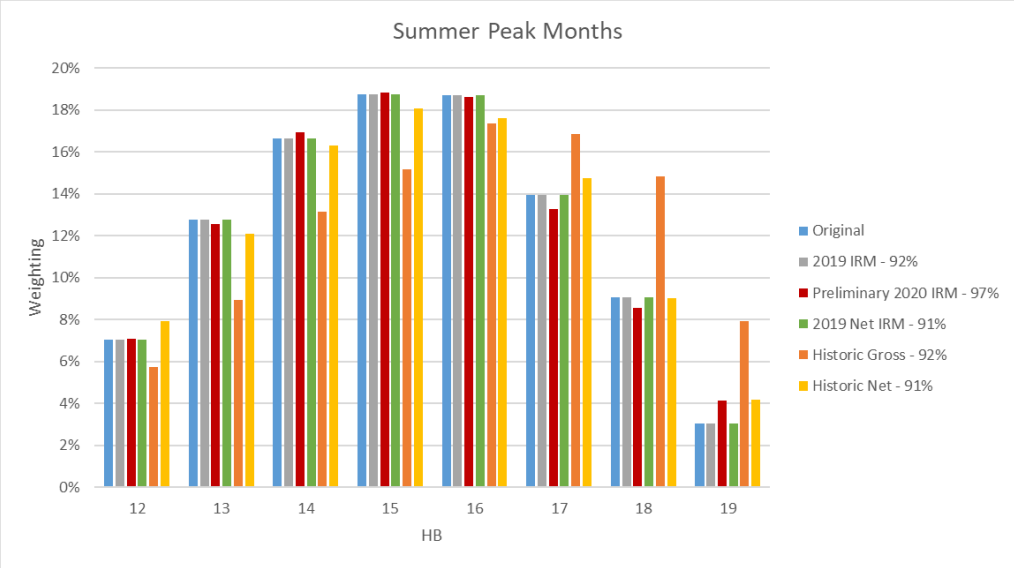
- Net analysis results reflect the potential weightings at the 91% threshold of the 2019 Net IRM compared to Historic Net data

Results of Analysis

Results of Analysis

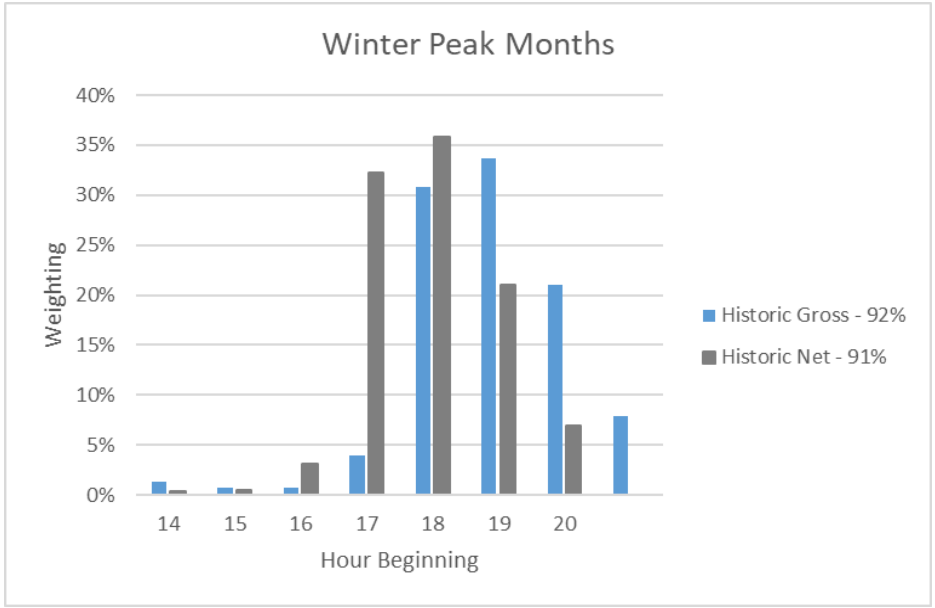
- The results of the analysis compares the different potential weightings that could be applied across the 8-hour window
- Results include the distribution of Loss of Load Events for:
  - 2019 IRM Gross at the 92% threshold
  - Historic Gross at the 92% threshold
  - 2019 IRM Net at the 91% threshold
  - Historic Net at the 91% threshold
- Additional results for comparison include:
  - 2019 IRM Final Base Case – all LOLE from the 2019 IRM Study
  - 2020 IRM Preliminary Base Case Gross at the 97% threshold

