DRAFT – FOR DISCUSSION PURPOSES ONLY

ANNUAL ASSESSMENT
OF
RESOURCE ADEQUACY

COVERING THE

NEW YORK CONTROL AREA

For the years 2017–2019

In compliance with the NYSRC Reliability Rule A.3, Requirement R1

Presented to the
Reliability Compliance Monitoring Subcommittee of the
New York State Reliability Council

June 1, 2017

EXECUTIVE SUMMARY

This assessment was written in compliance with the New York State Reliability Council ("NYSRC") Reliability Rule A.3 (*Review of Resource Adequacy)*, Requirement R1 over the assessment period of 2017-2019.

While this assessment is not a probabilistic (*i.e.,* MARS) study, it compares forecast capacity and loads against current installed capacity requirements (*i.e.,* IRM and LCRs) that are established based on probabilistic resource adequacy analyses, and projected over two future years (i.e., 2018 and 2019).

The NYSRC conducts annual resource adequacy studies that establish the statewide Installed Capacity ("ICAP") reserve margin (i.e., IRM study)[1] for the New York Control Area ("NYCA") for the upcoming capability period. From the period of 1999 through 2017, these studies have resulted in the NYSRC adopting reserve margins ranging from 15% to 18%. For 2017, the Installed Reserve Margin ("IRM") was established at 18.0% and was assumed to be the same value for 2018 and 2019 for purposes of this report.

For the analysis, three cases were evaluated against the baseline forecast of peak load set forth in the 2017 Gold Book.[2] The first case is referred to herein as the Class Year Study case, which includes the 2017 Gold Book's ICAP existing resources plus those that have completed their Class Year facilities study as identified in the 2017 Gold Book. The second case is referred to herein as the Interconnection Agreement case, which includes the 2017 Gold Book's existing units plus those identified on the NYISO Interconnection Queue as having completed an Interconnection Agreement as of May 2017. The third case is referred to herein as the Extreme case and assumes an extreme scenario in which no capacity additions occur during the assessment period. All of these cases utilize only expected New York Control Area resources. The derivation of these cases is documented in the attached Appendices 1, 1A, and 1B.

In addition to the scenarios described above using the baseline forecast of peak load, both the Class Year Study case and Interconnection Agreement case were also evaluated under the extreme scenario utilizing the 90th percentile forecast of peak load,[3] which represents an extremely high peak load demand.

With the baseline forecast of peak load, a projected 18.0% statewide IRM is met (meaning that the projected percentage reserve margin beyond forecasted annual peak load would equal to or exceed 18 percent) throughout the assessment period, even under the Extreme case. Because NYSRC's annual IRM study has adopted the Load Forecast Uncertainty (LFU) in its probabilistic model, an extremely high peak load demand, including the 90th percentile forecast of peak load, has already been considered in the study using the

[1] *See, e.g.*, NYSRC Report titled, "New York Control Area Installed Capacity Requirement for the Period May 2017 to April 2018," December 2, 2016.
[2] The NYISO "Load & Capacity Data" publication is commonly referred to as the "Gold Book." The baseline forecast of peak load data is provided in the 2017 Gold Book under Tables I-2a, I-2b-1, and I-2b-2.
[3] The 90th percentile forecast of peak load data is provided in the 2017 Gold Book under Table I-2d. The 90th percentile forecast of peak load is one point within the range defined by the Load Forecast Uncertainty in the probabilistic model.

baseline forecast data. To isolate the results of a specific forecast, such as the 90th percentile forecast of peak load, a deterministic assessment needs to be performed. Based on a deterministic assessment, a projected 18.0% IRM cannot be met for the 90th percentile forecast of specific annual peak load in 2017 with only expected New York Control Area resources.

The NYISO conducts an annual locational requirements study[4] that establishes minimum Locational Capacity Requirements ("LCRs") for the New York City, Long Island, and the G-J Locality.[5] Currently, the New York City LCR is 81.5% of the New York City capability year peak load forecast. The Long Island LCR is currently 103.5% of the Long Island capability year peak load forecast. The G-J Locality LCR is currently 91.5% of the G-J Locality capability year peak load forecast.

With the baseline forecast of peak load and the proposed 2017-2019 resource additions, New York City would meet a projected LCR of 81.5% over the assessment period.

With the baseline forecast of peak load, Long Island would meet a projected LCR of 103.5% throughout the assessment period.

With the baseline forecast of peak load and the proposed 2017-2019 resource additions, the G-J Locality would meet a projected LCR of 91.5% over the assessment period.

It is worth noting that even without the proposed 2017-2019 resource additions, New York City, Long Island, and the G-J Locality would still be able to meet their respective projected LCR requirements for the baseline forecast of peak load throughout the assessment period.

Similar to the IRM study, the probabilistic model in NYISO's annual LCR study has also adopted the Load Forecast Uncertainty ("LFU") in the baseline forecast data. To consider a specific forecast, such as the 90th percentile forecast of peak load, a deterministic assessment needs to be performed. Based on a deterministic assessment of the 90th percentile forecast of peak load and the proposed 2017-2019 resource additions, New York City, Long Island, and the G-J Locality can still meet the projected LCRs of 81.5%, 103.5%, and 91.5% throughout the assessment period, respectively.

It is important to note that any deterministic assessment of extreme scenarios, including the Extreme case utilizing the baseline forecast of peak load and all scenarios utilizing the 90th percentile forecast of peak load, only provide limited "what if" information and, without a probabilistic assessment, do not test resource adequacy. Only the cases including planned resources and interconnections with other regions and that utilize the baseline forecast of peak load can demonstrate whether NYCA or a Locality has adequate resources.

[4] *See, e.g.*, NYISO Report titled, "Locational Minimum Installed Capacity Requirements Study Covering the New York Balancing Authority Area for the 2017–2018 Capability Year," January 13, 2017.
[5] The G-J Locality encompasses Load Zones G, H, I, and J.

INTRODUCTION

This assessment is performed to satisfy NYSRC Reliability Rule A.3, Requirement R1,[6] which states:

R1. An *NYCA resource adequacy* assessment shall be conducted annually for the next summer period and two years beyond, for demonstrating that proposed NYCA *resources* meet NYCA statewide *IRM* and New York City and Long Island *locational capacity requirements* as determined by *NYSRC* and *NYISO* studies conducted in accordance with A.1 and A.2. The assessment shall be documented in a *resource* adequacy report, covering at a minimum, the evaluations and information below:

R1.1 The assessment shall evaluate a base case assuming proposed *resources* and the most likely *load* forecast, as well as alternate scenarios approved by RCMS.

R1.2 Any potential base case *resource* adequacy needs shall be addressed by *NYISO* procedures. The *NYISO* shall report to the *NYSRC* on identified needs and possible corrective actions consistent with *NYISO* procedures.

R1.3 The *resource* adequacy report shall include key assumptions and other factors considered in the assessment.

The statewide requirement is met under NYSRC Reliability Rule A.1, Requirement R1 which reads:

> The *NYSRC* shall establish the *IRM* requirement for the *NYCA* such that the probability (or risk) of disconnecting any *firm load* due to *resource* deficiencies shall be, on average, not more than once in ten years. Compliance with this criterion shall be evaluated probabilistically, such that the loss of *load* expectation (LOLE) of disconnecting *firm load* due to *resource* deficiencies shall be, on average, no more than 0.1 day per year. This evaluation shall make due allowance for *demand* uncertainty, scheduled outages and deratings, forced outages and deratings, assistance over interconnections with neighboring *control areas, NYS Transmission System emergency transfer capability,* and *capacity* and/or *load relief* from available *operating procedures.*

For the 2017 capability year, the NYSRC determined that this criterion will be met with an ICAP requirement of 118.0% of the forecast NYCA peak load. This assessment compares reserve margins derived from resource projections and the peak load forecast over the assessment period against an assumed 18.0% IRM requirement.[7]

[6] New York State Reliability Council Reliability Rules & Compliance Manual for Planning and Operating the New York State Power System, Version 39, November 10, 2016.
[7] New York State Reliability Council report titled, "New York Control Area Installed Capacity Requirement for the Period May 2017 to April 2018", December 2, 2016.

