NYISO's 2018 Comprehensive Area Review of Resource Adequacy

Covering the New York Control Area for the Study Period 2019 – 2023

Prepared by the NYISO for the NPCC

Final

Approved at the December 4, 2018 Reliability Coordinating Committee (RCC) Meeting

Executive Summary

The New York Independent System Operator (NYISO) conducts an annual Area Review of Resource Adequacy of the New York State Bulk Power System (BPS) as required by the Northeast Power Coordinating Council (NPCC) and the New York State Reliability Council (NYSRC). The purpose of this assessment is to demonstrate conformance with the applicable NPCC resource adequacy planning requirements and NYSRC Reliability Rules.

This report represents the 2018 NYISO Comprehensive Area Review of Resource Adequacy ("2018 Comprehensive Review") and covers a five-year study period, *i.e.,* 2019 (study year 1) through 2023 (study year 5).

Major Findings

This 2018 Comprehensive Review demonstrates that New York Control Area (NYCA) will meet the NPCC resource adequacy criterion: *i.e.,* NYCA's loss of load expectation (LOLE) of disconnecting firm load due to resource deficiencies is, on average, no more than 0.1 days/year throughout the five-year study period. The results in this report are based on the study assumptions employed for NYISO's 2018 Reliability Needs Assessment[1] (RNA).

Major Assumptions and Results

Figure 1 lists the major assumptions modeled in this review. **Figure 2**Figure 2 lists the Loss of Load Expectation (LOLE) results, while **Appendix A**: Resource Adequacy Model Assumptions and **B** contain the study assumptions matrix and topologies.

[1] Final version of the 2018 RNA is available here: http://www.nyiso.com/public/markets_operations/services/planning/planning_studies/index.jsp

Figure 1: Modeling Assumptions Highlights

Model Assumptions	
Assumption	**Description**
Adequacy Criterion	NPCC and NYSRC Loss of Load Expectation (LOLE) requirement (LOLE no more than 0.1 days/year)
Reliability Model	GE MARS program (version 3.22.6)
Load Model	Based on the baseline load forecast from the NYISO's 2018 Load and Capacity Data Report (2018 Gold Book). 11 NYCA zones are modeled. The 2018 GB baseline load forecast includes reductions for energy efficiency, codes and standards, distributed generation, behind-the-meter (BtM) photovoltaic (PV) solar, and increases to account for electric vehicles. For the resource adequacy load model, the deducted BtM solar MW was added back to the NYCA zonal loads, which then allows for a discrete modeling of the BtM solar resources.
Load shapes	Used Multiple Load Shape MARS Feature. 8760 h historical load shapes were used as base shapes for LFU bins: Bin 1: 2006 Bin 2: 2002 Bins 3-7: 2007 Peak adjustments are being performed on a seasonal basis.
Load Forecast Uncertainty (LFU)	Used updated summer LFU bin weight values for the 11 NYCA zones.
Generating Capacity Additions	2,300 MW (includes 680 MW CPV Valley, and 1,020 MW Cricket Valley)
Generating Capacity Retirements	3,600 MW (includes 2,150 MW Indian Point 2 and 3)
Unit Availability	Based on NERC GADS data (EFORd calculation) and five-year unit history
Topology	As modeled for the 2018 RNA. Emergency transfer criteria limits are modeled for the interfaces between NYCA zones
Emergency Operating Procedures	EOPs that reduce load during emergency conditions to maintain operating reserves are modeled
External Control Areas	Load and Capacity fixed through the study years External Areas adjusted to be between 0.1 and 0.15 days/year LOLE

Figure 2: NYCA LOLE Results

2018 Comprehensive Review NYCA LOLE Results					
Year	**2019**	**2020**	**2021**	**2022**	**2023**
Projected Resources* (MW)	41,728	42,362	41,358	41,500	41,500
Base Load Forecast					
NYCA Base Load Forecast** (MW)	32,857	32,629	32,451	32,339	32,284
LOLE Results	0.01	0.00	0.01	0.01	0.01
High Load Forecast					
NYCA High Load Forecast (MW)	34,099	34,367	34,554	34,727	34,946
LOLE Results	0.03	0.02	0.06	0.07	0.09

*Projected resources includes NYCA Capacity, net purchases and sales as per the 2018 Gold Book and SCRs. NYCA Capacity values are resources electrically internal to NYCA, additions, re-ratings, and retirements (including proposed retirements and mothballs). Capacity values reflect the lesser of CRIS and DMNC values.

**NYCA load values represent baseline coincident summer peak demand.

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1. Introduction

The NPCC Directory 1 requires each Area to conduct a Comprehensive Review of Resource Adequacy at least once every three years. In subsequent years, each Planning Coordinator will conduct an Annual Interim Review of Resource Adequacy that will cover, at a minimum, the remaining years studied in the Comprehensive Review of Resource Adequacy.

The most recent NYISO Comprehensive Review was performed by NYISO in 2015 and was approved by the NPCC Reliability Coordinating Council (RCC) in December 2015.

This Comprehensive Review is based upon the NYISO's most recent reliability planning process (*i.e.,* 2018-2019 RPP) under Attachment Y of its Open Access Transmission Tariff approved by the Federal Energy Regulatory Commission. The results are from the 2018 Reliability Needs Assessment, which has been approved by NYISO's Board on October 17, 2018 and it is now posted on the NYISO's web site[2]. The RNA is followed by a Comprehensive Reliability Plan (CRP) in 2019, which completes the 2018-2019 RPP cycle.

This report follows the guidelines outlined in NPCC's Regional Reliability Reference Directory No. 1, Appendix D[3]. The NYISO submits the 2018 Comprehensive Review of Resource Adequacy, covering the study period 2019 through 2023, to satisfy NPCC requirements.

1.1. NYISO's Planning Processes

The New York Independent System Operator (NYISO) was formed in 1997 and commenced operations in 1999. The NYISO is a not-for-profit organization that manages New York's bulk electricity grid, administers the state's competitive wholesale electricity markets, provides system and resource planning for state's bulk power system, and works to advance the technology serving the power system. The organization is governed by an independent Board of Directors and a governance structure made up of committees with market participants and stakeholders.

The NYISO is also the regional Planning Coordinator for the New York Balancing Authority Area of the Northeast Power Coordinating Council. As the Planning Coordinator, the NYISO is responsible to conduct reliability studies and provide results to NPCC demonstrating that the New York bulk power system complies with NPCC reliability criteria as defined in NPCC's Regional Reliability Reference Directory No. 1, Design and Operation of the Bulk Power System.

[2] 2018 Final RNA: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Planning_Studies/Reliability_Planning_Studies/Reliability_Assessment_Documents/2018-Reliability-Needs-Assessment.pdf

[3] https://www.npcc.org/Standards/Directories/Directory_1_TFCP_rev_20151001_GJD.pdf

The Comprehensive System Planning Process[4] (CSPP) is the NYISO's biennial ten-year planning process. The CSPP was approved by the Federal Energy Regulatory Commission (FERC) and its requirements are contained in Attachment Y of the NYISO's Open Access Transmission Tariff (OATT). One of the NYISO's responsibilities is to prepare for the impact of expected changes in supply and demand of power on the reliable operation of the New York transmission system over a ten-year period. The analyses, evaluations and forecasts produced by the NYISO's system and resource planning activities assist Market Participants, regulators and policy makers as they plan for the future. One way the NYISO accomplishes this responsibility is through the reliability planning process (RPP) component of the CSPP.

The CSPP is comprised of four components:

1. Local Transmission Planning Process (LTPP),
2. Reliability Planning Process (RPP),
3. Congestion Assessment and Resource Integration Study (CARIS), and
4. Public Policy Transmission Planning Process.

The first component in the CSPP cycle is the LTPP. Under this process, the local Transmission Owners (TOs) perform transmission studies for their transmission areas according to all applicable criteria. This process produces the Local Transmission Owner Plan (LTP), which feeds into the NYISO's determination of system needs through the CSPP.

The second component in the CSPP cycle is the RPP. Its requirements are described in the Reliability Planning Process Manual (NYISO Manual 26) and Attachment Y of the OATT. Under this biennial process, the reliability of the New York State Bulk Power Transmission Facilities (BPTF) is assessed, any Reliability Needs are identified, solutions to identified needs are proposed and evaluated for their viability and sufficiency to satisfy the identified needs, and the more efficient or cost-effective transmission solution to the identified needs if any is selected by the NYISO. This process was originally developed and implemented in conjunction with stakeholders, was approved by FERC in December 2004, and was revised in 2014 to conform to FERC Order No. 1000.

The RPP consists of two studies:

1. **The Reliability Needs Assessment (RNA):** The NYISO performs a biennial study in which it evaluates the resource and transmission adequacy and transmission system security of the New York BPTF over a ten-year Study Period. As described above, the results of the individual Transmission Owner Local Transmission Plans are incorporated into the RNA. Through this

[4] See Attachment Y of the NYISO Open Access Tariff (OATT)

evaluation, the NYISO identifies Reliability Needs in accordance with applicable Reliability Criteria. This report is reviewed by NYISO stakeholders and approved by the Board of Directors.

