2020 RNA Appendices

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A Report by the

New York Independent

System Operator

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DRAFT 1

For September 10, 2020 ESPWG/TPAS

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# Appendix A - 2020 Reliability Needs Assessment Glossary

**Annual Transmission Reliability Assessment (ATRA):** An assessment, conducted by the NYISO staff in cooperation with Market Participants, to determine the System Upgrade Facilities required for each generation project and Class Year Transmission Project included in this Assessment to interconnect to the New York State Transmission System in compliance with Applicable Reliability Standards and the NYISO Minimum Interconnection Standard. *(Source: Attachment S of OATT)*

**Area Transmission Review (ATR):** The NYISO, in its role as Planning Coordinator, is responsible for providing an annual report to the NPCC Compliance Committee in regard to its Area Transmission Review in accordance with the NPCC Reliability Compliance and Enforcement Program and in conformance with the NPCC Design and Operation of the Bulk Power System. *(Source: NPCC Directory #1)*

**Baseline Forecast:** The baseline forecasts from the NYISO’s Gold Book report the expected NYCA load, and include the projected impacts of energy efficiency programs, building codes and standards, distributed energy resources, behind-the-meter energy storage, behind-the-meter solar photovoltaic power (“solar PV”), electric vehicle usage, and electrification of heating and other end uses. The baseline forecasts are used in the RNA Base Cases for determining Bulk Power Transmission Facilities Reliability Needs for the RNA Study Period *(Source: 2020 Gold Book).*

**Best Technology Available (BTA):** NYS DEC policy establishing performance goals for new and existing electricity generating plants for Cooling Water Intake Structures. The policy applies to plants with design intake capacity greater than 20 million gallons/day and prescribes reductions in fish mortality. The performance goals call for the use of wet, closed-cycle cooling systems at existing generating plants. *(Source: Section 316(b), Clean Water Act, United States Environmental Protection Agency)*

**New York State Bulk Power Transmission Facility (BPTF):** The facilities identified as the New York State Bulk Power Transmission Facilities in the annual Area Transmission Review submitted to NPCC by the ISO pursuant to NPCC requirements. *(Source: Attachment Y of OATT definitions)*

**CARIS:**  The Congestion Assessment and Resource Integration Study for economic planning developed by the ISO in consultation with the Market Participants and other interested parties pursuant to Section 31.3 of this Attachment Y. (*Source: NYISO OATT*.)

**Clean Energy Standard (CES):** State initiative for 70% of electricity consumed in New York State to be produced from renewable sources by 2030.

**Climate Leadership and Community Protection Act (CLCPA):** State statute enacted in 2019 to address and mitigate the effects of climate change. Among other requirements, the law mandates that; (i) 70% of energy consumed in New York State be sourced from renewable resources by 2030, (ii) greenhouse gas emissions must be reduced by 40% by 2030, (iii) the electric generation sector must be zero greenhouse gas emissions by 2040, and (iv) greenhouse gas emissions across all sectors of the economy must be reduced by 85% by 2050 (*Source: 2019 CARIS Phase I*)

**Contingencies:** An actual or potential unexpected failure or outage of a system component, such as a generator, transmission line, circuit breaker, switch, or other electrical element. A contingency also may include multiple components, which are related by situations leading to simultaneous component outages. *(Source: NYSRC Reliability Rules)*

**Dependable Maximum Net Capability (DMNC):** The sustained maximum net output of a Generator, as demonstrated by the performance of a test or through actual operation, averaged over a continuous time period as defined in the ISO Procedures. *(Source: OATT Definitions)*

**Electric System Planning Work Group (ESPWG):** The Electric System Planning Work Group, or any successor work group or committee designated to fulfill the functions assigned to the ESPWG in this tariff. *(Source: Attachment S of OATT)*

**Emergency Transfer Criteria**: It is intended that the NYS Bulk Power System be operated within Normal Transfer Criteria at all times insofar as possible. However, in the event that adequate facilities are not available to supply firm load within Normal Transfer Criteria, emergency transfer criteria may be invoked. Under emergency transfer criteria, transfers may be increased up to, but not exceed, emergency ratings and limits as follows:

a. Pre-contingency line and equipment loadings may be operated up to LTE ratings for up to four (4) hours, provided the STE ratings are set appropriately. Otherwise, pre-contingency line and equipment loadings must be within normal ratings. Pre-contingency voltages and transmission interface flows must be within applicable pre-contingency voltage and stability limits.

b. Post-contingency line and equipment loadings within STE ratings. Post-contingency voltages and transmission interface flows within applicable post-contingency voltage and stability limits. *(Source: NYSRC Reliability Rules)*

**Fault**: An electrical short circuit. *(Source: NYSRC Reliability Rules)*

**Federal Energy Regulatory Commission (FERC):** The federal energy regulatory agency within the U.S. Department of Energy that approves the NYISO’s tariffs and regulates its operation of the bulk electricity grid, wholesale power markets, and planning and interconnection processes.

**FERC Form 715:** Annual report that is required by transmitting utilities operating grid facilities that are rated at or above 100 kV. The report consists of transmission systems maps, a detailed description of transmission planning Reliability Criteria, detailed descriptions of transmission planning assessment practices, and detailed evaluation of anticipated system performance as measured against Reliability Criteria.

**Forced Outage:** An unscheduled inability of a Market Participant’s Generator to produce Energy that does not meet the notification criteria to be classified as a scheduled outage or de-rate as established in ISO Procedures. If the Forced Outage of a Generator starts on or after May 1, 2015, the Forced Outage will expire at the end of the month which contains the 180th day of its Forced Outage but may be extended if the Market Participant has Commenced Repair of its Generator. *(Source: Market Services Tariff-MST- Definitions)*

**Gold Book:** Annual NYISO publication of its Load and Capacity Data Report.

**Installed Capacity (“ICAP”):** External or Internal Capacity, in increments of 100 kW, that is made available pursuant to Tariff requirements and ISO Procedures *(Source: NYISO’s MST Definitions).*

**Installed Capacity Requirement (ICR)**: The annual statewide requirement established by the NYSRC in order to ensure resource adequacy in the NYCA. *(Source: NYSRC Reliability Rules)*

**Installed Reserve Margin (IRM):** The amount of installed electric generation capacity above 100% of the forecasted peak electric demand that is required to meet NYSRC resource adequacy criteria. Most studies in recent years have indicated a need for a 15-20% reserve margin for adequate reliability in New York.

**Local Transmission Plan (LTP):** The Local Transmission Owner Plan, developed by each Transmission Owner, which describes its respective plans that may be under consideration or finalized for its own Transmission District. *(Source: Attachment Y of OATT)*

**Local Transmission Planning Process (LTPP)**: The Local Planning Process conducted by each Transmission Owner for its own Transmission District. *(Source: Attachment Y of OATT)*

**Loss of Load Expectation (LOLE):** 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. *(Source: NYSRC Reliability Rules)*

**Market Monitoring Unit:** “Market Monitoring Unit” shall mean the consulting or other professional services firm, or other similar entity, retained by the Board, as specified in Section 30.4.2 of Attachment O, that is responsible for carrying out the Core Market Monitoring Functions and the other functions that are assigned to it in Attachment O. The Market Monitoring Unit shall recommend Tariff and market rule changes, but shall not participate in the administration of the ISO’s Tariffs, except as specifically authorized in Attachment O. *(Source: Attachment O of MST)*

**Market Participant:** An entity, excluding the ISO, that produces, transmits, sells, and/or purchase for resale Unforced Capacity, Energy or Ancillary Services in the Wholesale Market. Market Participants include: Transmission Customers under the ISO OATT, Customers under the ISO Services Tariff, Power Exchanges, Transmission Owners, Primary Holders, LSEs, Suppliers and their designated agents. Market Participants also include entities buying or selling TCCs*. (Source: MST Definitions)*

**New York Control Area (NYCA):** New York Control Area (“NYCA”): The Control Area that is under the control of the ISO which includes transmission facilities listed in the ISO/TO Agreement Appendices A-1 and A-2, as amended from time-to-time, and generation located outside the NYS Power System that is subject to protocols (*e.g.,* telemetry signal biasing) which allow the ISO and other Control Area operator(s) to treat some or all of that generation as though it were part of the NYS Power System. *(Source: MST Definitions)*

**New York State Department of Environmental Conservation (NYSDEC):** The agency that implements the New York State Environmental Conservation Law, with some programs also governed by federal law.

**New York Independent System Operator (NYISO):** Formed in 1997 and commencing operations in 1999, the NYISO is a not-for-profit organization that manages New York’s bulk electricity grid – an over 11,000-mile network of high voltage lines that carry electricity throughout the state. The NYISO also oversees the state’s wholesale electricity markets. The organization is governed by an independent Board of Directors and a governance structure made up of committees with Market Participants and stakeholders as members.

**New York State Department of Public Service (NYDPS):** As defined in the New York Public Service Law, it serves as the staff for the New York State Public Service Commission.

**New York State Energy Research and Development Authority (NYSERDA):** A corporation created under the New York State Public Authorities law and funded by the System Benefits Charge (SBC) and other sources. Among other responsibilities, NYSERDA is charged with conducting a multifaceted energy and environmental research and development program to meet New York State's diverse economic needs, and administering state System Benefits Charge, Renewable Portfolio Standard, energy efficiency programs, the Clean Energy Fund, and the NY-Sun Initiative.

**New York State Public Service Commission (NYPSC):** The New York State Public Service Commission is the decision making body of the New York State Department of Public Service. The PSC regulates the state's electric, gas, steam, telecommunications, and water utilities and oversees the cable industry. The Commission has the responsibility for setting rates and ensuring that safe and adequate service is provided by New York's utilities. In addition, the Commission exercises jurisdiction over the siting of major gas and electric transmission facilities.

**NY-Sun Initiative:** A program initiated by Governor Cuomo in 2012 and administered by NYSERDA for the purpose of obtaining more than 6,000 MW-DC of behind-the-meter solar PV by the end of 2023.