In addition to the NYSRC requirement on the NYCA IRM, the NYISO establishes the LCRs.[8] The NYISO defines a locational requirement as:

> A locational ICAP requirement specifies the minimum amount of installed capacity that must be procured from resources situated specifically within a Locality. It considers generation within the Locality as well as the transmission import capability to the Locality in order to meet the resource adequacy reliability criteria of the NYSRC and the Northeast Power Coordinating Council ("NPCC"). These criteria require that the NYCA Loss of Load Expectation ("LOLE") shall be, on average, no more than 0.1 day per year. Further, NYISO's Market Administration and Control Area Services Tariff and the NYSRC Reliability Rules require the NYISO to establish locational ICAP requirements.

This assessment also examines the ratios of capacity to load for New York City, Long Island, and the G-J Locality[9] over the assessment period. These ratios are then compared to the existing LCRs in order to determine whether the planned resources are adequate for these Localities.

LOAD FORECAST

NYISO's forecast involves a two-step process. In the first step, the overall NYCA energy requirements are forecasted. The model used in the energy requirements forecast has considered the manufacturing employment share, education and health care employment share, total income, and other demographic variables. In the second step, the total NYCA peak demand is forecasted. The peak demand is derived, zone by zone, from the annual energy using load factors averaged over the previous five years. The annual energy and the peak demand are projected with the impact of statewide energy saving programs and behind-the-meter generation.

Figure 1 shows the peak load forecast for the NYCA from the 2017 Gold Book.[10] The solid line is the baseline forecast of peak load[11] and the dashed line represents the 90th percentile forecast of peak load.[12] The average annual growth rate of the NYCA peak load forecast over 2017-2019 assessment period is also identified.

[8] NYISO report titled, "Locational Minimum Installed Capacity Requirements Study Covering the New York Balancing Authority Area for the 2017–2018 Capability Year," January 13, 2017.
[9] The G-J Locality encompasses Load Zones G, H, I, and J.
[10] The NYISO "Load & Capacity Data" publication is commonly referred to as the "Gold Book."
[11] The baseline forecast of peak load data is provided in the 2017 Gold Book under Tables I-2a, I-2b-1, and I-2b-2.
[12] The 90th percentile forecast of peak load data is provided in the 2017 Gold Book under Table I-2d. The 90th percentile forecast of peak load is one point within the range defined by the Load Forecast Uncertainty in the probabilistic model.

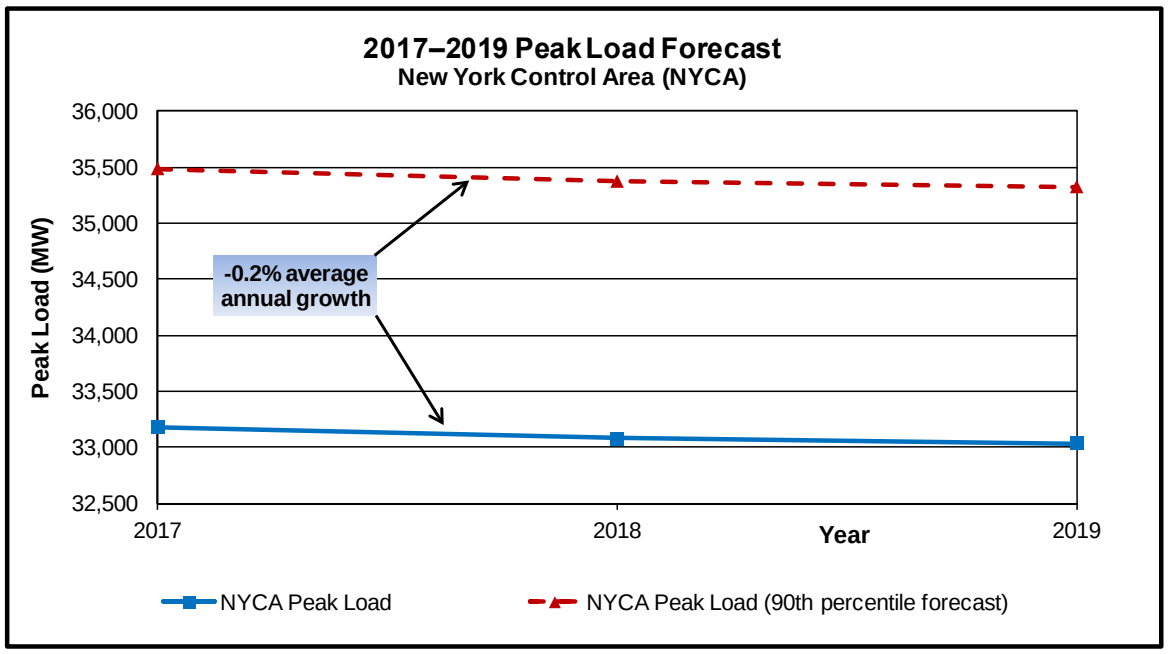

Figure 1. Peak load forecast for the New York Control Area

Figures 2, 3, and 4 show the peak load forecast for New York City ("NYC"), Long Island ("LI"), and the G-J Locality from the 2017 Gold Book, respectively, as well noting the average annual growth rate for each respective Locality during the 2017-2019 assessment period.