2. **The Comprehensive Reliability Plan (CRP):** After the RNA is complete, the NYISO requests the submission of market-based solutions to satisfy any identified Reliability Need. The NYISO also identifies a Responsible TO and requests that the TO submits a regulated backstop solution and that any interested entities submit alternative regulated solutions to address the identified Reliability Needs. The NYISO evaluates the viability and sufficiency of the proposed solutions to satisfy the identified Reliability Needs and evaluates and selects the more efficient or cost-effective transmission solution to the identified need. In the event that market-based solutions do not materialize to meet a Reliability Need in a timely manner, the NYISO triggers regulated solution(s) to satisfy the need. The CRP sets forth the NYISO's findings regarding the proposed solutions. The CRP is reviewed by NYISO stakeholders and approved by the Board of Directors.

In the event that there is a potential loss of resources due to a proposed generator retirement or mothballing, the NYISO will administer its Generator Deactivation Process for Generator Deactivation Notices that it receives. If necessary, the NYISO will seek solutions to address any Generator Deactivation Reliability Needs identified through that process. In addition, the NYISO may request solutions outside of its normal planning cycle if there appears to be an imminent threat to the reliability of the Bulk Power Transmission System arising from causes other than deactivating generation.

The third component of the CSPP is the economic planning process in which the NYISO performs the Congestion Assessment and Resource Integration Study (CARIS). The CARIS study utilizes, as its starting point, the results from the viability and sufficiency assessment portion of the CRP process, once they are finalized and become publicly available. CARIS Phase 1 examines congestion on the New York bulk power system, and the costs and benefits of generic alternatives to alleviate that congestion. During CARIS Phase 2, the NYISO evaluates specific transmission project proposals for regulated cost recovery.

The fourth component of the CSPP is the Public Policy Transmission Planning Process. Under this process, interested entities propose, and the New York State Public Service Commission (NYPSC) identifies, transmission needs driven by Public Policy Requirements. The NYISO then requests that interested entities submit proposed solutions to the identified Public Policy Transmission Need. The NYISO evaluates the viability and sufficiency of the proposed solutions to satisfy the identified Public Policy Transmission Need. The NYISO then evaluates and may select the more efficient or cost-effective transmission solution to the identified need. The NYISO develops the Public Policy Transmission Planning Report that sets forth its findings regarding the proposed solutions. This report is reviewed by NYISO stakeholders and approved by the Board of Directors.

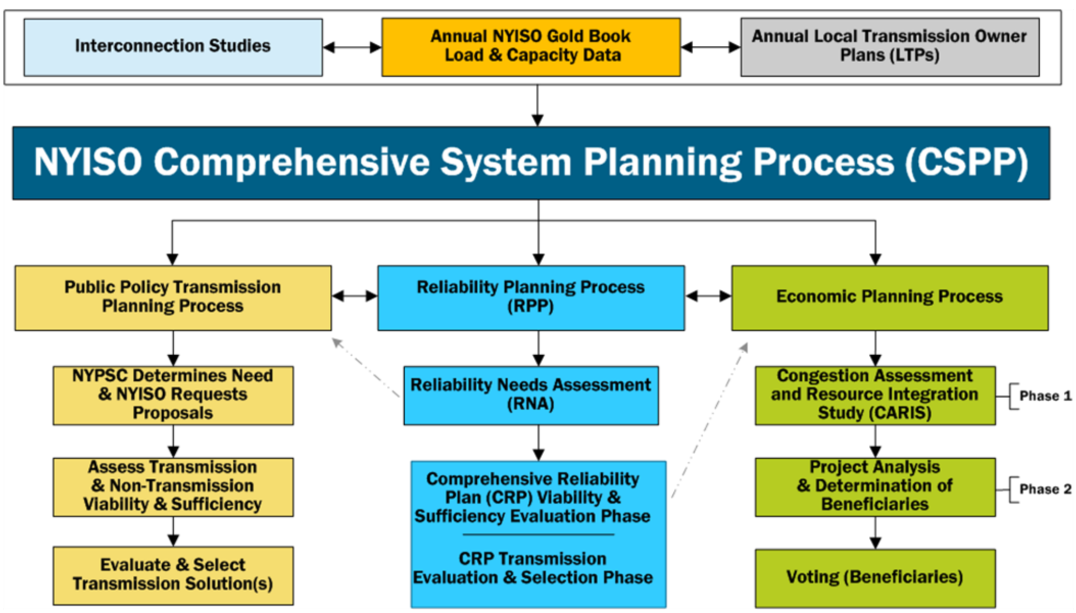
In concert with these four components, interregional planning is conducted with NYISO's neighboring control areas in the United States and Canada under the Northeastern ISO/RTO Planning Coordination Protocol. The NYISO participates in interregional planning and may consider Interregional Transmission Projects in its regional planning processes.

Additionally, NYISO provides significant support to the New York State Reliability Council (NYSRC), which conducts an annual Installed Reserve Margin study. This study determines the Installed Reserve Margin (IRM) for the upcoming Capability Year (May 1st through April 30th). The IRM is used to quantify the capacity required to meet the NPCC and NYSRC resource adequacy criterion of a LOLE of no greater than 0.1 days per year.

Link to various NYISO Planning Studies:
http://www.nyiso.com/public/markets_operations/services/planning/planning_studies/index.jsp

The NYISO CSPP is illustrated in **Figure 3.**

Figure 3: NYISO Comprehensive System Planning Process



1.2. Previous Comprehensive Review

The Reliability Coordinating Committee (RCC) approved the 2015 New York Comprehensive Review of Resource Adequacy in December 2015. The findings of that review demonstrated that New York would meet the NPCC Resource Adequacy Design Criterion for the study period under the base case load and resource conditions described in this report.

1.3. Comparison of Load and Resources with Previous Comprehensive Review

1.3.1. Demand Forecast

The baseline peak load forecast used for NYISO's 2018 reliability planning process (RPP) is based upon a model that incorporates forecasts of economic drivers, end use and technology trends, and normal weather conditions. The NYISO incorporates the impacts of energy efficiency and technology trends directly into the forecast model, with additional adjustments for distributed energy resources, electric vehicles and behind-the-meter solar photovoltaic (PV). The baseline forecast includes upward adjustments for increased usage of electric vehicles, and downward adjustments for the impacts of energy efficiency trends, distributed energy resources and behind-the-meter solar PV. The ten-year annual average energy growth rate is lower as compared to data reported in 2015 comprehensive review (-.14% per year in 2018 versus .16% in 2014[5]). The ten-year annual average summer peak demand growth rate is lower than the data reported in 2015 comprehensive review (-.13% per year in 2018 versus 0.83% in 2014).

The demand-side management impacts included or accounted for in the 2018 base case forecast derive from actual and projected spending levels and realization rates for state-sponsored programs such as the Clean Energy Fund and the NY-Sun Initiative. They also include the impacts of building codes and appliance efficiency standards, distributed generation, and electric vehicles.

1.3.2. Resources

The 2018 RNA's resource adequacy base case models as generation resources the existing generation adjusted for the unit retirements, mothballing, and proposals to retire or mothball announced as of April 4, 2018, along with the new resource additions that met the base case inclusion rules set forth in Section 3 of the RPP Manual. This capacity is summarized in **Figure 4** below, and also includes the NYCA net purchases and sales and the Special Capacity Resources[6]. The baseline peak load is reflected in the **Figure 4,** along with a comparison with the prior Comprehensive Review assumptions.

[5] *The 2015 NPCC NY Comprehensive Review was based on the 2014 Gold Book data.*

[6] *SCRs are Demand Side Resources whose Load is capable of being interrupted at the direction of the NYISO, and/or Demand Side Resources that have a Local Generator, which is not visible to the NYISO's Market Information System and is rated 100 kW or higher, that can be operated to reduce Load from the NYS Transmission System and/or the distribution system at the direction of the NYISO. Small customer aggregations may also qualify as SCRs. The Unforced Capacity of a SCR corresponds to its pledged amount of Load reduction as adjusted by historical performance factors (i.e., test and event performance) and as increased by the Transmission District loss factor, as calculated in accordance with Section 4.12.2.1 to the ICAP Manual*

Figure 4: Comparison of Peak Load Forecasts and Capacity Resources from Previous Review

Comparison of Peak Load Forecasts (MW) and Capacity Resources (MW) with the 2015 Comprehensive Review					
Year	2019	2020	2021	2022	2023
2018 Comprehensive Review – Capacity Resources*	41,728	42,362	41,358	41,500	41,500
2015 Comprehensive Review – Capacity Resources*	42,507	42,507	-	-	-
Delta	-779	-145	N/A	N/A	N/A
2018 Comprehensive Review – Baseline Load Forecast**	32,857	32,629	32,451	32,339	32,284
2015 Comprehensive Review – Baseline Load Forecast**	35,454	35,656	-	-	-
Delta	-2,597	-3,027	N/A	N/A	N/A

*Projected resources includes NYCA Capacity, net purchases and sales as per the 2018 Gold Book and the SCR. NYCA Capacity values are resources electrically internal to NYCA, additions, re-ratings, and retirements (including proposed retirements and mothballs). Capacity values reflect the lesser of Capacity Resource Interconnection Service (CRIS) and Dependable Maximum Net Capability (DMNC) values.

**NYCA load values represent baseline coincident summer peak demand.

2. Resource Adequacy Criterion

The NYISO adheres to the NPCC resource adequacy criterion[7], which reads:

"R4. Each Planning Coordinator or Resource Planner shall probabilistically evaluate resource adequacy of its Planning Coordinator Area portion of the bulk power system to demonstrate that the loss of load expectation (LOLE) of disconnecting firm load due to resource deficiencies is, on average, no more than 0.1 days per year.