**New York State Reliability Council (NYSRC):** An organization established by agreement among the Member Systems of the New York Power Pool (the “NYSRC Agreement”). *(Source: OATT Definitions)*

**Normal Transfer Criteria*:*** Under normal transfer criteria, adequate facilities are available to supply firm load with the bulk power transmission system within applicable normal ratings and limits as follows:

a. Pre-contingency line and equipment loadings within normal *rating*s. Pre-contingency voltages and transmission *interface* flows within applicable pre-contingency voltage and *stability limit*s.

b. Post-contingency line and equipment loadings within applicable *emergency* (LTE or STE) *rating*s. Post-contingency voltages and transmission *interface* flows within applicable post-contingency voltage and *stability limit*s.

All contingencies listed in Table B2 “NYSRC Planning Design Criteria: Contingency Event, “in the reliability rules apply under normal transfer criteria. *(Source: NYSRC Reliability Rules)*

**Normal Transfer Limit:** The maximum allowable transfer is calculated based on thermal, voltage, and stability testing, considering contingencies, ratings, and limits specified for normal conditions. The normal transfer limit is the lowest limit based on the most restrictive of these three maximum allowable transfers. *(Source: NYSRC Reliability Rules)*

**North American Electric Reliability Corporation (NERC):** The North American Electric Reliability Council or, as applicable, the North American Electric Reliability Corporation. *(Source: OATT Definitions)*

**Northeast Power Coordinating Council (NPCC):** The Northeast Power Coordinating Council, or any successor organization. *(Source: Attachment Y of OATT)*

**Open Access Transmission Tariff (OATT):** Document of Rates, Terms and Conditions, regulated by the FERC, under which the NYISO provides transmission service. The OATT is a dynamic document to which revisions are made on a collaborative basis by the NYISO, New York’s Electricity Market Stakeholders, and the FERC.

**Order 890:** Adopted by FERC in February 2007, Order 890 is a change to FERC’s 1996 transmission open access regulations (established in Orders 888 and 889). Order 890 is intended to provide for more effective competition, transparency and planning in wholesale electricity markets and transmission grid operations, as well as to strengthen the Open Access Transmission Tariff (OATT) with regard to non-discriminatory transmission service. Order 890 requires Transmission Providers – including the NYISO – to have a formal planning process that provides for a coordinated transmission planning process, including reliability and economic planning studies.

**Order 1000:** The Final Rule entitled Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities, issued by the Commission on July 21, 2011, in Docket RM10-23-001, as modified on rehearing, or upon appeal. (See FERC Stats & Regs. ¶ 31,323 (2011) (“Order No. 1000”), on reh’g and clarification, 139 FERC ¶ 61,132 (“Order No. 1000-A”), on reh’g and clarification, 141 FERC ¶ 61,044 (2012) (“Order No. 1000- B”). *(Source: Attachment Y of OATT)*

**Outage:** The forced or scheduled removal of generating capacity or a transmission line from service.

**Peak Demand:** The maximum instantaneous power demand, measured in megawatts (MW), and also known as peak load, is usually measured and averaged over an hourly interval.

**Queue Position:** Queue position shall mean the order of a valid Interconnection Request, Study Request, or Transmission Interconnection Application relative to all other pending Requests, that is established based upon the date and time of receipt of the valid Interconnection Request by NYISO, unless specifically provided otherwise in an applicable transition rule set forth in Attachment P, Attachment X or Attachment Z to the ISO OATT*. (Source: Attachment X of OATT)*

**Rating:** The operational limits of an electric system, facility, or element under a set of specified conditions.

i. *Normal Rating*: The capacity rating of a transmission facility that may be carried through consecutive twenty- four (24) hour load cycles.

ii. *Long Time Emergency (LTE) Rating:* The capacity rating of a transmission facility that can be carried through infrequent, non- consecutive four (4) hour periods.

iii. *Short Time Emergency (STE) Rating*: The capacity rating of a transmission facility that may be carried during very infrequent contingencies of fifteen (15) minutes or less duration. *(Source: NYSRC Reliability Rules)*

**Reasonably Available Control Technology for Oxides of Nitrogen (NOx RACT):** Regulations promulgated by NYSDEC for the control of emissions of nitrogen oxides (NOx) from fossil fuel-fired power plants. The regulations establish presumptive emission limits for each type of fossil fueled generator and fuel used in an electric generator in NY. The NOx RACT limits are part of the State Implementation Plan for achieving compliance with the National Ambient Air Quality Standard (NAAQS) for ozone. *(Source: 6 NYCRR Part 227-2)*

**Reactive Power Resources:** Facilities such as generators, high voltage transmission lines, synchronous condensers, capacitor banks, and static VAr compensators that provide reactive power. Reactive power is the portion of electric power that establishes and sustains the electric and magnetic fields of alternating-current equipment. Reactive power is usually expressed as kilovolt-amperes reactive (kVAr) or megavolt-ampere reactive (MVAr).

**Regional Greenhouse Gas Initiative (RGGI):** A cooperative effort by a group of Northeast and Mid-Atlantic states to limit power sector greenhouse gas emissions using a market-based cap-and-trade approach. *(Source: https://www.rggi.org/)*

**Reliability:** The degree of performance of the bulk electric system that results in electricity being delivered to customers within accepted standards and in the amount desired. Reliability may be measured by the frequency, duration, and magnitude of adverse effects on the electric supply. Electric system reliability can be addressed by considering two basic and functional aspects of the electric system – adequacy and security.

i. *Adequacy:* The ability of the electric systems to supply the aggregate electrical demand and energy requirements of their customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements. Note: Adequacy encompasses both generation and transmission.

ii.*Security:* The ability of the electric system to withstand disturbances such as electric short circuits or unanticipated loss of system elements. The ability of the power system to withstand the loss of one or more elements without involuntarily disconnecting firm load. *(Source: NYSRC Reliability Rules)*

**Reliability Criteria:** The electric power system planning and operating policies, standards, criteria, guidelines, procedures, and rules promulgated by the North American Electric Reliability Corporation (NERC), Northeast Power Coordinating Council (NPCC), and the New York State Reliability Council (NYSRC), as they may be amended from time to time. *(Source: Attachment Y of OATT definition)*

**Reliability Need:** A condition identified by the ISO as a violation or potential violation of one or more Reliability Criteria. *(Source: Attachment Y of OATT definition)*

**Reliability Needs Assessment (RNA):** The Reliability Needs Assessment as approved by the ISO Board under this Attachment. *(Source: Attachment Y of OATT definition)*

**Reliability Planning Process (RPP):** The process set forth in this Attachment Y by which the ISO determines in the RNA whether any Reliability Need(s) on the BPTFs will arise in the Study Period and addresses any identified Reliability Need(s) in the CRP, as the process is further described in Section 31.1.2.2. (Source: Attachment Y of OATT)

**Reliability Solutions:**

i. *Alternative Regulated Solutions (ARS)*: Regulated solutions submitted by a TO or other developer in response to a solicitation for solutions to a Reliability Need identified in an RNA.

ii*. Gap Solution:* A solution to a Reliability Need that is designed to be temporary and to strive to be compatible with permanent market-based proposals. A permanent regulated solution, if appropriate, may proceed in parallel with a Gap Solution. Note: The NYISO may call for a Gap Solution to an imminent threat to reliability of the Bulk Power Transmission Facilities if no market-based solutions, regulated backstop solutions, or alternative regulated solutions can meet the Reliability Needs in a timely manner.

iii. *Market-Based Solutions:* Investor-proposed projects that are driven by market needs to meet future reliability requirements of the bulk electricity grid as outlined in the RNA. Those solutions can include generation, transmission and demand response Programs.

iv. *Regulated Backstop Solutions*: Proposals required of certain TOs to meet Reliability Needs as outlined in the RNA. Those solutions can include generation, transmission or demand response. Non-Transmission Owner developers may also submit regulated solutions. *(Source: Attachment Y of OATT)*

**Responsible Transmission Owner (Responsible TO):** The Transmission Owner or Transmission Owners designated by the ISO, pursuant to Section 31.2.4.3, to prepare a proposal for a regulated backstop solution to a Reliability Need or to proceed with a regulated solution to a Reliability Need. The Responsible Transmission Owner will normally be the Transmission Owner in whose Transmission District the ISO identifies a Reliability Need and/or that owns a transmission facility on which a Reliability Need arises. *(Source: Attachment Y of OATT definitions)*

**RNA Study Period:** The seven-year time period encompassing years 4 through 10 following the year in which the RNA is conducted, which is used in the RNA and the CRP. For example, the 2020 RNA covers the 7-year Study Period of 2024 through 2030. *(Source: Attachment Y of OATT definitions with STAR).*

**Short-Term Assessment of Reliability (STAR):** The ISO’s assessment, in coordination with the Responsible Transmission Owner(s), of whether a Short-Term Reliability Process Need will result from a Generator becoming Retired, entering into a Mothball Outage, a Generator being unavailable due to an ICAP Ineligible Forced Outage, or from other changes to the availability of Resources or to the New York State Transmission System. The ISO performs STARs on a quarterly basis, commencing on the dates specified in ISO Procedures.

**Short-Term Reliability Process:** The process set forth in this Attachment FF by which the ISO evaluates and addresses the reliability impacts resulting from both: (i) Generator Deactivation Reliability Need(s), and/or (ii) other Reliability Needs on or affecting the BPTFs that are identified in a STAR. The Short-Term Reliability Process evaluates reliability needs in years one through five of the ten-year Study Period, with a focus on needs in years one through three.

**Short-Term Reliability Process Need:** A Generator Deactivation Reliability Need or a condition identified by the ISO in a STAR as a violation or potential violation of one or more Reliability Criteria on the BPTF.

**Short-Term Reliability Process Solution:** A solution to address a Short-Term Reliability Process Need, which may include (i) an Initiating Generator, (ii) a solution proposed pursuant to Section 38.4, or (iii) a Generator identified by the ISO pursuant to Section 38.5.