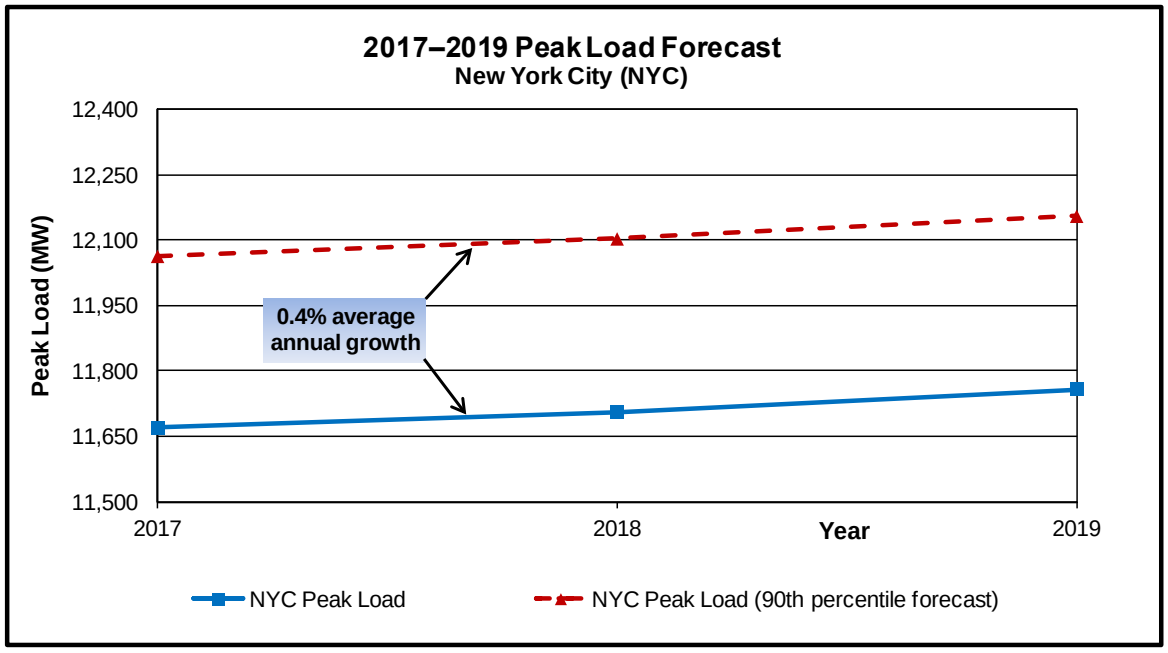

Figure 2. Peak load forecast for New York City

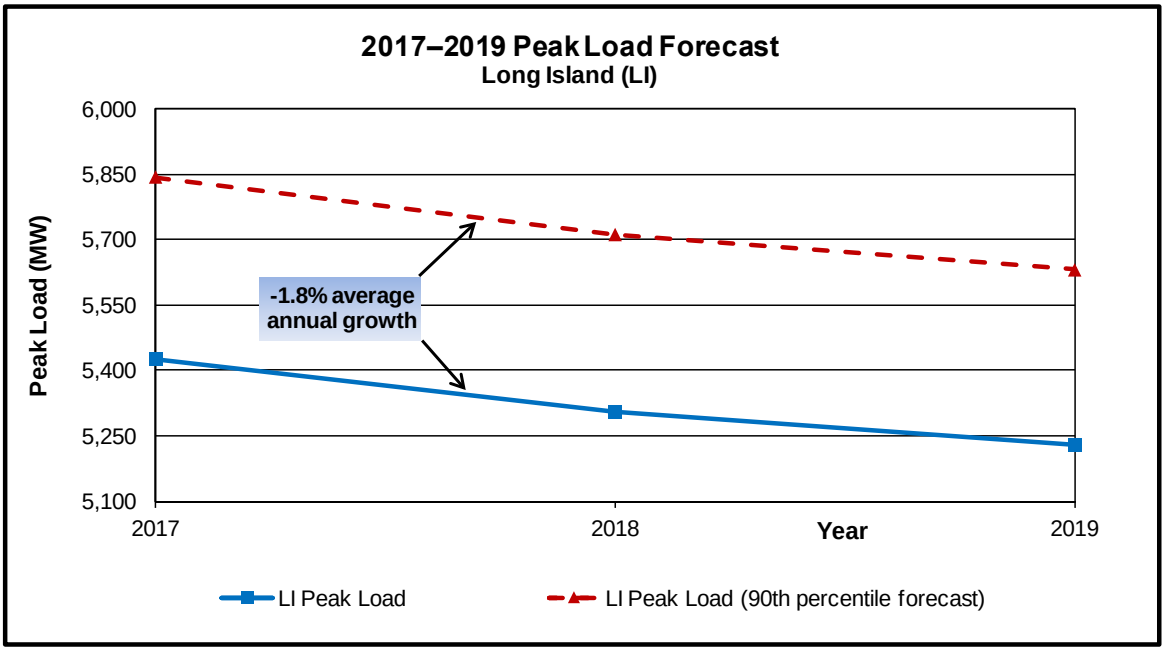

Figure 3. Peak load forecast for Long Island

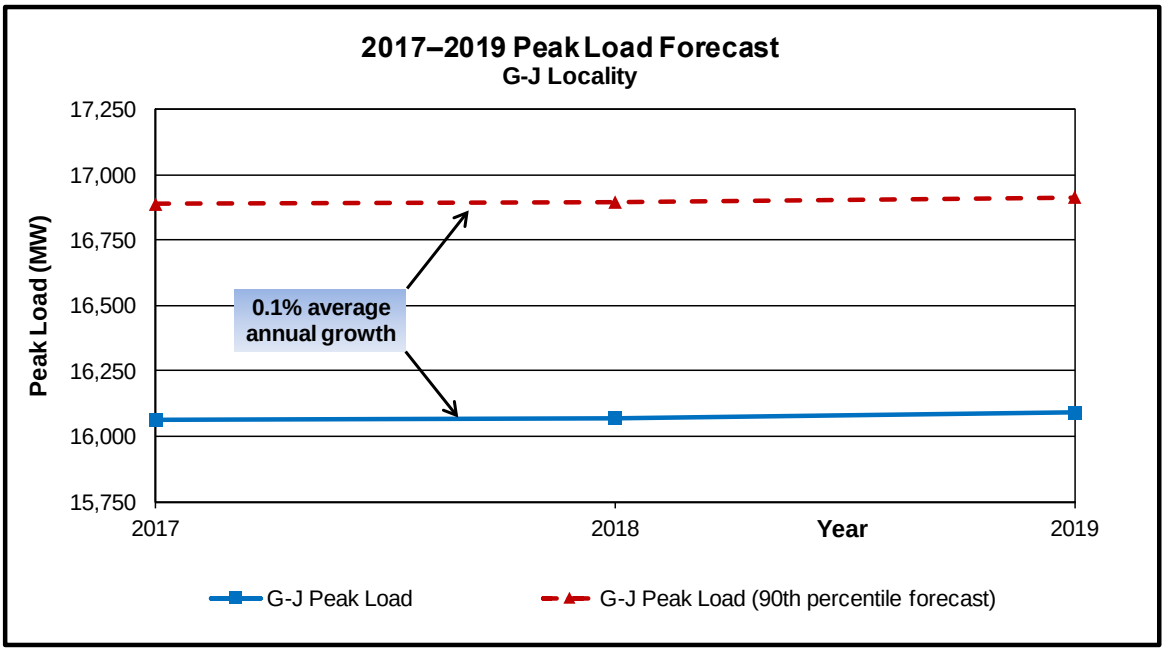

Figure 4. Peak load forecast for G-J Locality

CAPABILITY PROJECTIONS

The NYCA 2017-2019 capability projections from the 2017 Gold Book are shown in Figure 5.[13] This projection incorporates capacity additions, re-ratings, and deactivations that are identified in the 2017 Gold Book and uses the lesser of the Capacity Resource Interconnection Service ("CRIS") or summer Demonstrated Maximum Net Capability ("DMNC") values for each unit. The statewide net purchases[14] and Special Case Resources ("SCRs") are also included based on the information in Tables V-1 and V-2a of the 2017 Gold Book.

Capacity projections are broken into two curves in Figure 5. The first one labeled "CY Studies" contains project additions and re-ratings that have completed their Class Year ("CY") facilities study and have accepted their cost allocations. The second curve labeled "IA Completed" shows the projection of capacity assuming inclusion of projects that are identified on the NYISO Interconnection Queue as having completed an Interconnection Agreement ("IA") as of May 2017.

Appendix 1 is based on the "Proposed Generator Additions & CRIS Requests" table (Table IV-1) of the 2017 Gold Book and has been revised to include re-ratings and deactivations. The appendices, including appendices 1A and 1B, detail the units under consideration for the capability projections. The firm capacity backed contracts that are associated with UDRs are included under the net purchases.

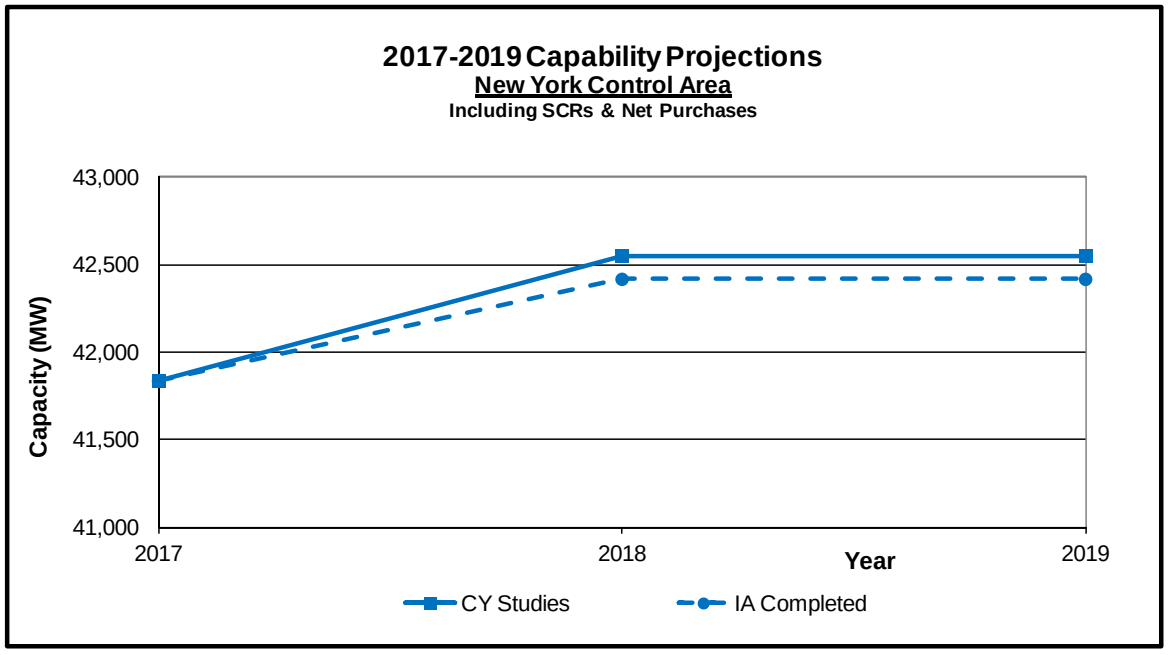

Figure 5. Capability projections for the New York Control Area

[13] The capacities listed include wind units at their full rated value as provided in the 2017 Gold Book under Table III-3a.