> *R4.1 Make due allowances for demand uncertainty, scheduled outages and deratings, forced outages and deratings, assistance over interconnections with neighboring Planning Coordinator Areas, transmission transfer capabilities, and capacity and/or load relief from available operating procedures."*

The NYISO also adheres to the New York State Reliability Council (NYSRC) resource adequacy criterion[8] (A.1-R1), which reads:

"A.1: Establishing NYCA Installed Reserve Margin Requirements

R1. The NYSRC shall annually perform and document an analysis to calculate the NYCA Installed Reserve Margin (IRM) requirement for the following Capability Year. The IRM analysis shall:

> *R1.1 Probabilistically establish the IRM requirement for the NYCA 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 days per year. This evaluation shall make due allowances for demand uncertainty, scheduled outages and deratings, forced outages and deratings, assistance over interconnections with neighboring control areas, emergency NYS Transmission System transfer capability, and capacity and/or load relief from available operating procedures."*

The NYSRC LOLE criterion is consistent with the NPCC LOLE criterion.

In addition, NYSRC imposes Installed Capacity Requirements on NYCA Load Serving Entities (LSE) (A.2-R2), as follows:

"A.2: Establishing Load Serving Entity Installed Capacity Requirements

> *R1. The NYISO shall annually establish Load Serving Entity (LSE) installed capacity (ICAP) requirements, including Locational Capacity Requirements (LCRs), in accordance with NYSRC rules and NYISO tariffs..."*

[7] NPCC Directory #1: https://www.npcc.org/Standards/Directories/Directory_1_TFCP_rev_20151001_GJD.pdf

[8] NYSRC Reliability Rules: http://www.nysrc.org/pdf/Reliability%20Rules%20Manuals/RRC%20Manual%20V43%20Final[4070].pdf

2.1. Application of the Criteria

The NYISO evaluates the Reliability Criteria (as promulgated by NERC, NPCC, and NYSRC) of the New York State Bulk Power Transmission Facilities in its Reliability Planning Process (RPP), pursuant to Attachment Y of the NYISO OATT. The Reliability Needs Assessment is the first step of the NYISO Reliability Planning Process. As a product of this step, the NYISO documents the Reliability Needs in the Reliability Needs Assessment report, which ultimately is presented to the NYISO Board of Directors for approval. The Comprehensive Reliability Plan (CRP) follows the RNA for a complete 2-year RPP cycle. The CRP provides documentation of the solutions determined to be viable and sufficient to meet the identified Reliability Needs and, if appropriate, ranks any regulated transmission solutions submitted for the Board to consider for selection of the more efficient or cost effective transmission project. If built, the selected transmission project is eligible for cost allocation and recovery under the NYISO's tariff.

In the event that there is a potential loss of resources due to a proposed generator retirement or mothballing, the NYISO will administer its Generator Deactivation Process for Generator Deactivation Notices that it receives. If necessary, the NYISO will seek solutions to address any Generator Deactivation Reliability Needs identified through that process. In addition, the NYISO may request gap solutions outside of its normal planning cycle if there appears to be an imminent threat to the reliability of the Bulk Power Transmission System arising from causes other than deactivating generation.

The NYSRC, with support from the NYISO, annually performs and documents an analysis to calculate the NYCA Installed Reserve Margin (IRM) requirement for the following Capability Year (the IRM Study). The IRM analysis probabilistically establishes the IRM requirement for the NYCA to meet the A.1-R1 NYSRC requirement. Additionally, the NYISO annually performs evaluations to establish the Load Serving Entities capacity requirements, including Locational Capacity Requirements, for each capability year.

The NYISO conducts its resource adequacy analysis using the GE MARS software package, which performs a probabilistic simulation of outages of capacity and select transmission resources. The NYISO models the transmission system in MARS using interface transfer limits applied to the connections between the MARS areas.

The NYISO developed the system representations for PJM, Ontario, New England, and Hydro Quebec modeled in the 2018 RNA Base Case from the NPCC CP-8 2017 Summer Assessment. To avoid overdependence on emergency assistance from the external areas, the emergency operating procedure data is removed from the model for each external area. In addition, the capacity of the external areas was further modified such that the LOLE value of each external area was set at a minimum value of 0.10 and capped at a value of 0.15 through year 10. Also, an overall NYCA emergency assistance limit is employed.

Deviations from the forecasted loads are captured by the use of a load forecast uncertainty (LFU) model.

The internal transfer limits modeled are the summer emergency ratings derived from the RNA power flow cases. The NYISO developed external transfer limits from the NPCC CP-8 Summer Assessment MARS database with changes based upon the RNA Base Case assumptions.

Emergency operating procedures (EOP) are also modeled in both the RNA and the IRM studies; these are aimed at either reducing load, or increasing capacity.

2.2. Capacity Resources to Meet Criteria

The current approved Installed Reserve Margin[9] requirement for the May 1, 2018 through April 30, 2019 Capability Year is 18.2% of the forecasted NYCA summer peak load. This value is based upon an annual Installed Reserve Margin study report adopted by the NYSRC[10] completed in December, 2017. Should the reserve margin requirement remain constant over this NPCC Comprehensive Review study period, the NYCA would have a minimum excess capacity of 2,891 MW under base load forecast to meet the current Installed Reserve Margin requirement. **Figure 5** and **Figure 8** show the resources necessary to meet the current capability year reserve margin requirement of 18.2% of the baseline load forecast, if it were to be extended to cover the five-year study period for this Comprehensive Review.

2.3. NPCC vs NYSRC LOLE Criterion

The New York State Reliability Council LOLE criterion is the same as the NPCC LOLE criterion.

[9] Capitalized terms are defined in the NYISO's Tariffs, Agreements and Procedures.

[10] http://www.nysrc.org/NYSRC_NYCA_ICR_Reports.asp

3. Resource Adequacy Assessment

3.1. Baseline Load Forecast Results

Assessment results for the baseline load forecast are summarized in **Figure 5**, and are based on NYISO's 2018 RNA study assumptions (study projected to be approved in Q4 2018). The results indicate that no LOLE violations arise during the 5-year study period of this Comprehensive Review. **Figure 5** also summarizes the amount of excess capacity resources during the study period, should the current capability year IRM requirement of 18.2% be constant over the 5-year study period.

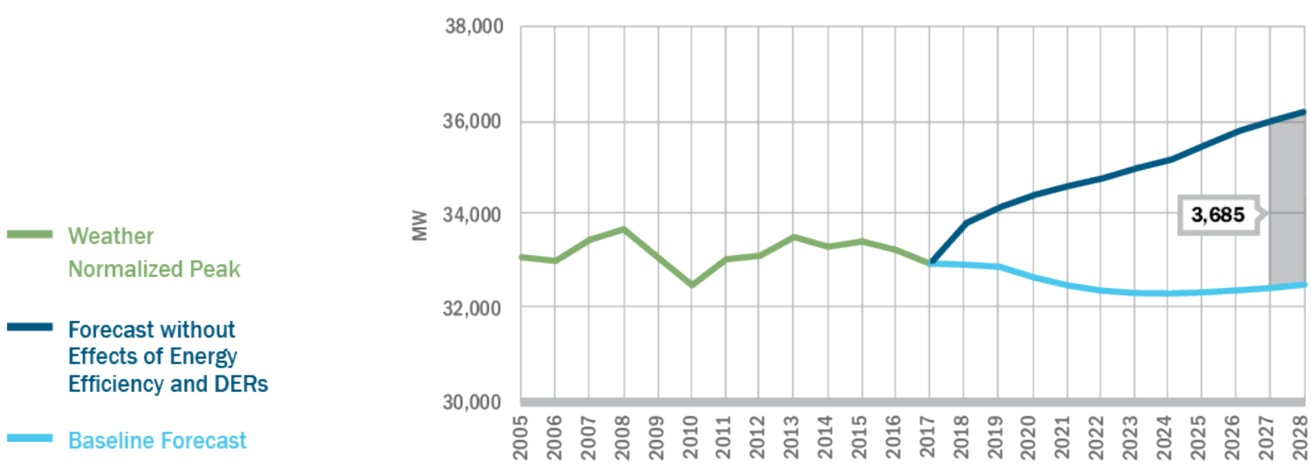
Figure 5: Baseline Load Forecast Results

Baseline Load and Resources Totals and LOLE Results					
Year	2019	2020	2021	2022	2023
Baseline Load Forecast *(MW)*	32,857	32,629	32,451	32,339	32,284
Projected Resources *(MW)*	41,728	42,362	41,358	41,500	41,500
ProjectedResources/ BaselineLoad*	127.0%	129.8%	127.4%	128.3%	128.5%
LOLE Results *(days/year)*	0.01	0.00	0.01	0.01	0.01

* 2018-2019 Installed Capacity Requirement: 118.2%*Load

Figure 6 below shows the peak demand trends since 2005 and also the magnitude of the impacts (reductions) from the energy efficiency, codes and standards, and BtM solar PV.

Figure 6: Electric Peak Demand Trends in New York State – Actual & Forecast: 2005-2028



3.2. High Load (Topline) Forecast Scenario Results

The baseline peak load forecast includes impacts (reductions) associated with projected energy reductions coming from statewide energy efficiency and BtM solar PV programs. The topline forecast scenario excludes these energy efficiency program impacts from the peak forecast, resulting in the higher forecast levels. This results in a 2,600 MW higher peak load in 2023, as comparing with the baseline forecast, as shown in **Figure 7.**

Year	Topline Load	Baseline Load	Delta
			Topline - RNA Base Case
2019	34,099	32,857	1,242
2020	34,367	32,629	1,738
2021	34,554	32,451	2,103
2022	34,727	32,339	2,388
2023	34,946	32,284	2,662

Figure 8 contains the LOLE results for this scenario.