**Short-Term Assessment of Reliability Start Date:** The date on which the ISO next commences a STAR after the ISO issues a written notice to a Market Participant pursuant to Section 38.3.1.4 indicating that the Generator Deactivation Notice for its Generator is complete. If a Market Participant’s Generator enters into an ICAP Ineligible Forced Outage pursuant to Section 5.18.2.1 of the ISO Services Tariff, then the Short-Term Assessment of Reliability Start Date is the date on which the ISO next commences a STAR; except (i) when the ISO determines that it should commence a stand alone Generator Deactivation Assessment based on the potential for an immediate reliability need to arise (see Section 38.3.4), or (ii) when the ISO is able to and elects to add a Generator that is in an ICAP Ineligible Forced Outage to a STAR that has already begun. Under either exception [(i) or (ii)], the Short-Term Assessment of Reliability Start Date is the date on which the Generator entered an ICAP Ineligible Forced Outage. *(Source: Attachment Y, Section 38.1)*

**Special Case Resource (“SCR”):** Demand Side Resources whose Load is capable of being interrupted upon demand at the direction of the ISO, and/or Demand Side Resources that have a Local Generator, which is not visible to the ISO’s Market Information System and is rated 100 kW or higher, that can be operated to reduce Load from the NYS Transmission System or the distribution system at the direction of the ISO. Special Case Resources are subject to special rules, set forth in Section 5.12.11.1 of this ISO Services Tariff and related ISO Procedures, in order to facilitate their participation in the Installed Capacity market as Installed Capacity Suppliers. (Source: NYISO MST Tariff Definitions)

**System Benefits Charge (SBC):** An amount of money, charged to ratepayers on their electric bills, which is administered and allocated by NYSERDA towards energy-efficiency programs, research and development initiatives, low-income energy programs, and environmental disclosure activities.

**Transfer Capability:** The measure of the ability of interconnected electrical systems to reliably move or transfer power from one area to another over all transmission facilities (or paths) between those areas under specified system conditions.

**Transmission Constraints:** Limitations on the ability of a transmission system to transfer electricity during normal or emergency system conditions.

**Transmission Owner (TO):** A public utility or authority that owns transmission facilities and provides Transmission Service under the NYISO’s tariffs

**Unforced Capacity:** The measure by which Installed Capacity Suppliers will be rated, in accordance with formulae set forth in the ISO Procedures, to quantify the extent of their contribution to satisfy the NYCA Installed Capacity Requirement, and which will be used to measure the portion of that NYCA Installed Capacity Requirement for which each LSE is responsible (*Source: Market Services Tariff (MST) Definitions).*

**Unforced Capacity Deliverability Rights:**  Unforced Capacity Deliverability Rights (“UDRs”) are rights, as measured in MWs, associated with (i) new incremental controllable transmission projects, and (ii) new projects to increase the capability of existing controllable transmission projects that have UDRs, that provide a transmission interface to a Locality. When combined with Unforced Capacity which is located in an External Control Area or non-constrained NYCA region either by contract or ownership, and which is deliverable to the NYCA interface in the Locality in which the UDR transmission facility is electrically located, UDRs allow such Unforced Capacity to be treated as if it were located in the Locality, thereby contributing to an LSE’s Locational Minimum Installed Capacity Requirement. To the extent the NYCA interface is with an External Control Area the Unforced Capacity associated with UDRs must be deliverable to the Interconnection Point (Source: MST Definitions)

**Weather Normalized:** Adjustments made to normalize the impact of weather when making energy and peak demand forecasts. Using historical weather data, energy analysts can account for the influence of extreme weather conditions and adjust actual energy use and peak demand to estimate what would have happened if the hottest day or the coldest day had been the typical, or “normal,” weather conditions. “Normal” is usually calculated by taking the average of the previous 20 years of weather data.

**Zone:** One of the eleven regions in the NYCA connected to each other by identified transmission interfaces and designated as Load Zones A-K.

# Appendix B - The Reliability Planning Process

This appendix presents an overview of the NYISO’s Reliability Planning Process (RPP). A detailed discussion of the RPP, including applicable Reliability Criteria, is contained in NYISO Manual titled “Reliability Planning Process Manual 26,” which is posted on the NYISO’s website.

The NYISO RPP is an integral part of the NYISO’s overall Comprehensive System Planning Process (CSPP). The CSPP is comprised of four components:

* Local Transmission Planning Process (LTPP),
* Reliability Planning Process (RPP), along with the newly defined quarterly Short Term Reliability Process (STRP)
* Congestion Assessment and Resource Integration Study (CARIS), and
* Public Policy Transmission Planning Process.

As part of the LTPP, local Transmission Owners perform transmission security studies for their BPTFs in their transmission areas according to all applicable criteria. Links to the Transmission Owner’s LTPs can be found on the NYISO’s website. The LTPP provides inputs for the RPP and STRP.

During the RPP, the NYISO conducts the Reliability Needs Assessment (RNA) and Comprehensive Reliability Plan (CRP). The RNA evaluates the resource adequacy and transmission security of the bulk power system over the RNA study period (i.e. year 4 through year 10). In identifying resource adequacy needs, the NYISO identifies the amount of resources in megawatts (known as “compensatory megawatts”) and the locations in which they are needed to meet those needs. After the RNA is complete, the NYISO requests and evaluates market-based solutions, regulated backstop solutions, and alternative regulated solutions that address the identified Reliability Needs. This step results in the development of the CRP for the seven-year study period (*i.e.,* year 4 through year 10).

The RPP is a long-range assessment of both resource adequacy and transmission reliability of the New York bulk power system conducted over a seven-year planning horizon. There are two different aspects to analyzing the bulk power system’s reliability in the RNA: adequacy and security. Adequacy is a planning and probabilistic concept. A system is adequate if the probability of having sufficient transmission and generation to meet expected demand is equal to or less than the system’s standard, which is expressed as a loss of load expectation (LOLE). The New York State bulk power system is planned to meet an LOLE that, at any given point in time, is less than or equal to an involuntary load disconnection that is not more frequent than once in every 10 years, or 0.1 days per year. This requirement forms the basis of New York’s installed reserve margin (IRM) resource adequacy requirement.

Transmission Security is an operating and deterministic concept. N-1 events are evaluated to assess their impact on the system, as viewed from the normal (or ‘N’) system condition. N‑1‑0 and N‑1‑1 analysis evaluates the ability of the system to meet design criteria after a critical element has already been lost. An N-1or N-1-1 violation occurs when the power flowing through a transmission element exceeds its applicable rating (thermal violation) or the voltage at a bus exceeds its specified range (voltage violation).

Certain areas of the Con Edison system are designed and operated for the occurrence of a second contingency. This type of combination can be described as N-1-1-0. For N-1-1-0 analysis, after the second contingency occurs, systems adjustments are allowed to secure the system back to normal ratings. The Con Edison planning criteria are contained in the NYSRC Reliability Rules, Rule G.1. Accordingly, a violation of the N-1-1-0 criterion on the BPTFs in the Con Edison Transmission District will be identified as a Reliability Need in the NYISO’s Reliability Needs Assessment.

The RPP is anchored in the market-based philosophy of the NYISO and its Market Participants, which posits that market solutions should be the preferred choice to meet the identified Reliability Needs reported in the RNA. In the CRP, the reliability of the bulk power system is assessed and solutions to Reliability Needs evaluated in accordance with existing Reliability Criteria of the North American Electric Reliability Corporation (NERC), the Northeast Power Coordinating Council, Inc. (NPCC), and the New York State Reliability Council (NYSRC) as they may change from time to time. These criteria and a description of the nature of long-term bulk power system planning are described in detail in the applicable planning manual, and are briefly summarized below. In the event that market-based solutions do not materialize to meet a Reliability Need in a timely manner, the NYISO designates the Responsible TO or Responsible TOs or developer of an alternative regulated solution to proceed with a regulated solution in order to maintain system reliability. The NYISO may provide regulated cost recovery for transmission solutions constructed to meet a Reliability Need. Under the RPP, the NYISO also has an affirmative obligation to report historic congestion across the transmission system. In addition, the draft RNA is provided to the Market Monitoring Unit for review and consideration of whether market rules changes are necessary to address an identified failure, if any, in one of the NYISO’s competitive markets. If market failure is identified as the reason for the lack of market-based solutions, the NYISO will explore appropriate changes in its market rules with its stakeholders and Independent Market Monitor. The RPP does not substitute for the planning that each TO conducts to maintain the reliability of its own bulk and non-bulk power systems.

The NYISO does not license or construct projects to respond to identified Reliability Needs reported in the RNA. The ultimate approval of those projects lies with regulatory agencies such as the FERC, the NYPSC/NYDPS, environmental permitting agencies, and local governments. The NYISO monitors the progress and continued viability of proposed market and regulated projects to meet identified needs, and reports its findings in annual plans.

In 2019, a major planning process was carved out of the RPP and defined as the Short-Term Reliability Process (STRP). This process was approved by the FERC and its requirements are contained in [Attachments Y and FF of the NYISO’s OATT](http://www.nyiso.com/public/webdocs/documents/tariffs/oatt/att_y.pdf). With this process in place, the RPP’s Study Period changes from a year 1 to year 10 analysis, into a year 4 to year 10 look ahead. At the same time, the STRP evaluates year 1 through year 5 from the Short Term Assessment of Reliability (STAR) Start Date, with a focus on Short-Term Reliability Needs arising in years 1 through 3 of the Study Period.

Consistent with Section 38.2 of the OATT, Short-Term Reliability Process Needs that arise within three years of the later of (a) the conclusion of the 365 day prior notice period for that is described in Section 38.3.1.1 of the OATT for Generator Deactivation Reliability Needs, or (b) the posting of a completed Short-Term Assessment of Reliability (“STAR”) for other Reliability Needs on the BPTF, will be addressed using the Short-Term Reliability Process.

Short-Term Reliability Process Needs that arise in the Near Term (within three years) will be addressed using the Short-Term Reliability Process (STRP).  Short-Term Reliability Process Needs that are not Near-Term needs on the BPTF will only be addressed using the STRP if an identified Reliability Need cannot timely be addressed through the ISO’s Reliability Planning Process.  If the Reliability Need is handled through the STRP, the NYISO will solicit market-based solutions of all types, a regulated transmission solution(s), and service offers from Generators, as appropriate. The NYISO will select a solution(s) consistent with the STRP process which may include selecting Generators to remain in service under temporary Reliability Must Run (RMR) agreements until the transmission solution is complete.