[14] Net purchases are long-term firm purchases less long-term firm sales. Firm purchases include grandfathered imports and Unforced Capacity Deliverability Rights (UDRs) with firm contracts.

Figures 6, 7, and 8 show the capability projections under the two cases as described above for New York City, Long Island, and the G-J Locality, respectively. It can be seen from Figure 7 that both cases for Long Island overlap. In addition, there are no capacity additions identified for Long Island.

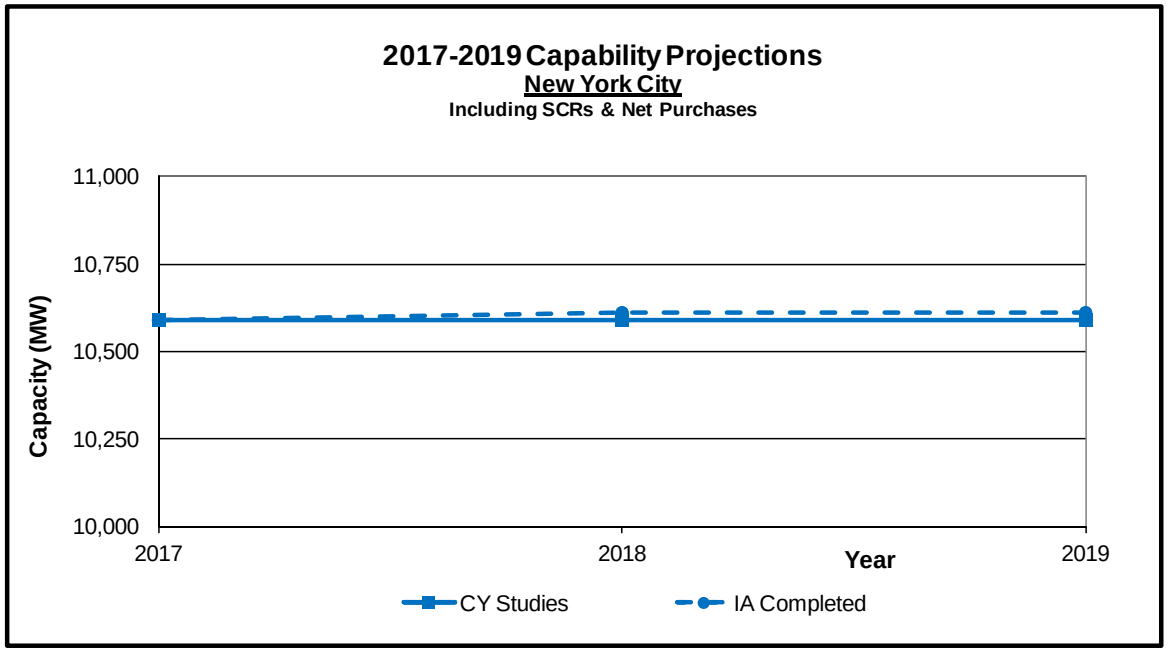

Figure 6. Capability projections for New York City

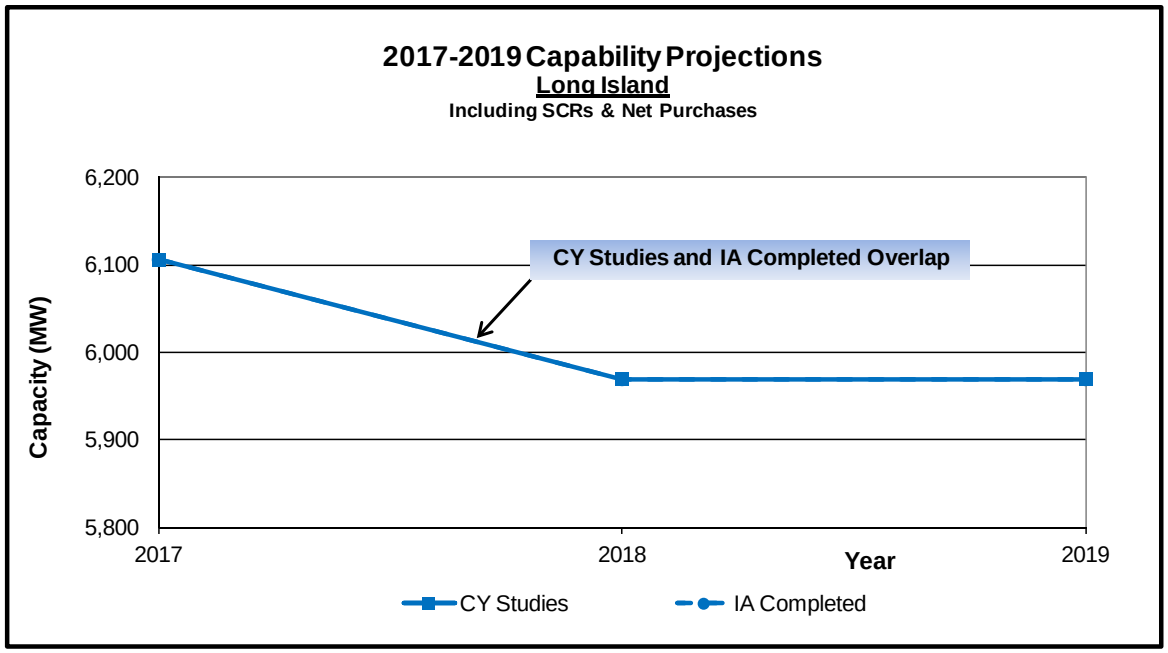

Figure 7. Capability projections for Long Island

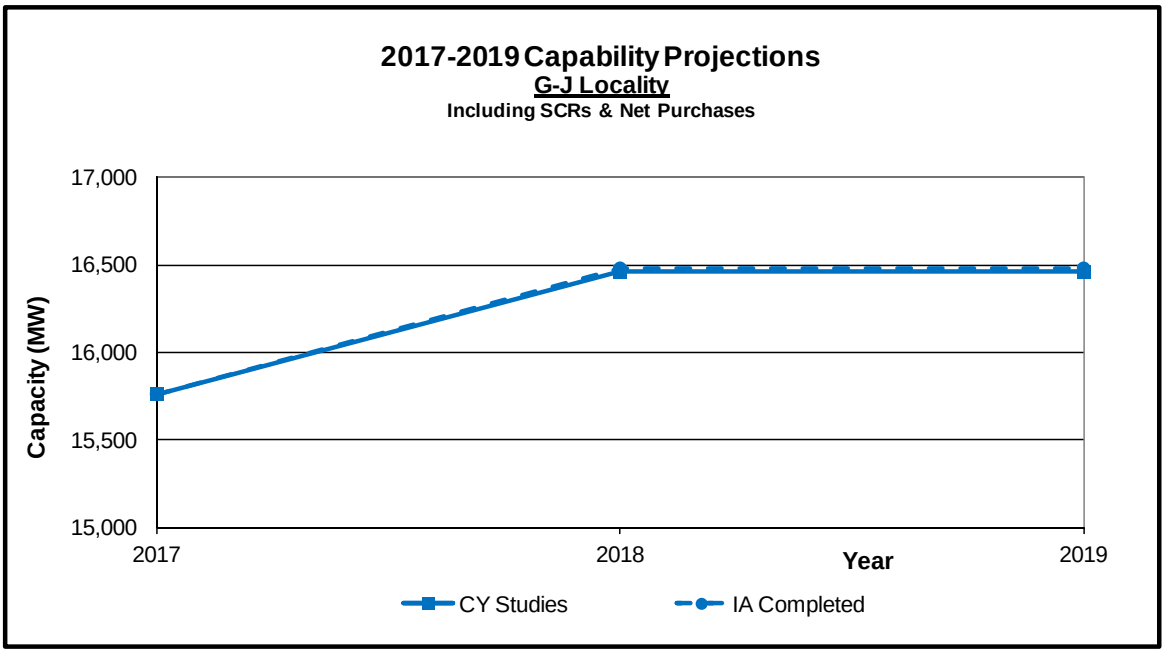

Figure 8. Capability projections for G-J Locality

RESERVE MARGIN LEVELS

From previous figures of projected load forecast and capability, the projections of NYCA installed capacity reserve margin and the capacity-to-load ratios for Localities are derived for the period of 2017-2019, as shown in Figures 9 through 16.

In the analysis, both cases of "CY Studies" and "IA Completed" are considered against the baseline forecast of peak load. The IRM and LCR projections over the assessment period are assumed to be the same as current requirements for the NYCA IRM and for the LCRs for Localities, respectively.

An Extreme case assuming no proposed generator additions are available during the assessment period is also examined under the baseline forecast of peak load.