Figure 7: High Load (Topline) vs. Baseline Summer Peak Forecast

Year	Topline Load	Baseline Load	Delta
			Topline - RNA Base Case
2019	34,099	32,857	1,242
2020	34,367	32,629	1,738
2021	34,554	32,451	2,103
2022	34,727	32,339	2,388
2023	34,946	32,284	2,662

Figure 8: High Load (Topline) Forecast Scenario Results

Topline Load Scenario LOLE Results					
Year	2019	2020	2021	2022	2023
LOLE Results *(days/year)*	0.03	0.02	0.06	0.07	0.09

3.3. Impact of Load and Resource Uncertainties

Some uncertainty exists relative to forecasting NYCA loads for any given year. This uncertainty is incorporated in the base case model by using a load forecast probability distribution that is sensitive to different weather and economic conditions.

Also, a number of recent state policies and initiatives and Department of Environmental Conservation rulemakings are underway that have the potential to significantly change the resource mix in the New York Control Area. These include the Clean Energy Standard, the Offshore Wind Master Plan, the Large-Scale

Renewable Program and Zero Emission Credits program for the James A. FitzPatrick, R.E Ginna and Nine Mile Point nuclear power plants. The NYISO will continue to monitor these and other developments to determine whether changing system resources and conditions could impact the reliability of the Bulk Power Transmission Facilities.

Only existing resources and those that have met certain inclusion rules in the NYISO's procedures are modeled. Existing resources are those listed in the 2018 Load and Capacity Data Report[11]. **Figure 9** lists generating units that met criteria for inclusion in the 2018 NYISO's planning assessments, while **Figure 10** lists the existing generator plants assumed out of service.

[11] NYISO's 2018 Gold Book: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and Reference_Docs/Data_and_Reference_Docs/2018-Load-Capacity-Data-Report-Gold-Book.pdf

Figure 9: Additions Assumed in the NYISO's 2018 RNA and this NPCC Comprehensive Review

Queue #	Project Name	Zone	CRIS Request	SP MW	Interconnection Status	Included in RNA Base Case From Beginning of
Proposed Transmission Additions, other than Local Transmission Owner Plans (LTPs)						
530	Western NY PPTPP Empire State Line	Regulated Transmission Solutions	n/a/	n/a	TIP Facility Study	Study Year 4
SDU	Leeds-Hurley SDU	System Deliverability Upgrades (SDU)	n/a	n/a	SDU triggered for construction in CY11	Study Year 2
Proposed Generation Additions						
251	CPV Valley Energy Center[1]	G	680.0	677.6	CY11	Study Year 1
349	Taylor Biomass	G	19.0	19.0	CY11	Study Year 3
395	Copenhagen Wind	E	79.9	79.9	CY15	Study Year 1
403	Bethlehem Energy Center Uprate	F	78.1	72.0	CY15	Study Year 1
387	Cassadaga Wind	A	126.0	126.0	CY17	Study Year 2
421	Arkwright Summit	A	78.4	78.0	CY17	Study Year 1
444	Cricket Valley Energy Center II	G	1020.0	1020.0	CY17	Study Year 2
461	East River 1 Uprate	J	n/a	2.0	CY17	Study Year 1
462	East River 2 Uprate	J	n/a	2.0	CY17	Study Year 1
467	Shoreham Solar	K	24.9	25.0	CY17	Study Year 1
510	Bayonne Energy Center II	J	120.4	120.4	CY17	Study Year 1
511	Ogdensburg	E	79.0	79.0	CY17	Study Year 1
N/A	Nine Mile Point 2	C	63.4	63.4	CY17 (CRIS only)	Study Year 1
N/A	East River 6	J	8.0	N/A	CY17 (CRIS only)	Study Year 1
		Total MW gen. additions	2,377	2,364		

Notes:

1. On August 1, 2018, the New York State Department of Environmental Conservation (DEC) denied the January 2018 application of Competitive Power Ventures Valley Energy Center (CPV Valley) to renew its Air State Facility (ASF) permit for the reasons set forth in the DEC's letter. Subsequently, Supreme Court, Albany County, issued a Temporary Restraining Order regarding the DEC's determination. The NYISO will continue to monitor the status of the CPV Valley facility.

Figure 10: Generation Deactivations Assumed in the NYISO's 2018 RNA and this NPCC Comprehensive Review

Owner/Operator	Plant Name	Zone	CRIS	2018 RNA Base Case
Helix Ravenswood LLC	Ravenswood 04	J	15.2	out
	Ravenswood 05	J	15.7	out
	Ravenswood 06	J	16.7	out
International Paper Company	Ticonderoga	F	7.6	part of the SCR program
Niagara Generation LLC	Niagara Bio-Gen	A	50.5	out
NRG Power Marketing LLC	Dunkirk 2	A	97.2	out
	Huntley 67	A	196.5	out
	Huntley 68	A	198.0	out
	Astoria GT 05	J	16.0	out
	Astoria GT 07	J	15.5	out
	Astoria GT 08	J	15.3	out
	Astoria GT 10	J	24.9	out
	Astoria GT 11	J	23.6	out
	Astoria GT 12	J	22.7	out
	Astoria GT 13	J	24.0	out
ReEnergy Black River LLC	Chateaugay Power	D	18.6	out
Binghamton BOP, LLC	Binghamton	C	43.8	out
Helix Ravenswood, LLC	Ravenswood 09	J	21.7	out
Entergy Nuclear Power Marketing, LLC	Indian Point 2	H	1027.0	out
	Indian Point 3	H	1040.0	out
Selkirk Cogen Partners, LP	Selkirk 1	F	82.1	out
	Selkirk 2	F	291.3	out
J- Power USA Generation, LP Edgewood Energy, LLC	PPL Pilgrim ST GT1	K	45.6	out
	PPL Pilgrim ST GT2	K	46.2	
Helix Ravenswood, LLC	Ravenswood 2-1	J	40.4	out
	Ravenswood 2-2	J	37.6	
	Ravenswood 2-3	J	39.2	
	Ravenswood 2-4	J	39.8	
	Ravenswood 3-1	J	40.5	
	Ravenswood 3-2	J	38.1	
	Ravenswood 3-4	J	35.8	
Lyonsdale Biomass, LLC	Lyonsdale (Burrows)	E	20.2	out
	Total 2018 RNA MW assumed as deactivated		3,647	

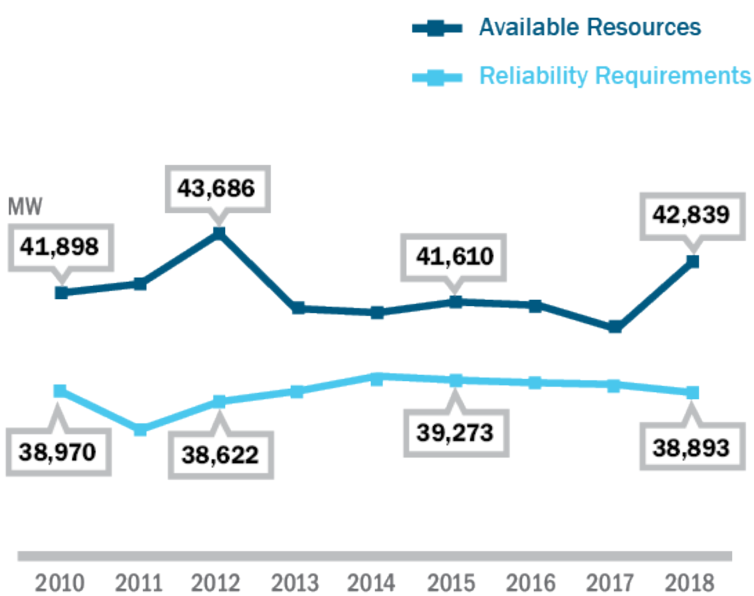
3.4. Summary of Past Resource Adequacy Studies

The 2016-2017 Reliability Planning Process cycle was completed in 2017 and identified no Reliability Needs under the study assumptions at the time.

The IRM for the current capability year (i.e., May 1st, 2018 through April 30th, 2019) is 18.2% of the NYCA baseline forecasted peak load and has varied historically from 15% to 18%. All values in the IRM calculation are based upon full installed capacity values of resources.

Figure 11 shows the MW requirement vs resources available through time, based on the available resources assumptions calculations from the NYISO's Gold Book.

Figure 11: Available Resources & Reliability Requirements[12]: 2010-2018



[12] Source: NYISO's 2018 Power Trends: https://home.nyiso.com/wp-content/uploads/2018/05/2018-Power-Trends_050318.pdf?utm_source=Homepage&utm_medium=Website&utm_campaign=PT18_Report&utm_term=2018-Power-Trends

4. Resource Capacity Mix

From a statewide perspective, New York has a relatively diverse mix of generation resources. However, New York's grid is characterized by regional differences whereby the downstate supply mix is less diverse than the upstate supply mix.