STRP Needs that arise more than three years after the later of (x) the conclusion of the 365 day prior notice period for Generator Deactivation Reliability Needs, or (y) the posting of a completed STAR for other Reliability Needs on the BPTF, will only be addressed using the STRP if the identified Reliability Need cannot timely be addressed through the RPP set forth in this Attachment Y.

The CRP also provides inputs for the NYISO’s economic planning process known as CARIS. CARIS Phase 1 examines congestion on the New York bulk power system and the costs and benefits of alternatives to alleviate that congestion. During CARIS Phase 2, the NYISO evaluates specific transmission project proposals for regulated cost recovery.

Another component of the CSPP is the Public Policy Transmission Planning Process. Under this component, interested entities propose, and the NYPSC identify, transmission needs driven by Public Policy Requirements. The NYISO then requests that interested entities submit proposed solutions to the Public Policy Transmission Need(s) identified by the NYPSC. The NYISO evaluates the viability and sufficiency of the proposed solutions to satisfy the identified Public Policy Transmission Need. Upon a confirmation by the NYPSC that a need for a transmission solution still exists, 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 containing its findings regarding the proposed solutions. This report is reviewed by NYISO stakeholders and approved by the Board of Directors.

In concert with each of the NYISO’s regional planning processes, 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.

Figure 1 summarizes the CSPP and Figure 2 summarizes the RPP process.

Figure 1: NYISO’s Comprehensive System Planning Process (CSPP)

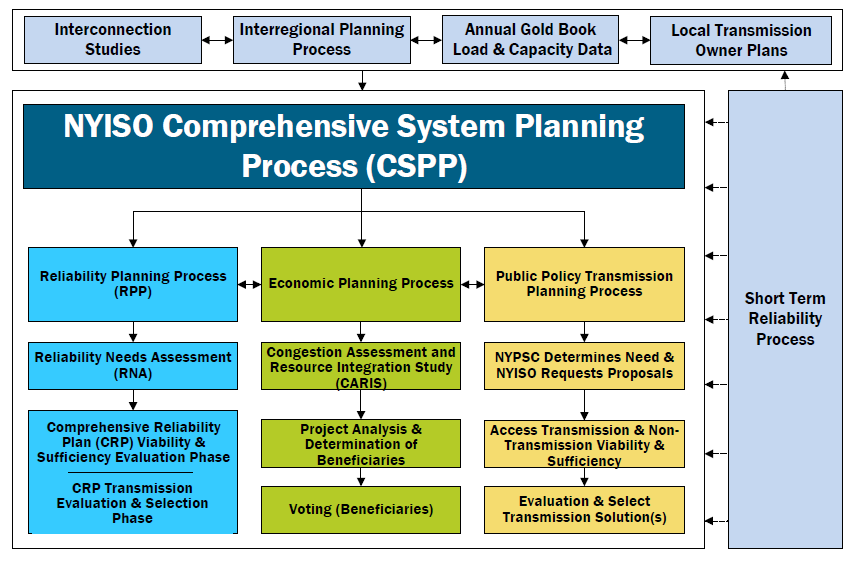


Figure 2: NYISO RPP



# Appendix C - Load and Energy Forecast 2021-2030

## Historical Overview

In order to perform the 2020 RNA, a forecast of summer and winter peak demands and annual energy requirements was produced for the years 2020 ‑ 2030. The New York Control Area (NYCA) is a summer peaking system and is expected to remain a summer peaking system over the study period. In longer term, the NYISO may become a winter peaking system in the mid-2030s due to increasing electrification primarily via heat pumps and electric vehicles. Both summer and winter peaks show considerable year-to-year variability due to the influence of peak-producing weather conditions for the seasonal peaks. Annual energy is also influenced by weather conditions over the entire year. However, the resulting variation in annual energy levels is relatively lower.

Figure 3 below reports the NYCA historic seasonal peaks and annual energy growth since 2010. The table provides both actual results and weather-normalized results, together with annual average growth rates for each table entry. The growth rates are averaged over the period 2010 to 2019.

Figure 3: Historical Energy and Seasonal Peak Demand - Actual and Weather-Normalized



## Forecast Overview

Figure 4 below shows historical and forecast growth rates of annual energy for five different regions in New York and in total. The 5 regions are Zones A to E, Zones F and G, H and I, Zone J, and Zone K. Figure 5 shows historical and forecast growth rates of summer and winter peak demand for the same 5 regions. The corresponding load forecast uncertainty values for each of 5 regions are also included.

Figure 4: Annual Energy and Average Growth – Actual and Forecast



Figure 5: Actual and Forecast Seasonal Peak Demand and Average Growth, and LFU Multipliers



1 Years listed reflect the NYISO capability year; For example, the year 2010 reflects the winter period spanning 2010-2011

## Forecast Methodology

In addition to developing load forecasts for each of the load zones, the NYISO received and evaluated forecasts from all Transmission Owners, which were used in combination with the forecasts the NYISO developed. The NYISO employs a multi-stage process to develop load forecasts for each of the eleven zones within the NYCA.

In the first stage, baseline energy and peak models are built based on projections of end-use intensities and economic variables. End-use intensities modeled include those for lighting, refrigeration, cooking, heating, cooling, and other plug loads. Appliance end-use intensities are generally defined as the product of saturation levels (average number of units per household or commercial square foot) and efficiency levels (energy usage per unit or a similar measure). End-use intensities specific to New York are estimated from appliance saturation and efficiency levels in both the residential and commercial sectors. These intensities include the projected impacts of energy efficiency programs and improved codes and standards. Economic variables considered include Gross Domestic Product (“GDP”), households, population, and commercial and industrial employment. Projected long-term weather trends from the NYISO Climate Change Impact Study Phase I are included in the end-use models.

In the second stage, the incremental impacts of additional policy-based energy efficiency, behind-the-meter solar PV and distributed generation are deducted from the forecast; and the incremental impacts of electric vehicle usage and other electrification are added to the forecast. The impacts of net electricity consumption of energy storage units due to charging and discharging are added to the energy forecasts, while the peak reducing impacts of behind-the-meter energy storage units are deducted from the peak forecasts. In the final stage, the NYISO aggregates load forecasts by Zone. The 2020 summer peak forecast is the 2020 ICAP forecast.

## Forecast Results

Figure 6 through Figure 16 include information on the 2020 Baseline forecast specific to the 2020 RNA look ahead period. Annual energy, summer, and winter peak forecasts and the corresponding average annual growth rates are provided for reference along with comparisons to the 2018 RNA baseline forecast used (Gold Book forecasts). Behind-the-meter impacts on summer peak reductions and total zonal peak requirements (demand and solar PV) are also provided.

Figure 6: Gold Book Baseline Energy Forecast Growth Rates - 2020 to 2030



Figure 7: 2028 Energy Forecast Comparison between 2018 Gold Book and 2020 Gold Book



Figure 8: Gold Book Baseline Summer Coincident Peak Demand Forecast Growth Rates – 2020 to 2030



Figure 9: 2028 Summer Peak Forecast Comparison between 2018 Gold Book and 2020 Gold Book



Figure 10: Annual Energy by Zone - Actual and 2020 Gold Book Baseline Forecast (GWh)



Figure 11: Summer Coincident Peak Demand by Zone - Actual and 2020 Gold Book Baseline Forecast (MW)



Figure 12: Winter Coincident Peak Demand by Zone - Actual and 2020 Gold Book Baseline Forecast (MW)



Figure 13: 2020 Gold Book Behind-the-Meter Solar PV Baseline Annual Energy Reductions by Zone (GWh)



Figure 14: 2020 RNA Base Case Annual Energy Forecast with BTM Solar PV Added Back (GWh)



Figure 15: 2020 Gold Book Behind-the-Meter Solar PV Baseline Summer Coincident Peak Demand Reductions by Zone (MW)



Figure 16: 2020 RNA Base Case Summer Coincident Peak Demand Forecast with BTM Solar PV Added Back (MW)



# Appendix D - Resource Adequacy and Transmission System Security Assessments

The analysis performed during the Reliability Needs Assessment requires the development of base cases for transmission security analysis and for resource adequacy analysis. The power flow system model is used for transmission security assessment and also for the development of the transfer limits to be implemented in the Multi-Area Reliability Simulation (MARS) model. The NYISO conducts comprehensive assessment of the transmission system through a series of steady-state power flow, transient stability, and short circuit studies.

The NYISO used the MARS model to determine whether adequate resources would be available to meet the NYSRC and NPCC reliability criteria of one day in ten years (0.1 days/year). The results identify LOLE violations, and details are in the Section 6 of the RNA report.

The MARS model was also used to evaluate selected scenarios.