In addition to the scenario with the baseline forecast of peak load, the "CY Studies" and "IA Completed" cases are also evaluated under the extreme scenario utilizing the 90th percentile forecast of peak load, which represents an extremely high peak load demand.

Figure 9 indicates that an assumed 18.0% projected NYCA IRM would be met throughout the assessment period for all cases with the baseline forecast of peak load, even without any proposed capacity additions. In the scenario of a 90th percentile forecast of peak load, based on a deterministic assessment that only uses expected New York Control Area resources, as shown in Figure 10, the 18.0% projected IRM cannot be met during the specific annual peak load of 2017.

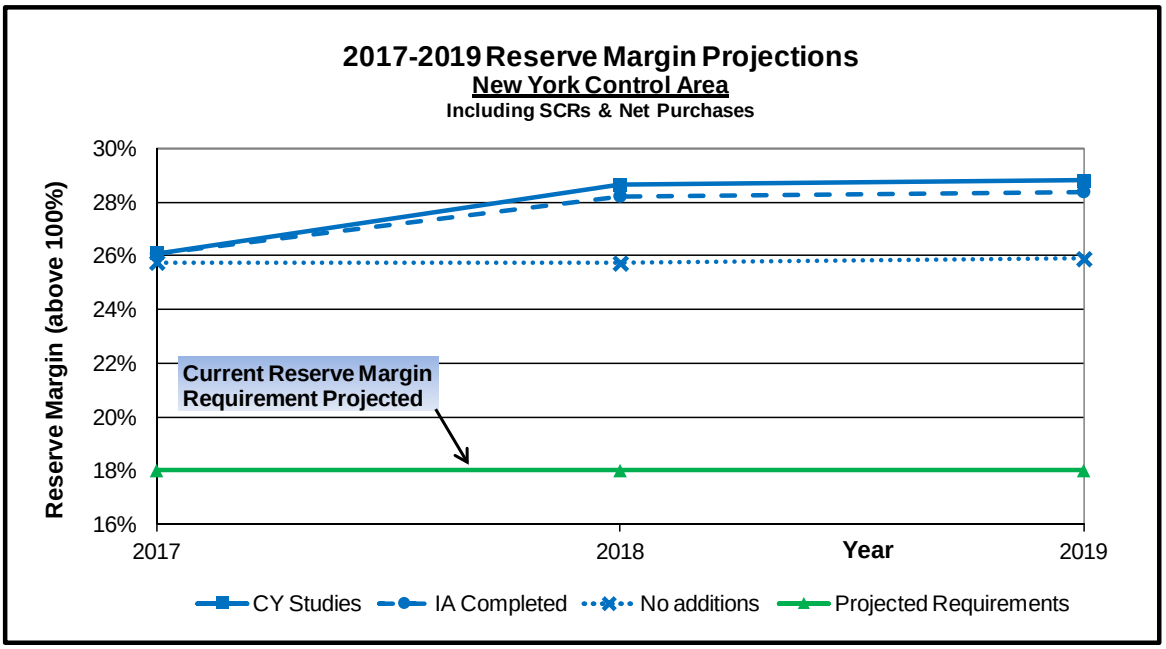

Figure 9. Reserve margin projections for the New York Control Area

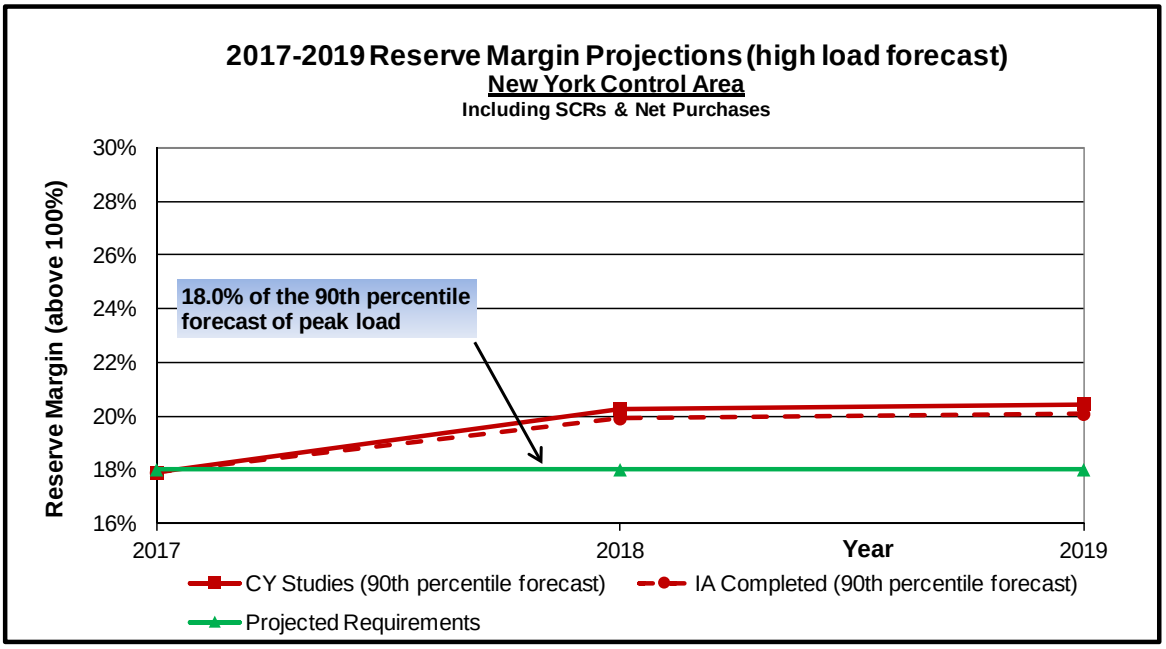

Figure 10. Reserve margin projections for the New York Control Area (high load forecast)

Figure 11 shows that New York City would meet a projected 81.5% LCR throughout the assessment period with the baseline forecast of peak load for all cases, even without any proposed capacity additions. Under the scenario of a 90th percentile forecast of peak load, as shown in Figure 12, the 81.5% projected LCR for New York City can still be met for both the "CY Studies" and "IA Completed" cases throughout the assessment period.