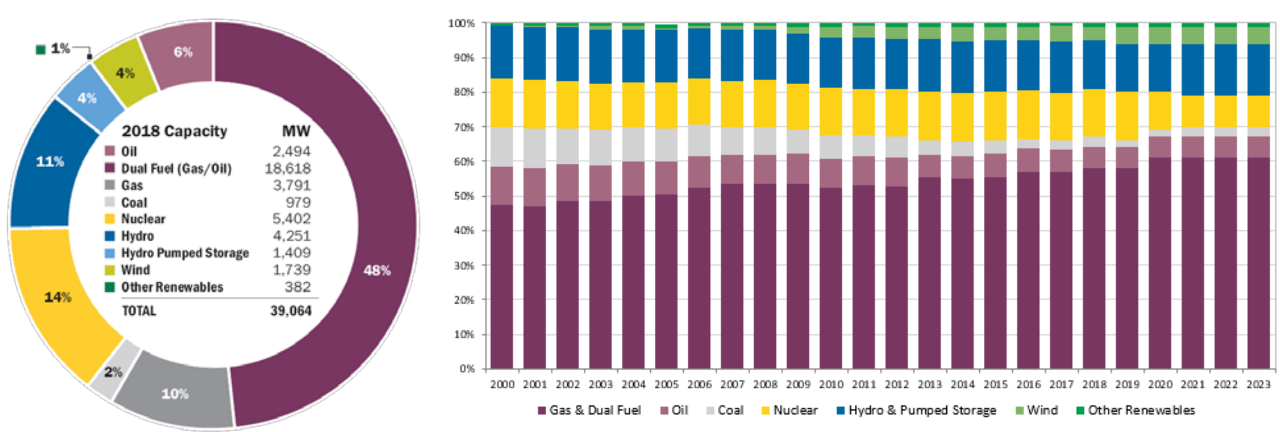
The combination of fuels used to produce power in New York has changed since 2000. New York's capability to produce power from natural gas and wind has grown, reflecting economic trends in natural gas costs and production as well as public policies supporting development of cleaner energy resources. During this time, the generating capacity from coal- and oil-fired plants has declined.

The portion of New York's generating capability from natural gas and dual-fuel facilities grew from 47% in 2000 to 58% in 2018. Wind power – virtually non-existent in 2000 – grew to 4.5% of New York State's generating capability in 2018.

In contrast, New York's generating capability from power plants using coal declined from 11% in 2000 to 2.5% in 2018. Generating capability from power plants fueled solely by oil dropped from 11% in 2000 to 6% in 2018. The shares of generating capability from nuclear power plants and hydroelectric facilities have remained relatively constant since 2000. Nuclear accounted for 14% of New York's generating capability in 2000-2018. Hydropower (including pumped storage) represented 15% of the state's generating capability in 2000 and 14% in 2018.

Figure 12 shows New York Statewide Generating Capacity by Fuel Source (2018), along with the fuel mix trends since 2000.

Figure 12: 2018 NYCA Summer Installed Capacity by Fuel Source (left), and Fuel Mix Trends since 2000 (right)



5. Regulatory Policy Activities

Federal, state and local government regulatory programs may impact the operation and reliability of the BPTF. Compliance with state and federal regulatory initiatives may require investment by the owners of New York's existing thermal power plants. If the owners of those plants have to make considerable investments, the cost of these investments could impact whether they remain available in the NYISO's markets and therefore potentially affect the reliability of the BPTF. The purpose of this section is to review the status of regulatory programs and their potential grid impacts. The following regulatory programs – each at various points in the development and implementation – are summarized in **Figure 13** on the next page:

Figure 13: Highlights of Regulatory Programs

PUBLIC POLICY INITIATIVE	POLICY GOAL	POLICYMAKING ENTITY	NY GRID RESOURCE IMPACTS
Clean Energy Standard (CES)	50% of energy consumed in New York State generated from renewable resources by **2030**.	New York State Public Service Commission (PSC) / New York State Energy Research and Development Authority (NYSERDA)	About **17,000 MW** of new, largely intermittent capacity to enter grid and markets.
New York City Residual Oil Elimination	Eliminate combustion of fuel oil numbers 6 and 4 in New York City by **2020 and 2025**, respectively.	New York City	About **3,000 MW** of installed capacity could be affected.
Offshore Wind Development	Develop 2,400 MW of offshore wind capacity by **2030.**	New York State Public Service Commission (PSC) / New York State Energy Research and Development Authority (NYSERDA)	As much as **2,400 MW** of new intermittent capacity interconnecting to the grid in southeastern New York by 2030.
Part 251: Carbon Dioxide Emissions Limits	Establish restrictions on carbon dioxide emissions for fossil fuel-fired facilities in New York by **2020**.	New York State Department of Environmental Conservation (DEC)	**1,000 MW** of coal-fired capacity expected to deactivate or re-power.
Regional Greenhouse Gas Initiative (RGGI)	Reduce carbon dioxide emissions cap by 30% from **2020 to 2030** and expand applicability to currently exempt "peaking units" below current 25 MW threshold.	New York and other RGGI states	**26,100 MW** of installed capacity participate in RGGI.
Smog-Forming Pollutants Rule Proposal	Reduce ozone-contributing pollutants associated with New York State-based peaking unit generation.	New York State Department of Environmental Conservation (DEC)	DEC proposal is under development. There is nearly **3,500 MW** of peaking unit capacity in New York State.
Storage Deployment Target	Reduce costs and install storage capacity by **2025.**	New York State Public Service Commission (PSC) / New York State Energy Research and Development Authority (NYSERDA) / New York Power Authority (NYPA)	Installation of **1,500 MW** of battery storage capacity.
U.S. Clean Water Act	Adoption of "Best Technology Available for Cooling Water Intake" to protect aquatic biota.	U.S. Environmental Protection Agency / New York State Department of Environmental Conservation (DEC)	**16,900 MW** of installed capacity must achieve compliance upon licensing renewal.

6. Mechanism to Mitigate Risk

A number of recent state policies and initiatives, along with various Department of Environmental Conservation rulemakings are underway that have the potential to significantly change the resource mix in the New York Control Area. These include the Clean Energy Standard, the Offshore Wind Master Plan, the Large-Scale Renewable Program and Zero Emission Credits program for the James A. FitzPatrick, R.E Ginna and Nine Mile Point nuclear power plants. The NYISO will continue to monitor these and other developments to determine whether changing system resources and conditions could impact the reliability of the Bulk Power Transmission Facilities. The NYISO is also working to align new technologies with its markets to maximize their participation and contribution to reliability.

At this time, DER may participate in certain NYISO Energy, Ancillary Services, and Capacity Markets. The NYISO is working towards a three to five-year plan to better integrate distributed energy resources (DER), including demand response resources, into its energy and ancillary services markets. In February 2017, the NYISO published a report[13] providing a roadmap that the NYISO will use over the next three to five years as a framework to develop the market design elements, functional requirements, and tariff language necessary to implement the NYISO's vision to integrate DER. Currently, the NYISO is developing the market design for DER participation. In December 2017, NYISO published a market design concept proposal document[14] outlining the market design concepts for this initiative.

Behind-the-meter (BtM) solar PV is currently managed operationally in the day-ahead and real-time load forecasts. A solar forecasting system to integrate with the day-ahead and real-time markets was implemented in 2017. Two data streams are being produced, zonal data for behind-the-meter solar PV installations and bus-level data for utility-scale solar PV installations.

As part of its ongoing Reliability Planning Process, the NYISO monitors and tracks the progress of market-based projects and regulated backstop solutions, together with other resource additions and retirements, consistent with its obligation to protect confidential information under its Code of Conduct. The tracked resources include: 1. units interconnecting through the NYISO's interconnection processes; 2. the development and installation of local transmission facilities; 3. additions, mothballs or retirements of generators; 4. the status of mothballed/retired facilities; 5. the continued implementation of New York State energy efficiency programs, solar PV installations, additions due to the Clean Energy Standard, and

[13] http://www.nyiso.com/public/webdocs/markets_operations/market_data/demand_response/DER_Roadmap/DER_Roadmap/Distributed_Energy_Resources_Roadmap.pdf

[14] http://www.nyiso.com/public/webdocs/markets_operations/committees/bic_miwg/meeting_materials/2017-12-19/Distributed%20Energy%20Resources%202017%20Market%20Design%20Concept%20Proposal.pdf

similar programs; 6. participation in the NYISO demand response programs; and 7. the impact of new and proposed environmental regulations on the existing generation fleet.