Results of Analysis - Summer



	Summer					
	Gross				Net	
	2019 IRM Gross		Preliminary 2020 IRM Gross	Historic Gross	2019 IRM Net	Historic Net
HB	Final Base Case	92%	97%	92%	91%	91%
12	7%	7%	7%	6%	7%	8%
13	13%	13%	13%	9%	13%	12%
14	17%	17%	17%	13%	17%	16%
15	19%	19%	19%	15%	19%	18%
16	19%	19%	19%	17%	19%	18%
17	14%	14%	13%	17%	14%	15%
18	9%	9%	9%	15%	9%	9%
19	3%	3%	4%	8%	3%	4%

Results of Analysis - Winter



	Winter	
	Historic Gross	Historic Net
HB	92%	91%
14	1%	0%
15	1%	0%
16	1%	3%
17	4%	32%
18	31%	36%
19	34%	21%
20	21%	7%
21	8%	0%

Special Case Resources

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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

Evaluating SCR Performance

- Similar to all other performance-based resources, analysis could ensure that performance is reflecting the needs of the system
- This evaluation is not anticipating any changes to the structure of how SCRs are valued
  - SCRs will still be valued as a 4-hour resource
- Potential analysis of the SCR performance factors could include using the existing methodology with modifications:
  - Weighting test data versus event data
  - Aligning the test requirement with peak days
  - Expanding the duration of the required test

Next Steps and Schedule

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Next Steps

- At the next Working Group meeting, the NYISO will continue discussion of analysis and results of analysis of all performance-based resources

Schedule

Working Group Meeting	Topic of Discussion
Today's Meeting	Continued discussion of analysis for wind and solar resources, begin discussion of analysis for RoR Hydro and SCRs
November 2019	Continued discussion of analysis for all performance-based resources
November 2019	Market Design Concept Proposed for performance-based resources

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

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Appendix

Background

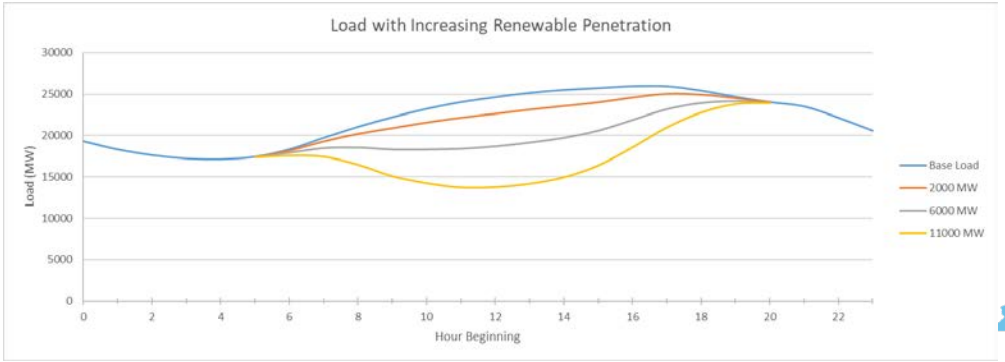
- **As a part of the Expanding Capacity Eligibility project, Peak Load Windows were proposed**
  - For resources with duration limitations of less than 1000 MW penetration, a 6 hour Peak Load Window is applicable
    - Summer: HB 13 – HB 18
    - Winter: HB 16 – HB 21
  - For resources with duration 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

Analysis Options

- **Analysis could assess when Loss of Load Events occur in the 2019 IRM Model**
  - Weightings could be developed for Summer and Winter months based off of when these events occur
- **The correlation of Loss of Load Events to load forecasts could be measured for respective Summer and Winter months**
  - The percentage of load that is associated with LOLE could be reflected within the Peak Load Window
  - Weightings could be developed based off of these values

Analysis Options

- **Using the weighting of different durations from the Expanding Capacity Eligibility project, weightings of the hours in the Peak Load Window could be adjusted**
  - For example, the top 4 load hours are weighted 90% until the system reaches 2000 MW of penetration, then weighting subsequently shifts to 75%
- **Gross and Net load could be analyzed to capture the anticipated penetration of wind and solar resources**
  - Weightings could be established based off of shifts in load curves as penetration increases



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