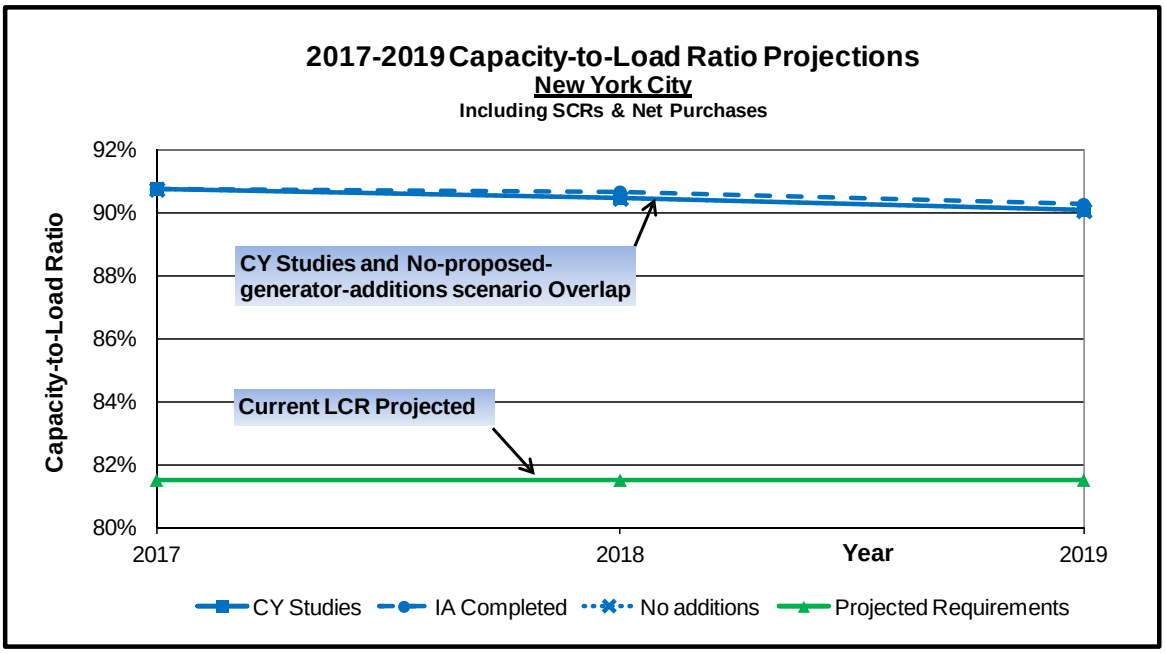

Figure 11. Capacity-to-Load Ratio Projections for New York City

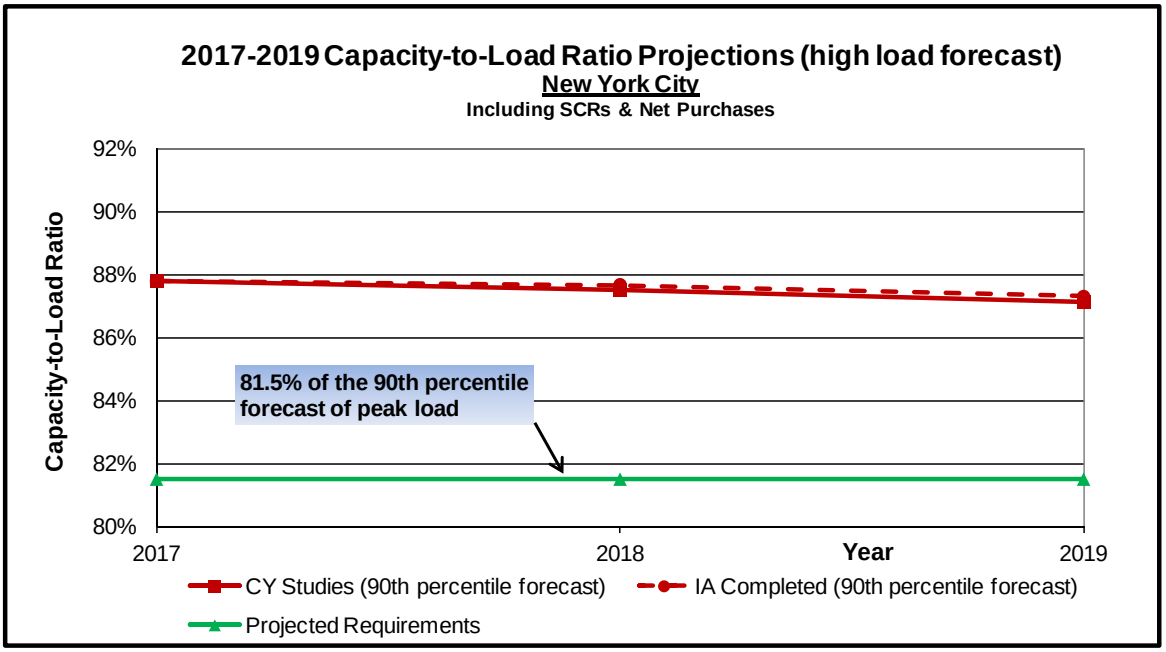

Figure 12. Capacity-to-Load Ratio Projections for New York City (high load forecast)

Figure 13 shows that Long Island would meet a projected 103.5% LCR throughout the assessment period with the baseline forecast of peak load for all cases. Since there are no capacity additions indentified for Long Island during 2017-2019, all these cases are the same. Under the scenario of a 90th percentile forecast of peak load, as shown in Figure 14,

the 103.5% projected LCR can still be met for both the "CY Studies" and "IA Completed" cases throughout the assessment period.