Substantial uncertainties exist in the next ten years that will impact the system resources. These uncertainties include, but are not limited to:

a) The 2018 RNA preliminary Base Case includes over 2,300 MW of proposed generation additions in various planning stages (including the 1,020 MW Cricket Valley, the 680 MW CPV Valley, and the 120 MW Bayonne Energy Center II facilities). The preliminary 2018 RNA base case assumptions reflect the retirement of over 3,600 MW, including the Indian Point plant, along with transmission projects and transmission owner LTPs that have met the RPP inclusion rules. If expected capacity resources do not materialize, the NYCA resource adequacy margin (as measured by comparison with the Loss of Load Expectation criterion of 0.1 days per year) will decrease.

b) If additional generating units become unavailable or deactivate beyond those units already contemplated in the 2018 RNA, the reliability of the New York system could be adversely affected. The NYISO recognizes that there are numerous risk factors related to the continued financial viability and operation of generating units. Depending on the units affected, the NYISO may need to take actions through its Generation Deactivation Process to maintain reliability.

c) The New York State Public Service Commission (NYSPSC) has confirmed the existence of the following two Public Policy Transmission Needs: Western New York, and AC Transmission consisting of Segment A (Central East), and AC Transmission Segment B (UPNY-SENY). The Western NY Public Policy project proposed by NextEra has been selected by the NYISO and is included in the 2018 RNA Base Case assumptions. Also, the NYISO is currently evaluating the transmission proposals for the AC Transmission PPTPP in order to select the more efficient or cost-effective solutions to these needs. The construction of additional transmission capacity in these areas would address existing transmission constraints and generally increase the reliability of the system. On August 1, 2018, the NYISO initiated the 2018-2019 Public Policy Transmission Planning Process (PPTPP) cycle by issuing a solicitation for proposed transmission needs driven by Public Policy Requirements. Comments on proposed public policy transmission needs deadline was September 30th, after which the NYISO files them with the New York PSC, and the PSC issues a notice seeking public comment on the proposed needs.

d) Capacity resources could decide to offer into markets in other regions and, therefore, some of the capability of those resources may not be available to the New York system. Accordingly, the NYISO will continue to monitor capacity imports, exports, generation additions and deactivations, and other resources and transmission infrastructure.

e) Completion of Transmission Owner Local Transmission Owner Plans included in the base case.

f) Changes to System Performance

Certain generators are aging, which may lead to more frequent and longer outages as well as increasing costs for those generators. Other generation, including nuclear units, have indicated their intent to retire. This trend may drive the potential need for new resources depending on future load forecasts.

g) Changes to System Load Level

A higher-than-forecasted load level could expose the system to potential reliability issues. A high load scenario performed under the 2018 RNA process showed potential LOLE violations starting 2025 (under a simulation modeling 3,000 MW higher load forecast, as compared with the baseline load). Note: the scenarios in RNA are for information purposes only.

h) Natural Gas Coordination

New York's reliance on natural gas as the primary fuel for electric generation justifies continued vigilance regarding the status of the natural gas system. The NYISO is actively involved in natural gas/electric coordination efforts with New York State and federal regulators, pipeline owners, generator owners, local distribution companies, and neighboring ISOs and Regional Transmission Operators ("RTOs"). FERC recently approved FERC Order No. 809, which addresses gas nomination changes and Day-Ahead Electric schedule deadlines. FERC has also approved Order No. 787, which allows RTOs to communicate non-public information to pipelines and gas local distribution companies (LDCs) in order to maintain system reliability.

In addition to the above-referenced FERC orders, the NYISO's efforts with respect to gas supply assurance focus on: (i) improving communication and coordination between the gas and electric sectors; (ii) annual, weekly and, when conditions warrant, *ad hoc* generator surveys of gas system and gas market participants to enhance awareness in the control room and provide electric system reliability benefits; and (iii) addressing the electric system reliability impact of the sudden catastrophic loss of gas.

i) Federal and State Environmental Regulations

Figure 13 contains highlights of the regulatory programs impacting the power grid.

Appendices

Appendix A: Resource Adequacy Model Assumptions

#	Parameter	2018 RNA Study Period: 2019 (y1) - 2028 (y10)
Load Parameters		
1	Peak Load Forecast	Adjusted 2018 Gold Book NYCA baseline peak load forecast. The GB 2018 baseline peak load forecast includes the impact (reduction) of behind-the-meter (BtM) solar at the time of NYCA peak. For the Resource Adequacy load model, the deducted BtM solar MW was added back to the NYCA zonal loads, which then allows for a discrete modeling of the BtM solar resources.
2	Load Shape (Multiple Load Shape)	Used Multiple Load Shape MARS Feature 8760 h historical load shapes were used as base shapes for LFU bins: Bin 1: 2006 Bin 2: 2002 Bins 3-7: 2007 Peak adjustments are being performed on a seasonal basis.
3	Load Forecast Uncertainty (LFU)	Used updated summer LFU values for the 11 NYCA zones.
Generation Parameters		
4	Existing Generating Unit Capacities	2018 Gold Book values. Use summer min (DMNC vs. CRIS). Use winter min (DMNC vs CRIS). Adjusted for RNA inclusion rules.
5	Proposed New Units (Non- Renewable)	GB2018 with Inclusion Rules Applied
6	Retirements, Mothballed units, IIFO	GB2018 with Inclusion Rules Applied
7	Forced and Partial Outage Rates *	Five-year (2013-2017) GADS data for each unit represented. Those units with less than five years – use representative data. Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period
8	Planned Outages	Based on schedules received by the NYISO and adjusted for history
9	Summer Maintenance	Nominal MW
10	Combustion Turbine Derates	Derate based on temperature correction curves

#	Parameter	2018 RNA Study Period: 2019 (y1) - 2028 (y10)
11	Landfill gas plants	New method: Actual hourly plant output over the period 2013-2017. Program randomly selects a LFG shape of hourly production over the 2013-2017 for each model replication.
12	Existing Wind Units (>5 years of data)	Actual hourly plant output over the period 2013-2017. Probabilistic model is incorporated based on five years of input shapes with one shape per replication being randomly selected in Monte Carlo process.
13	Existing Wind Units (<5 years of data)	For existing data, the actual hourly plant output over the period 2013-2017 is used. For missing data, the nameplate normalized average of units in the same load zone is scaled by the unit's nameplate.
14	Proposed Wind Units	Inclusion Rules Applied to determine the generating unit status. The nameplate normalized average of units in the same load zone is scaled by the unit's nameplate.
15	Utility-scale Solar Resources	The 31.5 MW Upton metered solar capacity: probabilistic model chooses from 5 years of production data output shapes covering the period 2013-2017. One shape per replication is randomly selected in Monte Carlo process.
16	BtM Solar Resources	The large projection of increasing retail (BtM) solar installations over the 10-year period required a discrete model with some level of detailed hourly performance. New method: 8760 hourly shapes are created by using NREL's PV Watt tool *(NREL's PVWatts Calculator, credit of the U.S. Department of Energy (DOE)/NREL/Alliance (Alliance for Sustainable Energy, LLC)*. The shapes are applied during the load adjustment to account for the impact of the BtM generation on both on peak and off peak hours. MARS will randomly select a daily shape from the current month for each day of each month of each replication.
17	BTM-NG Program	New category: These are former load modifiers to sell capacity into the ICAP market. Model as cogen type 2 unit in MARS. Unit capacity set to CRIS value, load modeled with weekly pattern that can change monthly.

#	Parameter	2018 RNA Study Period: 2019 (y1) - 2028 (y10)
18	Small Hydro Resources	New method: Actual hourly plant output over the period 2013-2017. Program randomly selects a Hydro shape of hourly production over the 2013-2017 for each model replication.
19	Large Hydro	Probabilistic Model based on 5- years of GADS data. Transition Rates representing the Equivalent Forced Outage Rates (EFORd) during demand periods over the most recent five-year period (2013-2017). Methodology consistent with thermal unit transition rates.
20	Capacity Purchases	Grandfathered Rights and other awarded long-term rights Modeled using MARS explicit contracts feature.
Transaction - Imports / Exports		
21	Capacity Sales	These are long-term contracts filed with FERC. Modeled using MARS explicit contracts feature. Contracts sold from ROS (Zones: A-F). ROS ties to external pool are derated by sales MW amount
22	FCM Sales	Model sales for known years Modeled using MARS explicit contracts feature. Contracts sold from ROS (Zones: A-F). ROS ties to external pool are derated by sales MW amount
23	UDRs	Updated with most recent elections/awards information (VFT, HTP, Neptune, CSC)
Topology		
24	Interface Limits	Developed by review of previous studies and specific analysis during the RNA study process
25	New Transmission	Based on TO- provided firm plans (via Gold Book 2018 process) and proposed merchant transmission; inclusion rules applied
26	AC Cable Forced Outage Rates	All existing cable transition rates updated with info received from ConEd and PSEG-LIPA to reflect most recent five-year history
27	UDR unavailability	Five-year history of forced outages