## 2020 RNA Assumptions Matrix

| **#** | **Parameter** | **2018 RNA/CRP**  **(2018 GB)**  Study Period: 2019 -2028 | **2020 RNA**  **(2020 GB)**  Study Period: 2024(y4) -2030 (y10) | **2020 RNA 70x30 Scenario Case**  Study Period: 2030 |
| --- | --- | --- | --- | --- |
| **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. | Similar method | 2 variations, same as the two CARIS 70x30 Scenarios:   1. RNA 70x30 NYCA High Load, similar to CARIS’s Case Labeled ‘Base Load’ 2. RNA 70x30 NYCA Low Load, similar to CARISs Case Labeled “Scenario Load” |
| 2 | Load **Shapes**   (Multiple Load Shapes) | Used Multiple Load Shape MARS Feature  8,760 hour historical load shapes were used as base shapes for LFU bins: Bin 1: 2006  Bin 2: 2002 Bins 3-7: 2007  Peak adjustments on a seasonal basis.  For the BtM Solar adjustment, the BtM shape is added back to account for the impact of the BtM generation on both on‑peak and off‑peak hours. | Similar method | Single year load shape that includes BtM taken directly from CARIS 70x30 Case original load (losses not included) |
| 3 | Load Forecast Uncertainty (**LFU**) | Used updated summer LFU values for the 11 NYCA zones. | Updated via Load Forecast Task Force (LFTF) process  Reference: April 13 2020 LFTF presentation: <https://www.nyiso.com/documents/20142/11883362/LFU_Summary.pdf> | Same as 2020 RNA Base Case |
| **Generation Parameters** | |  |  |  |
| 1 | **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. | Similar method | Same as 2020 RNA Base Case |
| 2 | **Proposed New Units Inclusion** Determination | GB2018 with Inclusion Rules Applied | Similar method | Off-shore wind, land-based wind and utility scale PV added to align with CARIS 70x30 Case Renewable Resources mix |
| 3 | Retirement, Mothballed Units, IIFO | GB2018 with Inclusion Rules Applied | Similar method | Units that are retired in 2020 RNA Base Case.  Additionally, all unit impacted by DEC’s Peaker Rule were removed to align with CARIS 70x30 Case assumptions |
| 4 | 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  For new units or units that are in service for less than three years, NERC 5-year class average EFORd data are used. | Similar method | Same as 2020 RNA Base Case |
| 5 | Planned Outages | Based on schedules received by the NYISO and adjusted for history | Similar method | Same as 2020 RNA Base Case |
| 6 | Summer Maintenance | Nominal 50 MW (25 in J and 25 in K) | None | Same as 2020 RNA Base Case |
| 7 | Combustion Turbine Derates | Derate based on temperature correction curves  For new units: used data for a unit of same type in same zone, or neighboring zone data. | Similar method | Same as 2020 RNA Base Case |
| 8 | Existing 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.  Probabilistic model is incorporated based on five years of input shapes, with one shape per replication randomly selected in the Monte Carlo process. | Similar method | Same as 2020 RNA Base Case |
| 9 | 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 | Similar method | 8760 hourly shapes based on output profile from CARIS 70x30 case.  Notes:   1. CARIS 70x30 case output profile captures curtailments observed in the CARIS MAPS simulations 2. CARIS 70x30 case wind shape input based on 2009 NREL data. |
| 10 | 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 rating. | Similar method | 8760 hourly shapes based on output profile from CARIS 70x30 case.  Notes:   1. CARIS 70x30 case output profile captures curtailments observed in the CARIS MAPS simulations 2. CARIS 70x30 case wind shape input based on 2009 NREL data. |
| 11a | Proposed **Land based Wind** Units | Inclusion Rules Applied to determine the generator status.  The nameplate normalized average of units in the same load zone is scaled by the unit’s nameplate rating. | Similar method | 8760 hourly shapes based on output profile from CARIS 70x30 case.  Notes:   1. CARIS 70x30 case output profile captures curtailments observed in the CARIS MAPS simulations 2. CARIS 70x30 case wind shape input based on 2009 NREL data. |
| 11b | Proposed **Offshore Wind** Units | N/A | N/A | 8760 hourly shapes based on output profile from CARIS 70x30 case.  Notes:   1. CARIS 70x30 case output profile captures curtailments observed in the CARIS MAPS simulations 2. CARIS 70x30 case wind shape input based on 2009 NREL data. |
| 12a | Existing  **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.) | Similar method | 8760 hourly shapes based on output profile from CARIS 70x30 case.  Notes:   1. CARIS 70x30 case output profile captures curtailments. 2. CARIS 70x30 case existing utility scale PV shape input based on Y2017 historical data. |
| 12b | Proposed  **Utility-scale Solar Resources** | Inclusion Rules Applied to determine the generator status.  The nameplate normalized average of units in the same load zone is scaled by the unit’s nameplate rating. | Similar method | 8760 hourly shapes based on output profile from CARIS 70x30 case.  Notes:   1. CARIS 70x30 case output profile captures curtailments. 2. CARIS 70x30 case future utility scale PV shape input based on 2006 NREL data. |
| 13 | Projected  **BtM Solar Resources** | The large projection of increasing retail (BtM) solar installations over the 10- year period require a discrete model with detailed hourly performance.  **New method:**  A 8,760 hourly shape was created by using NREL’s PV Watt[[1]](#footnote-1) tool.  MARS will randomly select a daily shape from the current month for each day of each month of each replication. | **New Method:**  Will use 5-year of inverter production data.  Probabilistic model is incorporated based on five years of input shapes with one shape per replication being randomly selected in Monte Carlo process  **Reference**: [April 6, 2020](https://www.nyiso.com/documents/20142/11718122/12d_2020RNA_MARS-BtMSolar-Apr6TPAS-ESPWG.pdf) TPAS/ESPWG meeting materials | 8,760 hourly shape from CARIS 70x30 output.  Note: CARIS BtM solar profile based on hourly shape created using NREL’s PV Watt tool. |
| 14 | Existing **BTM-NG Program** | **New category:**  These are former load modifiers to sell capacity into the ICAP market.  Modeled as cogen type 2 unit in MARS. Unit capacity set to CRIS value, load modeled with weekly pattern that can change monthly. | Similar method | Same as 2020 RNA Base Case |
| 15 | Existing **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 5-year window for each model replication. The randomly selected shape is multiplied by their current nameplate rating. | Similar method | Same as 2020 RNA Base Case |
| 16 | Existing **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. | Similar method | Same as 2020 RNA Base Case |
| 17 | Proposed **Energy Storage** | N/A | N/A | Utilize MARS Energy Storage model, which allows for charging and discharging, and also includes temporal constraints (*e.g.,* hours/days or hours/month) |
| **Transaction - Imports / Exports** | | |  |  |
| 1 | Capacity Purchases | Grandfathered Rights and other awarded long-term rights  Modeled using MARS explicit contracts feature. | Similar method | Same as 2020 RNA Base Case except for imports from HQ, see HQ section for additional information.  Add 1310 MW HVDC connection between HQ and Zone J |
| 2 | 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 | Similar method | Same as 2020 RNA Base Case |
| 3 | 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 | Similar method | Same as 2020 RNA Base Case |
| 4 | UDRs | Updated with most recent elections/awards information (VFT, HTP, Neptune, CSC) | Similar method | Same as 2020 RNA Base Case |
| 5 | EDRs | N/A | **New category:**  Cedars Uprate 80 MW. Increased the HQ to D by 80 MW.  Note: the Cedar bubble has been removed and its corresponding MW was reflected in HQ to D limit.  References:   1. [March 16, 2020](https://www.nyiso.com/documents/20142/11350020/06%202020RNA_MARS-BaseCasePrelimTopologyChanges.pdf) ESPWG/TPAS 2. [April 6, 2020](https://www.nyiso.com/documents/20142/11718122/12c_2020RNA_PreliminaryMARSTopoUpdates-Apr6TPAS-ESPWG.pdf) TPAS/ESPWG | Not modeled (see HQ section for additional information) |
| 6 | Wheel-Through Contract | n/a | **New category:**  300 MW HQ through NYISO to ISO-NE. Modeled as firm contract. Reduced the transfer limit from HQ to NYISO by 300 MW and increased the transfer limit from NYISO to ISO-NE by 300 MW. | Not modeled (see HQ section for additional information) |
| **MARS Topology:** a simplified bubble-and-pipe representation of the transmission system | | | |  |
| 0 |  |  | **Summary of major topology changes** (as compared with the 2018-2019 RPP):  [Link1)-7)](https://www.nyiso.com/documents/20142/11350020/06%202020RNA_MARS-BaseCasePrelimTopologyChanges.pdf); [Link8)-9)](https://www.nyiso.com/documents/20142/11718122/12c_2020RNA_PreliminaryMARSTopoUpdates-Apr6TPAS-ESPWG.pdf); [Link10)](https://www.nyiso.com/documents/20142/12654708/02%202020RNA_BCTopologyY1-Y10.pdf)   1. Marion-Farragut 345kV cables (B and C) assumed out of service 2. 71, 72, M51, M52 series reactors assumed by-passed after deactivation of Indian Point 3. Moses – St. Lawrence (L33P) tie line assumed out of service 4. Rainey – Corona transmission project in service impacting J to K limits 5. UPNY-SENY simplification 2021-2023 before the addition of AC PPTPP projects 6. AC PPTPs Segment A and B Projects Added starting 2024 7. Removal of Cedars bubble/tie to Zone D model; adding the MW from the bubble to the tie HQ to D tie limit. 8. Removal of PJM-SENY Group Interface 9. Updates to Zone K Imports/Exports 10. Somerset retirement impacts 11. The external areas model for PJM and ISO-NE were [simplified](https://www.nyiso.com/documents/20142/11350020/07%202020RNA_MARS-ExternalAreasSimplification.pdf) by consolidating the 5 PJM areas (bubbles) into one, and the 8 ISO-NE areas into one. | Same as 2020 RNA Base Case + LIPA topology updates for the 70x30 scenario additional (to the Base Case) peakers removal |
| 1 | Interface Limits | Developed by review of previous studies and specific analysis during the RNA study process | Similar method | Same as 2020 RNA Base Case |
| 2 | New Transmission | Based on TO- provided firm plans (via Gold Book 2018 process) and proposed merchant transmission; inclusion rules applied | Similar method | Same as 2020 RNA Base Case |
| 3 | AC Cable Forced Outage Rates | All existing cable transition rates updated with data received from ConEd and PSEG-LIPA to reflect most recent five-year history | Similar method | Same as 2020 RNA Base Case |
| 4 | UDR unavailability | Five-year history of forced outages | Similar method | Same as 2020 RNA Base Case |
| **Emergency Operating Procedures** | | |  |  |
| 1 | Special Case Resources | SCRs sold for the program discounted to historic availability (“effective capacity”). Summer values calculated from the latest available July registrations, held constant for all years of study. 5 calls/month | Similar method but with 15 calls/year  Note: also, combined the two SCR steps (generation and load zonal MW) | Same as 2020 RNA Base Case |
| 2 | EDRP Resources | 2018 Gold Book with effective capacity modeled.   Resources sold for the program and discounted to historic availability. Summer values calculated from July 2018 registrations and forecast growth. Values held constant for all years of study. | Not modeled: the values are less than 2 MW. | Same as 2020 RNA Base Case |
| 3 | Other EOPs | Based on TO information, measured data, and NYISO forecasts | Similar method | Same as 2020 RNA Base Case |
| **External Control Areas** | | |  |  |
| 1 | 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. | **New model:**  [Simplified](https://www.nyiso.com/documents/20142/11350020/07%202020RNA_MARS-ExternalAreasSimplification.pdf) model: The 5 PJM MARS areas (bubbles) were consolidated into one | Same as 2020 RNA Base Case |
| 2 | 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. | **New model:**  [Simplified](https://www.nyiso.com/documents/20142/11350020/07%202020RNA_MARS-ExternalAreasSimplification.pdf) model: The 8 ISO-NE MARS areas (bubbles) were consolidated into one | Same as 2020 RNA Base Case |
| 3 | 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. | Similar method | HQ bubble not modeled for consistency with CARIS. Imports from HQ modeled as injections based upon usage profile from MAPS analysis. No flows between HQ and IESO or ISONE. |
| 4 | 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. | Similar method | Same as 2020 RNA Base Case |
| 5 | Reserve Sharing | All NPCC Control Areas indicate that they will share reserves **equally** among all members before sharing with PJM. | Similar method | Same as 2020 RNA Base Case |
| 6 | NYCA Emergency Assistance Limit | Implemented a statewide limit of 3,500 MW | Similar method | Implemented a statewide (excluding assistance from HQ) limit of 3,500 MW |
| **Miscellaneous** | | |  |  |
| 1 | MARS Model Version | Version 3.22.6 | 3.29.1499 | 3.29.1499 |