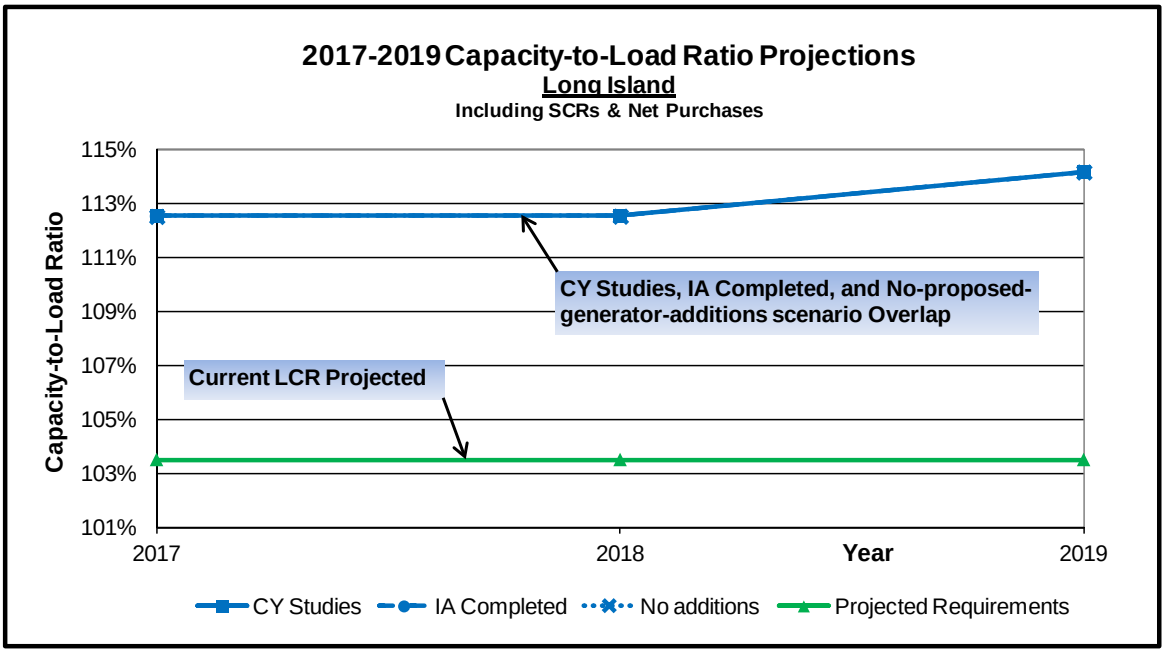

Figure 13. Capacity-to-Load Ratio Projections for Long Island

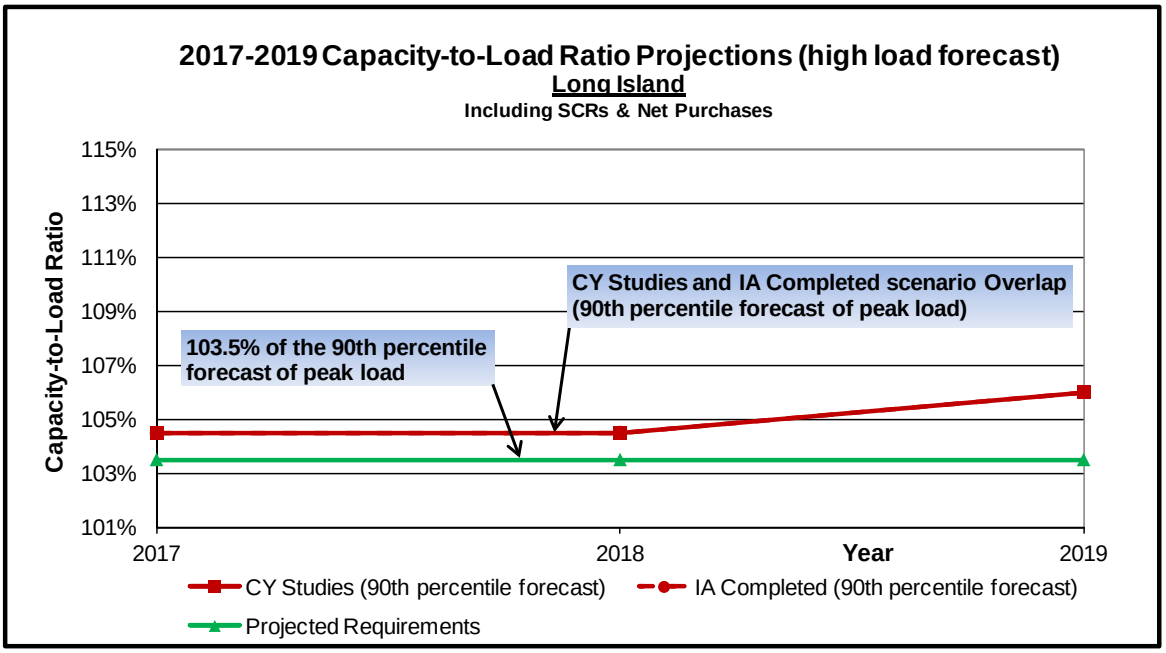

Figure 14. Capacity-to-Load Ratio Projections for Long Island (high load forecast)

Figure 15 shows that the G-J Locality would meet a projected 91.5% LCR throughout the assessment period for all cases with the baseline forecast of peak load, even without any proposed capacity additions. Under the scenario of the 90th percentile forecast of peak

load, as shown in Figure 16, the 91.5% projected LCR can still be met for both the "CY Studies" and "IA Completed" cases throughout the assessment period.

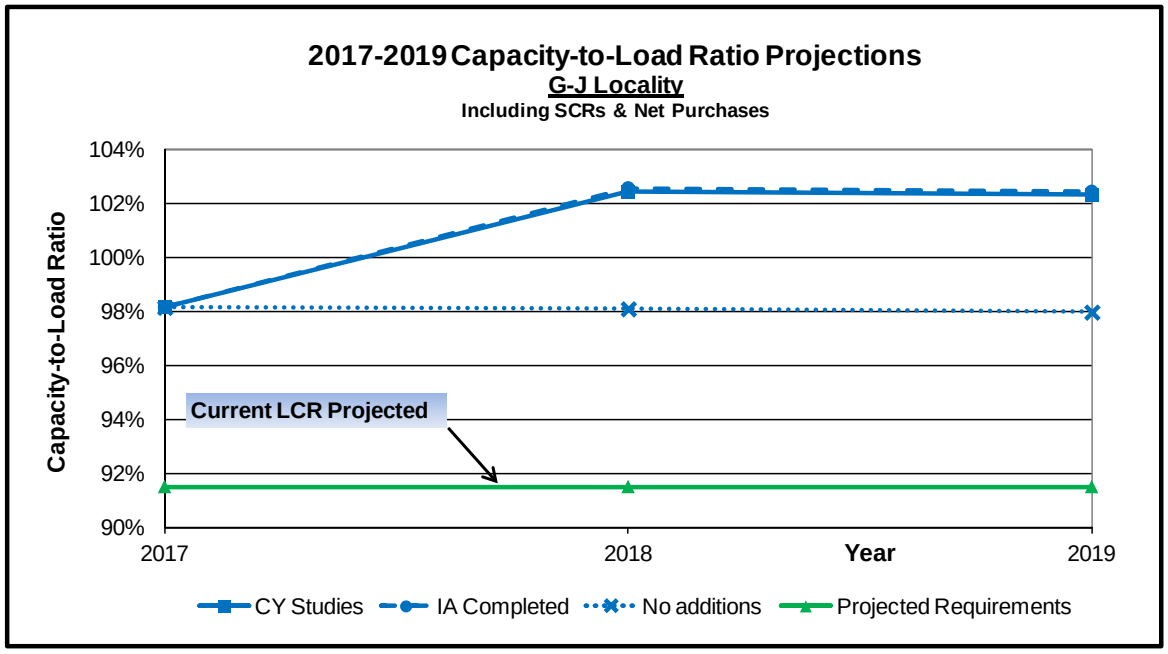

Figure 15. Capacity-to-Load Ratio Projections for G-J Locality

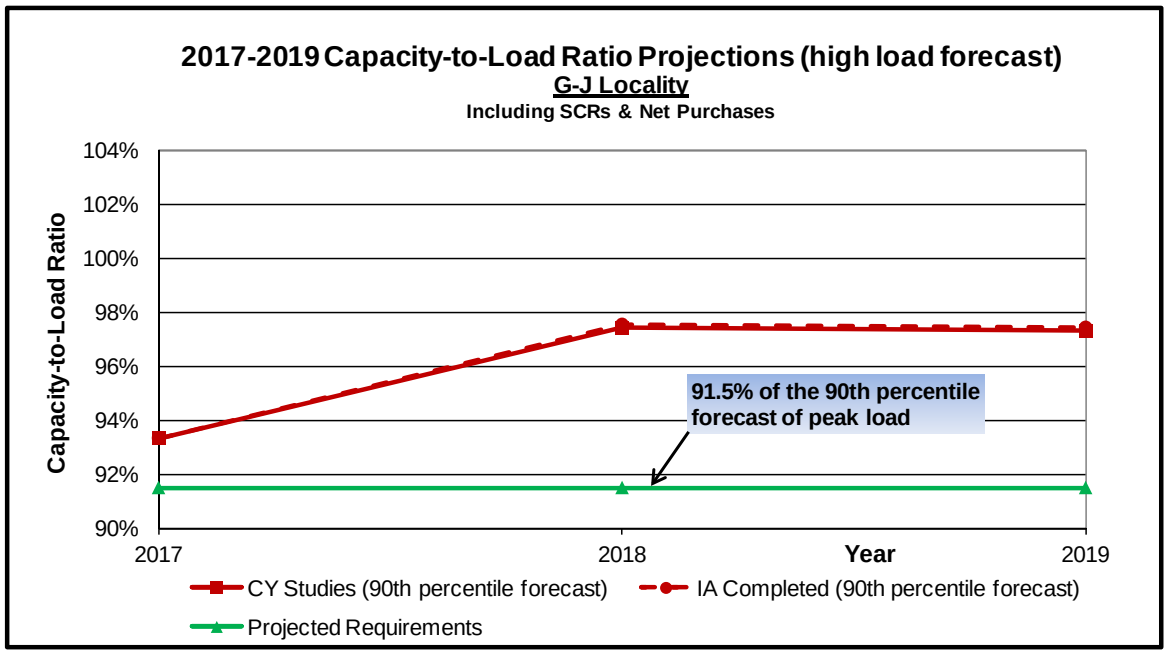

Figure 16. Capacity-to-Load Ratio Projections for G-J Locality (high load forecast)

CONCLUSION

With the baseline forecast of peak load, a projected 18.0% statewide IRM is met throughout the 2017-2019 assessment period, even under the Extreme case (with no new resource additions during assessment period). Because NYSRC's annual IRM study has adopted the Load Forecast Uncertainty ("LFU") in its probabilistic model, an extremely high peak load demand, including the 90th percentile forecast of peak load, has already been included in the study using the baseline forecast data. To consider the results for specific forecast, such as the 90th percentile forecast of peak load, a deterministic assessment needs to be performed. Based on a deterministic assessment, a projected 18.0% IRM cannot be met for the 90th percentile forecast of specific annual peak load in 2017 with only expected New York Control Area resources.