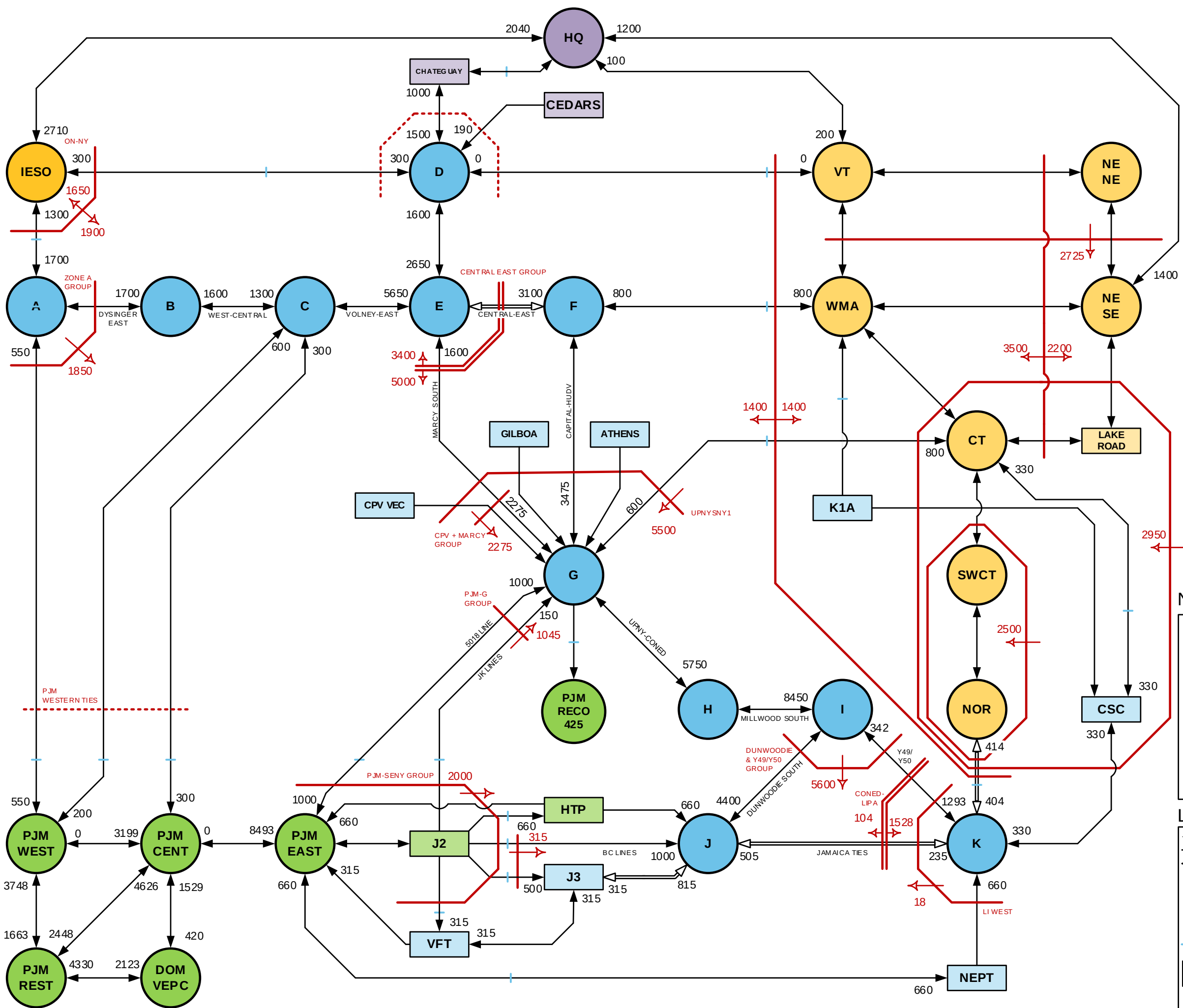
#	Parameter	2018 RNA Study Period: 2019 (y1) - 2028 (y10)
Emergency Operating Procedures		
28	Special Case Resources	SCRs sold for the program discounted to historic availability ('effective capacity'). Final Base Cases summer values will be calculated from the July 2016 registrations, held constant for all years of study
29	EDRP Resources	2018 Gold Book with effective capacity modeled Those sold for the program discounted to historic availability. Summer values will be calculated from July 2018 registrations and forecast growth. Values held constant for all years of study.
30	Other EOPs	Based on TO information, measured data, and NYISO forecasts
External Control Areas		
31	PJM	As per RNA Procedure External model (load, capacity, topology) provided by PJM/NPCC CP-8 WG. PJM is a 5-zone model. LOLE of pool adjusted to be between 0.10 and 0.15 days per year by adjusting capacity pro-rata in all areas.
32	ISONE	As per RNA Procedure External model (load, capacity, topology) provided by PJM/NPCC CP-8 WG. LOLE of pool adjusted to be between 0.10 and 0.15 days per year by adjusting capacity pro-rata in all areas.
33	HQ	As per RNA Procedure External model (load, capacity, topology) provided by PJM/NPCC CP-8 WG. LOLE of pool adjusted to be between 0.10 and 0.15 days per year by adjusting capacity pro-rata in all areas.
34	IESO	As per RNA Procedure External model (load, capacity, topology) provided by PJM/NPCC CP-8 WG. LOLE of pool adjusted to be between 0.10 and 0.15 days per year by adjusting capacity pro-rata in all areas.
35	Reserve Sharing	All NPCC Control Areas indicate that they will share reserves equally among all members before sharing with PJM.
36	NYCA Emergency Assistance Limit	Implemented a statewide limit of 3500 MW
Miscellaneous		
37	MARS Model Version	Version 3.22.6

*Weighted average EFORd value based on RNA Assumptions for Y2020

Unit Type	Five-Year Weighted EFORd
Coal	14.1%
Petroleum	16.6%
Gas	5.8%
Nuclear	3.1%
Hydro	1.0%
Pumped Storage	4.1%
Biomass	4.5%

Appendix B: MARS Model Topology

Figure 14: 2018 RNA Topology Year 1 (2019)



Notes

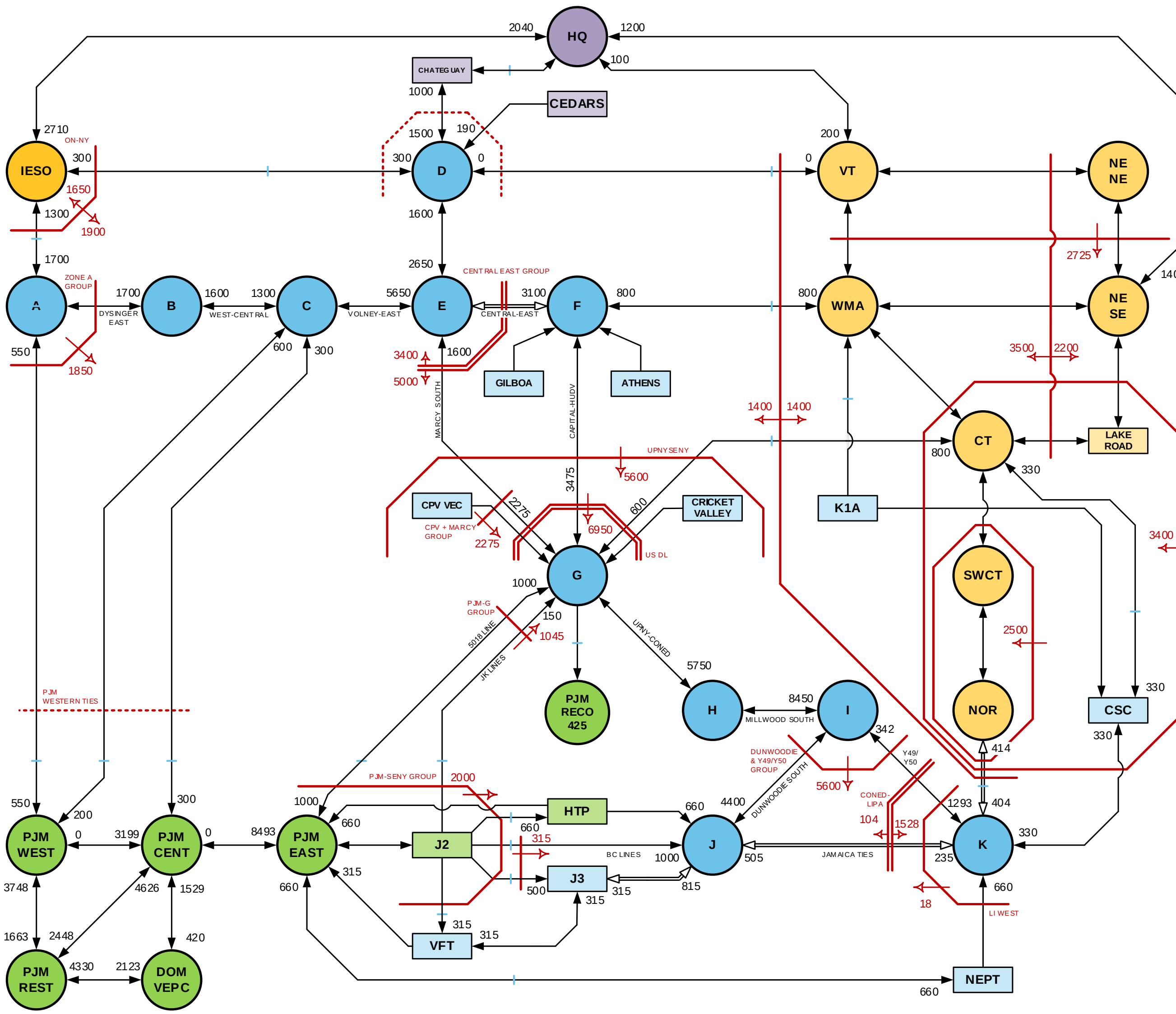
1. PJM to NY emergency assistance (EA) assumption for calculating the PJM-NY Western ties, PJM-G Group, and ABC Line Group flow distribution limit: 1500MW
2. NYCA EA simultaneous import limit: 3,500 MW
3. External areas representation based upon information received from the NPCC CP-8 WG

Legend

- Interface
- Unidirectional Interface
- Interface w/ Dynamic Ratings
- Interface Group
- Interface Group w/ Dynamic Ratings
- Monitoring Interface Group
- NYCA EA Interface Group Marker
- xx "Dummy Bubble"

NOTE: An interface is considered to not have a MW limitation if no number is specified

Figure 15: 2018 RNA Topology Year 2 (2020)



Notes

1. PJM to NY emergency assistance (EA) assumption for calculating the PJM-NY Western ties, PJM-G Group, and ABC Line Group flow distribution limit: 1500MW