## Assumptions Matrix for Transmission Security Assessment

| **Parameter** | **2020 RNA Transmission Security Studies Modeling Assumptions** | **2020 RNA 70x30 Scenario Case**  Study Period: 2030 | **Source** |
| --- | --- | --- | --- |
| Peak Load | NYCA baseline coincident summer peak forecast, which already includes EE and DG (including solar) reductions. | NYCA baseline coincident summer peak forecast for 2030 with adjustments to BTM Solar in accordance with the CARIS 70x30 Base Load. | 2020 Gold Book |
| Load Model | ConEd: voltage varying | No Change | 2020 FERC 715 filing |
| Rest of NYCA: constant power | No Change |
| System Representation | Per updates received through Databank process (Subject to RNA base case inclusion rules). | No Change | NYISO RAD Manual, 2020 FERC 715 filing |
| Inter-area Interchange Schedules | Consistent with ERAG MMWG interchange schedule. | No Change | 2020 FERC 715 filing, MMWG |
| Inter-area Controllable Tie Schedules | Consistent with applicable tariffs and known firm contracts or rights. | No Change | 2020 FERC 715 filing |
| In-City Series Reactors | Consistent with ConEdison operating protocol.  Note: series reactors on 71, 72, M51, and M52 are modeled by-passed with Y49, 41, and 42 series reactors modeled in-service. | No Change | 2020 FERC 715 filing, Con Edison protocol |
| SVCs, FACTS | Set at zero pre-contingency; allowed to adjust post-contingency | No Change | NYISO T&D Manual |
| Transformer & PAR taps | Taps allowed to adjust pre-contingency; fixed post-contingency. | No Change | 2020 FERC 715 filing |
| Switched Shunts | Allowed to adjust pre-contingency; fixed post-contingency. | No Change | 2020 FERC 715 filing |
| Fault Current analysis settings | Per Fault Current Assessment Guideline. | No Change | NYISO Fault Current Assessment Guideline |

## Summary of Proposed Generation and Transmission Assumptions

The figures below summarize similar information from the report, depicted in different ways.

Figure 17: Generation Additions by Year



Figure 18: Deactivations and Peaker Rule Status Change by Year



Figure 19: Status Change due to DEC Peaker Rule, Zone G



Figure 20: Status Change due to DEC Peaker Rule, Zone J



Figure 21: Status Change due to DEC Peaker Rule, Zone K



Notes:

1. The service pattern in the last two columns repeats in subsequent years of the RNA Study Period

2. Other compliance plans were submitted in addition to what is shown on this table. The table lists the plants with compliance plans that resulted in a change of status (*i.e.*, as also listed in the 2020 Gold Book Table iV-6)

Figure 22: NYCA and Zone J Summaries





## RNA Power Flow Base Case Development

The NYISO developed the 2020 RNA Base Cases used to analyze the performance of the transmission system from the 2020 FERC 715 filing power flow case library. The load representation in the power flow model is the summer peak load forecast reported in the 2020 Gold Book Table 1-3a baseline forecast of coincident peak demand. The system representation for the NPCC Areas in the base cases is from the 2019 Base Case Development libraries compiled by the NPCC SS-37 Base Case Development working group. The NYISO derived the PJM system representation from the PJM Regional Transmission Expansion Plan (RTEP) planning process models. The remaining models are from the Eastern Interconnection Reliability Assessment Group (ERAG) Multiregional Modeling Working Group (MMWG) 2019 power flow model library.

The NYISO utilized the RNA Base Case inclusion rules to screen the projects and plans for inclusion or exclusion from the 2020 RNA Base Case. The NYISO revised the RNA Base Case inclusion rules as set forth in Section 3 of the Reliability Planning Process Manual (Manual 26).

Specifically, the 2020 RNA Base Case does not include all projects currently listed on the NYISO’s interconnection queue or those shown in the 2020 Gold Book. Rather, it includes only those which met the screening requirements, as shown in the Figure 15 of the main report. The generation deactivation assumptions are reflected in Figure16 and Figure 17 of the main report. The firm transmission plans included in the RNA Base Case are listed in Figure 23 on the next page.

Figure 23: Firm Transmission Plans included in 2020 RNA Base Case























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2020 RNA MARS Model Base Case Development

The NYISO developed the system representations for PJM, Ontario, New England, and Hydro Quebec modeled in the 2020 RNA Base Case from the NPCC CP-8 2020 Summer Assessment. To avoid overdependence on emergency assistance from the external areas, the emergency operating procedure data was 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 a minimum value of 0.10 and capped at a value of 0.15 throughout Study Period.

The topology used in the MARS model RNA Base Case is located in Figures 27 to 29 in the body of the report. The internal transfer limits modeled are the summer emergency ratings derived from the RNA power flow cases discussed above. 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 Thermal Transfer Limit Analysis for Resource Adequacy Assessments

The NYISO performed analyses of the RNA Base Cases to determine emergency thermal transfer limits for the key interfaces used in the MARS resource adequacy analysis. Figure 24 below reports the emergency thermal transfer limits for the RNA base system conditions.

Figure 24: Emergency Thermal Transfer Limits





Figure 25: Dynamic Limit Tables





The method for modeling the UPNY-SENY interface in the MARS topology was changed for the 2020 RNA. However, the changes apply to years 2021 through 2023, which are not included in the 2020 RNA study period. Beginning in year 2024, the UPNY-SENY interface is modeled as a single limit because of the large increases in transfer capability from including the AC Transmission projects.

In the 2018 RNA MARS topology, the UPNY-SENY interface was modeled in a non-standard way because of limitations of the MARS program. For study years 2021 through 2023 in the 2018 RNA, a fictitious interface (UPNYSNY2) was modeled that included the generation output from the Cricket Valley and CPV Valley plants. A set of dynamic limit tables was applied to UPNYSNY2 to control the flow across the traditional UPNY-SENY interface. This modeled required having the Cricket Valley and the CPV Valley plants in their own MARS areas separate from Zone G. The MARS program was subsequently updated to simplify the model for the 2020 RNA. With these program updates, the interface limits can simply be applied to the traditional UPNY-SENY MARS interface, which eliminates the need to define the fictitious interface. It also allows the two plants to be modeled directly in Zone G, which avoids MARS treating them differently than the other units in Zone G. The UPNYSNY2 limits were replaced with UPNY-SENY MARS limits for the 2020 RNA, as shown in Figure 26.

Figure 26: 2018 RNA and 2020 RNA UPNYSNY Dynamic Limit Table



The E to G (Marcy South) interface was also updated for the 2020 RNA. In the 2018 RNA, a joint interface, CPV + Marcy Group, was utilized to capture the impact of the CPV Valley plant on the E to G interface. A flow calculation on the joint interface effectively reduced the limit on E to G by 90% of the CPV Valley plant output. For the 2020 RNA, this model was replaced with a DLT model applied to the E to G interface as shown in Figure 27. The joint interface and flow calculation were removed and the CPV Valley units were modeled directly in Zone G instead of as a separate MARS area.

Figure 27: E to G Dynamic Limit Table



The modeling changes resulted in flows and LOLE results that were extremely close when the models were tested and compared. The new simplified models are more straightforward to implement, maintain and verify in the MARS database.

Figure 28: UPNYSNY Topology Diagram in 2018 RNA and 2020 RNA



## Additional “Free Flow” MARS Simulations Observations

To determine if transmission reinforcements would be beneficial, a “NYCA free flow” test was executed, with results in the body of the report. A “free flow” simulation is one in which NYCA LOLEs are determined without considering any transmission transfer limitations within the NYCA system.  This provides an indication of whether any LOLE violations identified are purely resource related or if they are caused by limitations in the transmission system.

When removing the NYCA internal limits, the NYCA LOLE decreased to below the criterion level throughout the Study Period, indicating that there is no statewide resource deficiency. It also showed that transmission reinforcement, which would provide an injection into Zone J where the deficiency is located, is a potential option to resolve the identified resource adequacy Reliability Need.

Additional topology limits variations were performed to identify which specific interface transfer capability increases help the most, and to provide additional insights. The table below summarizes those simulations.

Figure 29: Free Flow Variations Results and Observations



## 2020 RNA Short Circuit Assessment

Figure 30 below provides the results of NYISO’s short circuit screening test for year 5 (2025) of the Study Period. Individual Breaker Analysis (IBA) is required for any breakers the ratings of which were exceeded by the maximum bus fault current. Either NYISO or the responsible Transmission Owner performed the analyses.