With the baseline forecast of peak load and the proposed 2017-2019 resource additions, New York City would meet a projected LCR of 81.5% over the assessment period.

With the baseline forecast of peak load, Long Island would meet a projected LCR of 103.5% throughout the assessment period.

With the baseline forecast of peak load and the proposed 2017-2019 resource additions, the G-J Locality would meet a projected LCR of 91.5% over the assessment period.

It is worth noting that even without the proposed 2017-2019 resource additions for the baseline forecast of peak load, New York City, Long Island, and the G-J Locality would still be able to meet their respective projected LCR requirements for the baseline forecast of peak load throughout the assessment period.

Similar to the IRM study, the probabilistic model of NYISO's annual LCR study has also adopted the LFU model in the baseline forecast data. To consider a specific forecast, such as the 90th percentile forecast of peak load, a deterministic assessment needs to be performed. Based on a deterministic assessment of the 90th percentile forecast of peak load and the proposed 2017-2019 resource additions, New York City, Long Island, and the G-J Locality can still meet the projected LCRs of 81.5%, 103.5%, and 91.5% throughout the assessment period, respectively.

It is important to note that any deterministic assessment of extreme scenarios, including the Extreme case utilizing the baseline forecast of peak load and all scenarios utilizing the 90th percentile forecast of peak load, only provide limited "what if" information and, without a probabilistic assessment, do not test resource adequacy. Only the cases including planned resources and interconnections with other regions and that utilize the baseline forecast of peak load can demonstrate whether NYCA or a Locality has adequate resources.

Appendix 1*

Proposed Resource Changes

QUEUE POS.	OWNER / OPERATOR	STATION UNIT	ZONE	DATE	CRIS (MW)	SUMMER (MW)	UNIT TYPE	CLASS YEAR	NOTES	Increase of Lessor of CRIS & Summer DMNC
Generator Additions										
431	Greenidge Generation	Greenidge Unit #4	C	Mar 2017	106.3	106.3	Steam Turbine	2015	(1)	106.3
251	CPV Valley, LLC	CPV Valley Energy Center	G	Feb 2018	680.0	677.6	Combined Cycle	2011	(1)	677.6
349	Taylor Biomass Energy Mont., LLC	Taylor Biomass	G	Apr 2018	19.0	19.0	Solid Waste	2011	(1)	19.0
395	Copenhagen Wind Farm, LLC	Copenhagen Wind	E	May 2018	79.9	79.9	Wind Turbines	2015		79.9
Generator Re-ratings										
	PSEG Energy Resource & Trade, LLC	Bethlehem Energy Center	F	2017-2018	835.0	835.0	Combined Cycle	2015		74.5
	Consolidated Edison Co. of NY, Inc.	East River 1 Uprate	J	Summer 2017	160.5	160.5	Steam Turbine		(1)	8.2
	Consolidated Edison Co. of NY, Inc.	East River 2 Uprate	J	Summer 2017	162.4	162.4	Steam Turbine		(1)	13.3
Generator Deactivations (Retirement / Mothballing / IIFO)										
	Cayuga Operating Company, LLC	Cayuga 1	C	7/1/2017	154.1	152.0	Steam Turbine			-152.0
	Cayuga Operating Company, LLC	Cayuga 2	C	7/1/2017	154.7	150.2	Steam Turbine			-150.2
	J-POWER USA Generation, L.P.	Shoreham GT3	K	8/13/2017	45.4	45.4	Combustion Turbine			-45.4
	J-POWER USA Generation, L.P.	Shoreham GT4	K	8/13/2017	43.9	44.6	Combustion Turbine			-43.9
	J-POWER USA Generation, L.P.	Freeport EQUS GT1	K	10/31/2017	48.3	47.5	Combustion Turbine			-47.5
GRAND TOTAL										**539.8**

* This table is modified from table IV-1, "Proposed Generator Additions & CRIS Requests" in the NYISO 2017 Gold Book.
(1) These projects are identified on the NYISO Interconnection Queue as having completed an Interconnection Agreement as of May 2017.

Appendix 1A – Determination of Annual Capacities

Units with Their Class Year Facilities Study Completed

	2017				2018				2019			
	NYCA	NYC	LI	G-J	NYCA	NYC	LI	G-J	NYCA	NYC	LI	G-J
2017 Gold Book - full wind:	**38664.5**	**9597.0**	**5280.9**	**14353.4**	**38664.5**	**9597.0**	**5280.9**	**14353.4**	**38664.5**	**9597.0**	**5280.9**	**14353.4**
Lesser of CRIS & Summer DMNC	38581.4	9582.1	5297.4	14669.1	38581.4	9582.1	5297.4	14669.1	38581.4	9582.1	5297.4	14669.1
Greenidge Unit #4	106.3				106.3				106.3			
CPV Valley Energy Center					677.6			677.6	677.6			677.6
Taylor Biomass					19.0			19.0	19.0			19.0
Copenhagen Wind					79.9				79.9			
Reratings												
Bethlehem Energy Center					74.5				74.5			
East River 1 Uprate												
East River 2 Uprate												
Deactivations												
Cayuga 1	-152.0				-152.0				-152.0			
Cayuga 2	-150.2				-150.2				-150.2			
Shoreham GT3					-45.4		-45.4		-45.4		-45.4	
Shoreham GT4					-43.9		-43.9		-43.9		-43.9	
Freeport EQUS GT1					-47.5		-47.5		-47.5		-47.5	
Total:	38385.5	9582.1	5297.4	14669.1	39099.7	9582.1	5160.6	15365.7	39099.7	9582.1	5160.6	15365.7

Appendix 1B – Determination of Annual Capacities

Units with Their Interconnection Agreement Completed

	2017				2018				2019			
	NYCA	NYC	LI	G-J	NYCA	NYC	LI	G-J	NYCA	NYC	LI	G-J
2017 Gold Book - full wind:	**38664.5**	**9597.0**	**5280.9**	**14353.4**	**38664.5**	**9597.0**	**5280.9**	**14353.4**	**38664.5**	**9597.0**	**5280.9**	**14353.4**
Lesser of CRIS & Summer DMNC	38581.4	9582.1	5297.4	14669.1	38581.4	9582.1	5297.4	14669.1	38581.4	9582.1	5297.4	14669.1
Greenidge Unit #4	106.3				106.3				106.3			
CPV Valley Energy Center					677.6			677.6	677.6			677.6
Taylor Biomass					19.0			19.0	19.0			19.0
Copenhagen Wind												
Reratings												
Bethlehem Energy Center												
East River 1 Uprate					8.2	8.2		8.2	8.2	8.2		8.2
East River 2 Uprate					13.3	13.3		13.3	13.3	13.3		13.3
Deactivations												
Cayuga 1	-152.0				-152.0				-152.0			
Cayuga 2	-150.2				-150.2				-150.2			
Shoreham GT3					-45.4		-45.4		-45.4		-45.4	
Shoreham GT4					-43.9		-43.9		-43.9		-43.9	
Freeport EQUS GT1					-47.5		-47.5		-47.5		-47.5	
Total:	38385.5	9582.1	5297.4	14669.1	38966.8	9603.6	5160.6	15387.2	38966.8	9603.6	5160.6	15387.2