2. NYCA EA simultaneous import limit: 3,500 MW

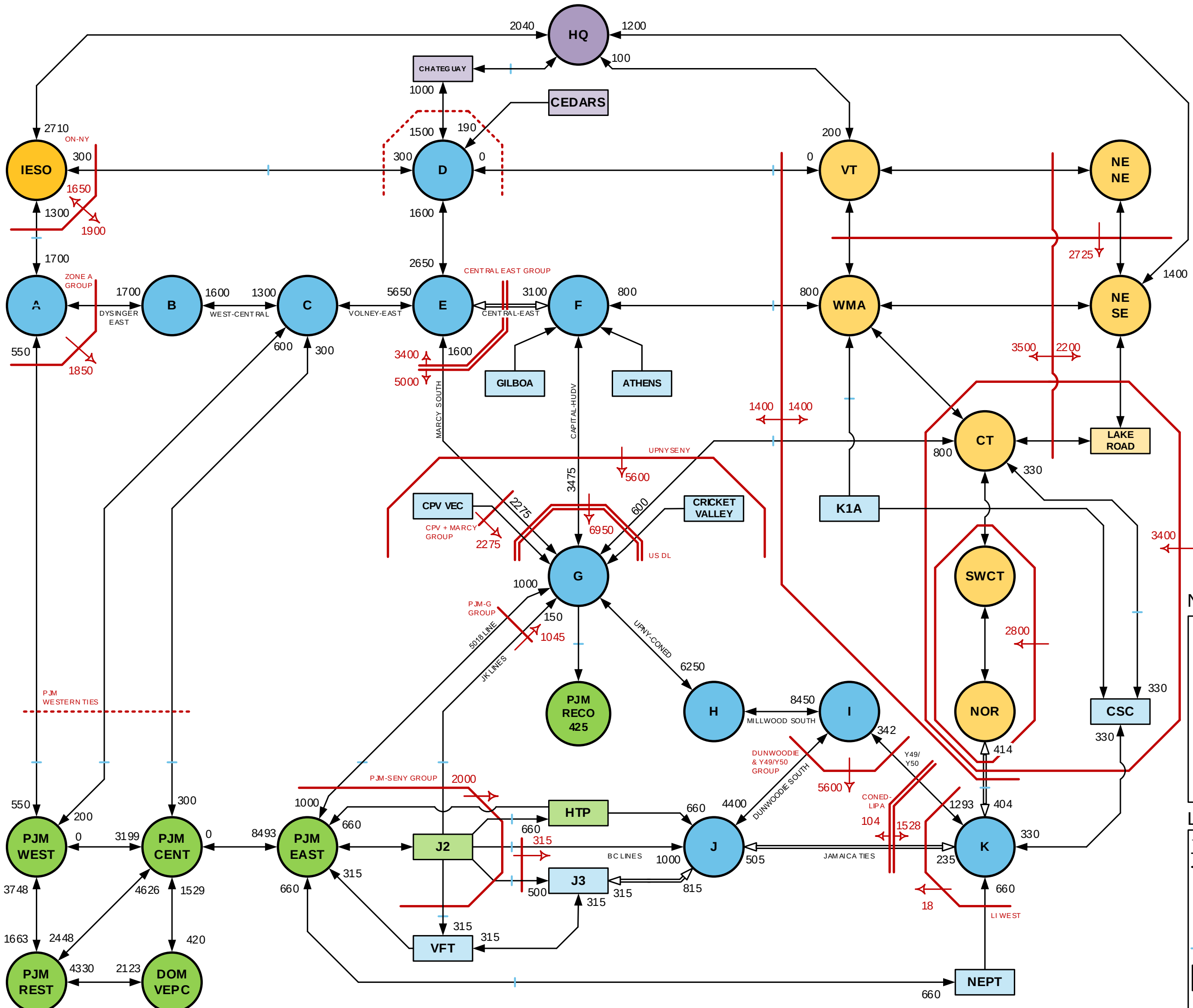
3. External areas representation based upon information received from the NPCC CP-8 WG

Legend

- Interface
- Unidirectional Interface
- Interface w/ Dynamic Ratings
- Interface Group
- Interface Group w/ Dynamic Ratings
- Monitoring Interface Group
- NYCA EA Interface Group Marker
- XX "Dummy Bubble"

NOTE: An interface is considered to not have a MW limitation if no number is specified

Figure 16: 2018 RNA Topology Year 3 (2021)



Notes

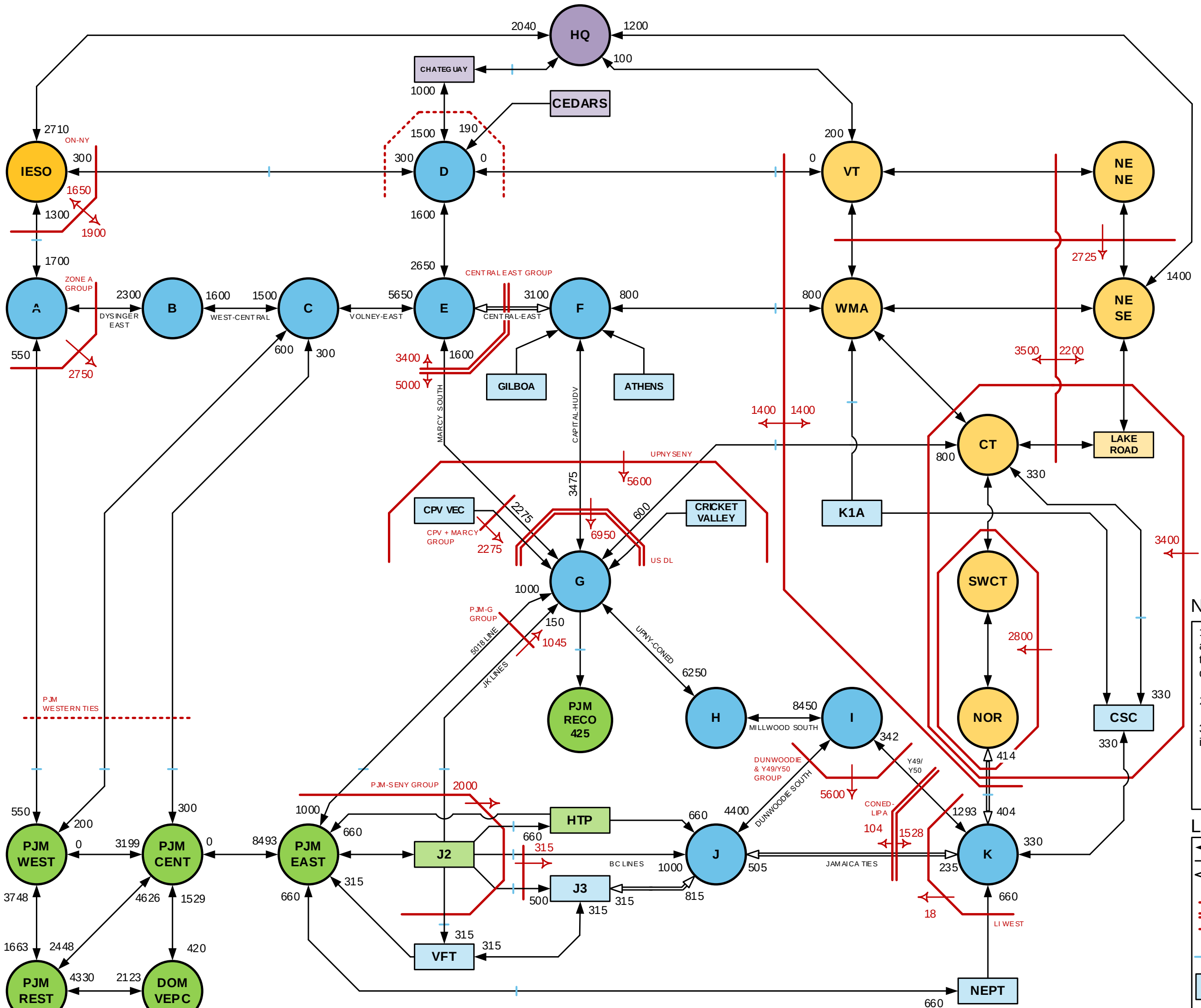
1. PJM to NY emergency assistance (EA) assumption for calculating the PJM-NY Western ties, PJM-G Group, and ABC Line Group flow distribution limit: 1500MW
2. NYCA EA simultaneous import limit: 3,500 MW
3. External areas representation based upon information received from the NPCC CP-8 WG

Legend

- Interface
- Unidirectional Interface
- Interface w/ Dynamic Ratings
- Interface Group
- Interface Group w/ Dynamic Ratings
- Monitoring Interface Group
- NYCA EA Interface Group Marker
- XX "Dummy Bubble"

NOTE: An interface is considered to not have a MW limitation if no number is specified

Figure 17: 2018 RNA Topology Year 4 through 10 (2022-28)



Notes

1. PJM to NY emergency assistance (EA) assumption for calculating the PJM-NY Western ties, PJM-G Group, and ABC Line Group flow distribution limit: 1500MW
2. NYCA EA simultaneous import limit: 3,500 MW
3. External areas representation based upon information received from the NPCC CP-8 WG

Legend

- Interface
- Unidirectional Interface
- Interface w/ Dynamic Ratings
- Interface Group
- Interface Group w/ Dynamic Ratings
- Monitoring Interface Group
- NYCA EA Interface Group Marker
- XX "Dummy Bubble"

NOTE: An interface is considered to not have a MW limitation if no number is specified