Figure 30: 2020 RNA Fault Current Analysis Summary Table for 2025 System Representation

| Substation | Nominal Voltage (kV) | Lowest Breaker Rating (kA) | Owner | Maximum Bus Fault (kA) | IBA Required | Breaker(s) Overdutied |
| --- | --- | --- | --- | --- | --- | --- |
| ACADEMY | 345 | 63.0 | Con Ed | 35.0 | N | N |
| ADIRONDACK | 230 | 32.4 | N. Grid | 10.5 | N | N |
| AES SOMERSET | 345 | 40.0 | NYSEG | 16.7 | N | N |
| ALPS | 345 | 39.0 | N. Grid | 17.4 | N | N |
| ALPS\_EAST | 345 | N/A[[2]](#footnote-2) | N. Grid | 7.9 | N | N |
| ALPS\_PAR 1 | 345 | N/A2 | N. Grid | 7.9 | N | N |
| ALPS\_PAR 2 | 345 | N/A2 | N. Grid | 7.9 | N | N |
| ASTE-ERG | 138 | 63.0 | Con Ed | 49.7 | N | N |
| ASTE-WRG | 138 | 63.0 | Con Ed | 49.7 | N | N |
| ASTORIA W-N | 138 | 63.0 | Con Ed | 43.6 | N | N |
| ASTORIA W-S | 138 | 63.0 | Con Ed | 43.6 | N | N |
| AstoriaAnnex | 345 | 63.0 | NYPA | 44.8 | N | N |
| ATHENS | 345 | 49.0 | N. Grid | 35.0 | N | N |
| BARRETT1 | 138 | 63.0 | LIPA | 48.8 | N | N |
| BARRETT2 | 138 | 63.0 | LIPA | 48.9 | N | N |
| BAYONNE | 345 | 50.0 | Con Ed | 25.3 | N | N |
| BOONVILLE | 115 | 23.0 | N. Grid | 10.8 | N | N |
| BOWLINE 2 | 345 | 40.0 | O&R | 26.8 | N | N |
| BOWLINE1 | 345 | 40.0 | O&R | 27.0 | N | N |
| BRKHAVEN | 138 | 63.0 | LIPA | 26.8 | N | N |
| BUCH138 | 138 | 40.0 | Con Ed | 15.5 | N | N |
| BUCHANAN N | 345 | 63.0 | Con Ed | 25.1 | N | N |
| BUCHANAN S | 345 | 63.0 | Con Ed | 37.1 | N | N |
| C.ISLIP | 138 | 38.9 | LIPA | 27.6 | N | N |
| CANANDAIGUA | 230 | 40.0 | NYSEG | 8.5 | N | N |
| CARLE PL | 138 | 63.0 | LIPA | 39.0 | N | N |
| CHASES LAKE | 230 | 39.0 | N. Grid | 9.6 | N | N |
| CHURCHTOWN | 115 | 21.4 | NYSEG | 8.3 | N | N |
| CLARKS CNRS | 345 | 40.0 | NYSEG | 11.6 | N | N |
| CLARKS CNRS | 115 | 40.0 | NYSEG | 17.4 | N | N |
| CLAY | 345 | 49.0 | N. Grid | 33.7 | N | N |
| CLAY | 115 | 45.0 | N. Grid | 38.7 | N | N |
| COOPERS CRN | 345 | 40.0 | NYSEG | 19.0 | N | N |
| COOPERS CRN4 | 115 | 22.6 | NYSEG | 14.9 | N | N |
| COOPERS CRN8 | 115 | 23.1 | NYSEG | 14.9 | N | N |
| CORONA-N | 138 | 63.0 | Con Ed | 49.4 | N | N |
| CORONA-S | 138 | 63.0 | Con Ed | 49.4 | N | N |
| CRICKET VLLY | 345 | 63.0 | Con Ed | 37.5 | N | N |
| DEWITT | 345 | 39.0 | N. Grid | 18.9 | N | N |
| DEWITT | 115 | 39.0 | N. Grid | 29.6 | N | N |
| DOLSON AVE | 345 | 63.0 | NYPA | 20.7 | N | N |
| DUFFY AVE | 345 | 58.6 | LIPA | 8.2 | N | N |
| Duley | 230 | 40.0 | NYPA | 7.6 | N | N |
| DUN NO | 138 | 40.0 | Con Ed | 35.5 | N | N |
| DUN NO S6 | 138 | 63.0 | Con Ed | 29.5 | N | N |
| DUN SO | 138 | 40.0 | Con Ed | 30.9 | N | N |
| DUN SO N7 | 138 | 63.0 | Con Ed | 26.8 | N | N |
| DUNKIRK | 230 | 33.0 | N. Grid | 10.1 | N | N |
| DUNWOODIE | 345 | 63.0 | Con Ed | 59.6 | N | N |
| E FISHKILL | 345 | 63.0 | CH | 44.6 | N | N |
| E FISHKILL | 115 | 40.0 | CH | 24.2 | N | N |
| E13 ST | 138 | 63.0 | Con Ed | 48.6 | N | N |
| E13ST 45 | 345 | 63.0 | Con Ed | 53.7 | N | N |
| E13ST 46 | 345 | 63.0 | Con Ed | 53.7 | N | N |
| E13ST 47 | 345 | 63.0 | Con Ed | 52.2 | N | N |
| E13ST 48 | 345 | 63.0 | Con Ed | 51.7 | N | N |
| EASTOVER 230 | 230 | 49.0 | N. Grid | 10.8 | N | N |
| EASTOVER N | 115 | 49.0 | N. Grid | 25.3 | N | N |
| EASTVIEW | 138 | 63.0 | Con Ed | 37.0 | N | N |
| EDIC | 345 | 39.0 | N. Grid | 36.5 | N | N |
| EGC PAR | 345 | 63.0 | NYPA | 9.9 | N | N |
| EGC-1 | 138 | 80.0 | LIPA | 65.3 | N | N |
| EGC-2 | 138 | 80.0 | LIPA | 65.3 | N | N |
| ELBRIDGE | 345 | 40.0 | N. Grid | 16.0 | N | N |
| ELBRIDGE D | 115 | 49.0 | N. Grid | 26.6 | N | N |
| ELWOOD 1 | 138 | 63.0 | LIPA | 38.3 | N | N |
| ELWOOD 2 | 138 | 63.0 | LIPA | 38.0 | N | N |
| FARRAGUT | 345 | 63.0 | Con Ed | 57.9 | N | N |
| FITZPATRICK | 345 | 37.0 | NYPA | 41.1 | Y | N |
| FIVE MILE RD | 345 | 49.0 | N. Grid | 7.7 | N | N |
| FIVE MILE RD | 115 | 49.0 | N. Grid | 14.4 | N | N |
| FRASER | 345 | 40.0 | NYSEG | 19.3 | N | N |
| FRASER | 115 | 40.0 | NYSEG | 19.0 | N | N |
| FREEPORT | 138 | 63.0 | LIPA | 34.2 | N | N |
| FRESH KILLS | 345 | 63.0 | Con Ed | 26.8 | N | N |
| FRESH KILLS | 138 | 40.0 | Con Ed | 32.1 | N | N |
| GARDEN (NM) | 34.5 | 21.0 | N. Grid | 17.5 | N | N |
| GARDENVILLE | 115 | 42.0 | N. Grid | 40.8 | N | N |
| GARDENVILLE1 | 230 | 31.0 | N. Grid | 20.2 | N | N |
| GILBOA 345 | 345 | 50.0 | NYPA | 25.3 | N | N |
| GLNWD NO | 138 | 63.0 | LIPA | 43.4 | N | N |
| GLNWD SO | 138 | 63.0 | LIPA | 43.0 | N | N |
| GOTHLS | 345 | 63.0 | Con Ed | 29.6 | N | N |
| GOWANUS | 345 | 63.0 | Con Ed | 28.7 | N | N |
| GREENLWN | 138 | 63.0 | LIPA | 28.3 | N | N |
| HAUPAGUE | 138 | 63.0 | LIPA | 21.5 | N | N |
| High Sheldon | 230 | 40.0 | NYSEG | 10.3 | N | N |
| HILLSIDE #4 | 115 | 21.1 | NYSEG | 19.0 | N | N |
| HILLSIDE #8 | 115 | 22.0 | NYSEG | 19.0 | N | N |
| HILLSIDE 230 | 230 | 35.9 | NYSEG | 14.4 | N | N |
| HILLSIDE#4 | 34.5 | 21.7 | NYSEG | 18.1 | N | N |
| HOLBROOK | 138 | 63.0 | LIPA | 47.9 | N | N |
| HOLTSGT-GTs | 138 | 63.0 | LIPA | 44.1 | N | N |
| HUNTLEY 68 | 230 | 30.0 | N. Grid | 17.4 | N | N |
| HUNTLEY 70 | 230 | 50.0 | N. Grid | 17.4 | N | N |
| HURLEY | 345 | 40.0 | CH | 18.7 | N | N |
| HURLEY AVE | 115 | 37.9 | CH | 16.6 | N | N |
| INDEPENDENCE | 345 | 44.0 | N. Grid | 39.0 | N | N |
| JAMAICA | 138 | 63.0 | Con Ed | 47.6 | N | N |
| KNICKERBOCKR | 345 | 40.0 | N. Grid | 27.6 | N | N |
| LADENTOWN | 345 | 63.0 | O&R | 39.1 | N | N |
| LAFAYETTE | 345 | 40.0 | N. Grid | 17.8 | N | N |
| LCST GRV | 138 | 63.0 | LIPA | 38.0 | N | N |
| LEEDS | 345 | 37.0 | N. Grid | 35.8 | N | N |
| LHH WHITE | 115 | 38.1 | N. Grid | 11.8 | N | N |
| LKE SCSS1 | 138 | 63.0 | LIPA | 37.5 | N | N |
| LOVT | 138 | 40.0 | O&R | 28.7 | N | N |
| LOVT\_345 | 345 | 63.0 | O&R | 35.7 | N | N |
| MARCY 345 | 345 | 63.0 | NYPA | 35.1 | N | N |
| MARCY 765 | 765 | 63.0 | NYPA | 10.2 | N | N |
| MASSENA 765 | 765 | 63.0 | NYPA | 7.9 | N | N |
| MEYER | 230 | 40.0 | NYSEG | 8.4 | N | N |
| MEYER | 115 | 18.9 | NYSEG | 11.9 | N | N |
| MEYER | 34.5 | 21.7 | NYSEG | 11.4 | N | N |
| MHTX2 | 138 | 50.0 | Con Ed | 13.8 | N | N |
| Midd Tap | 345 | 63.0 | CH | 19.2 | N | N |
| MILLR PL | 138 | 63.0 | LIPA | 14.6 | N | N |
| MILLWOOD | 345 | 63.0 | Con Ed | 46.1 | N | N |
| MILLWOOD 138 | 138 | 40.0 | Con Ed | 19.0 | N | N |
| MOTT HAVEN | 345 | 63.0 | Con Ed | 55.2 | N | N |
| NEWBRID | 138 | 80.0 | LIPA | 64.9 | N | N |
| NEWBRIDG | 345 | 58.6 | LIPA | 8.4 | N | N |
| NIAGARA 345 | 345 | 63.0 | NYPA | 33.5 | N | N |
| NIAGRA E 115 | 115 | 42.2 | NYPA | 37.1 | N | N |
| NIAGRA E 230 | 230 | 63.0 | NYPA | 53.8 | N | N |
| NIAGRA W 115 | 115 | 42.2 | NYPA | 27.9 | N | N |
| NIAGRA W 230 | 230 | 63.0 | NYPA | 53.8 | N | N |
| NMP#1 | 345 | 50.0 | N. Grid | 42.7 | N | N |
| NMP#2 | 345 | 50.0 | N. Grid | 43.6 | N | N |
| NRTHPRT1 | 138 | 63.0 | LIPA | 59.4 | N | N |
| NRTHPRT1-2 | 138 | 63.0 | LIPA | 59.4 | N | N |
| NRTHPRT2 | 138 | 63.0 | LIPA | 59.4 | N | N |
| NRTHPRT3 | 138 | 63.0 | LIPA | 45.2 | N | N |
| NRTHPRT4 | 138 | 63.0 | LIPA | 45.2 | N | N |
| NSCOT 77B | 345 | 39.0 | N. Grid | 38.0 | N | N |
| NSCOT 99B | 345 | 39.0 | N. Grid | 37.8 | N | N |
| NSCOT33 | 115 | 49.0 | N. Grid | 43.6 | N | N |
| NSCOT77 | 115 | 48.0 | N. Grid | 43.5 | N | N |
| NSCOT99 | 115 | 49.0 | N. Grid | 43.5 | N | N |
| OAKDALE | 115 | 40.0 | NYSEG | 27.1 | N | N |
| OAKDALE | 34.5 | 23.0 | NYSEG | 19.4 | N | N |
| OAKDALE 345 | 345 | 40.0 | NYSEG | 12.7 | N | N |
| OAKWOOD | 138 | 63.0 | LIPA | 27.4 | N | N |
| ONEIDA EAST | 115 | 23.0 | N. Grid | 13.3 | N | N |
| ONEIDA WEST | 115 | 23.0 | N. Grid | 13.3 | N | N |
| OSWEGO | 345 | 44.0 | N. Grid | 32.5 | N | N |
| OSWEGO M3 | 115 | 40.0 | N. Grid | 21.2 | N | N |
| PACKARD 2&3 | 230 | 49.0 | N. Grid | 39.5 | N | N |
| PACKARD 4&5 | 230 | 49.0 | N. Grid | 39.5 | N | N |
| PACKARD 6 | 230 | 49.0 | N. Grid | 39.6 | N | N |
| PACKARD NRTH | 115 | 62.0 | N. Grid | 29.5 | N | N |
| PACKARD STH | 115 | 58.0 | N. Grid | 26.3 | N | N |
| Patnode | 230 | 63.0 | NYPA | 10.5 | N | N |
| PILGRIM | 138 | 63.0 | LIPA | 57.6 | N | N |
| PL VILLE | 345 | 63.0 | Con Ed | 22.5 | N | N |
| PL VILLW | 345 | 63.0 | Con Ed | 22.8 | N | N |
| PLATTSBURGH | 115 | 20.3 | NYPA | 16.9 | N | N |
| PLEASANT VAL | 115 | 37.9 | CH | 24.5 | N | N |
| PLTVLLEY | 345 | 63.0 | Con Ed | 51.5 | N | N |
| PORTER | 230 | 21.0 | N. Grid | 17.6 | N | N |
| PORTER | 115 | 59.0 | N. Grid | 38.8 | N | N |
| PT JEFF | 138 | 63.0 | LIPA | 31.7 | N | N |
| Q396BRNPSU | 230 | 40.0 | NYSEG | 7.6 | N | N |
| Q505\_POI | 230 | 50.0 | N. Grid | 8.7 | N | N |
| Q545A\_DYSING | 345 | 50.0 | TransCo | 22.0 | N | N |
| Q545A\_ESTSTO | 345 | 50.0 | TransCo | 8.9 | N | N |
| Q545A\_PAR | 345 | 50.0 | TransCo | 9.5 | N | N |
| Q546\_230\_TRA | 230 | 40.0 | N. Grid | 8.8 | N | N |
| Q556 NS66K | 345 | 50.0 | N. Grid | 37.9 | N | N |
| Q556 Rott345 | 345 | N/A[[3]](#footnote-3) | N. Grid | 25.5 | N | N |
| Q556\_Prince | 345 | N/A3 | N. Grid | 30.5 | N | N |
| RAINEY | 345 | 63.0 | Con Ed | 57.2 | N | N |
| RAMAPO | 345 | 63.0 | Con Ed | 44.1 | N | N |
| REYNOLDS | 345 | 39.0 | N. Grid | 15.1 | N | N |
| REYNOLDS RD | 115 | 63.0 | N. Grid | 40.3 | N | N |
| RIVERHD | 138 | 63.0 | LIPA | 17.2 | N | N |
| RNKNKOMA | 138 | 63.0 | LIPA | 35.8 | N | N |
| ROBINSON RD. | 230 | 43.1 | NYSEG | 13.8 | N | N |
| ROBINSON RD. | 115 | 37.9 | NYSEG | 17.6 | N | N |
| ROBINSON RD. | 34.5 | 21.9 | NYSEG | 8.8 | N | N |
| ROCK TAV | 115 | 39.6 | CH | 25.2 | N | N |
| ROCK TAVERN | 345 | 63.0 | CH | 34.1 | N | N |
| Roseton | 345 | 63.0 | CH | 38.3 | N | N |
| ROSLYN | 138 | 63.0 | LIPA | 29.1 | N | N |
| ROTTERDAM66H | 230 | 39.0 | N. Grid | 11.1 | N | N |
| ROTTERDAM77H | 230 | 23.0 | N. Grid | 11.1 | N | N |
| ROTTERDAM99H | 230 | 23.0 | N. Grid | 11.1 | N | N |
| RULND RD | 138 | 63.0 | LIPA | 43.6 | N | N |
| Ryan | 230 | 40.0 | NYPA | 10.8 | N | N |
| S OSWEGO | 115 | 37.0 | N. Grid | 20.8 | N | N |
| S RIPLEY | 230 | 40.0 | N. Grid | 9.0 | N | N |
| S013A | 115 | 37.6 | RGE | 25.8 | N | N |
| S080 345kV | 345 | 40.0 | RGE | 19.9 | N | N |
| S080 922 | 115 | 40.0 | RGE | 16.9 | N | N |
| S082 B2 | 115 | 40.0 | RGE | 37.4 | N | N |
| S082 B3 | 115 | 40.0 | RGE | 37.3 | N | N |
| S122 | 345 | 40.0 | RGE | 18.3 | N | N |
| S122 B1 | 115 | 50.0 | RGE | 33.1 | N | N |
| S255 | 345 | 63.0 | RGE | 19.7 | N | N |
| S255 | 115 | 40.0 | RGE | 22.0 | N | N |
| SCHUYLER | 115 | 23.0 | N. Grid | 15.0 | N | N |
| SCRIBA | 345 | 54.0 | N. Grid | 46.4 | N | N |
| SCRIBA C | 115 | 40.0 | N. Grid | 10.5 | N | N |
| SCRIBA D | 115 | 40.0 | N. Grid | 10.4 | N | N |
| SECT 11 | 138 | 63.0 | Con Ed | 42.7 | N | N |
| SECT 12 | 138 | 63.0 | Con Ed | 42.7 | N | N |
| SHORE RD | 345 | 63.0 | LIPA | 28.9 | N | N |
| SHORE RD1 | 138 | 57.8 | LIPA | 46.8 | N | N |
| SHORE RD2 | 138 | 57.8 | LIPA | 46.7 | N | N |
| SHOREHAM1 | 138 | 63.0 | LIPA | 27.2 | N | N |
| SHOREHAM2 | 138 | 63.0 | LIPA | 27.2 | N | N |
| SILLS RD1 | 138 | 63.0 | LIPA | 31.5 | N | N |
| SMAH | 138 | 40.0 | RECO | 25.3 | N | N |
| SPRAINBROOK | 345 | 63.0 | Con Ed | 60.0 | N | N |
| ST LAWRN 115 | 115 | 40.6 | NYPA | 38.8 | N | N |
| ST LAWRN 230 | 230 | 32.4 | NYPA | 32.2 | N | N |
| STOLLE | 115 | 23.9 | NYSEG | 19.8 | N | N |
| STOLLE ROAD | 345 | 40.0 | NYSEG | 8.8 | N | N |
| STOLLE ROAD | 230 | 40.0 | NYSEG | 13.7 | N | N |
| STONEYRIDGE | 230 | 40.0 | NYSEG | 8.0 | N | N |
| STONY CREEK | 230 | 40.0 | NYSEG | 9.3 | N | N |
| SUGLF 345TAP | 345 | 63.0 | CH | 25.6 | N | N |
| SYOSSET | 138 | 63.0 | LIPA | 33.0 | N | N |
| Teall A | 115 | 39.0 | N. Grid | 26.9 | N | N |
| Teall B | 115 | 39.0 | N. Grid | 26.9 | N | N |
| TERMINAL | 115 | 23.0 | N. Grid | 16.0 | N | N |
| VALLEY | 115 | 39.0 | N. Grid | 8.3 | N | N |
| VERNON-E | 138 | 63.0 | Con Ed | 45.5 | N | N |
| VERNON-W | 138 | 63.0 | Con Ed | 32.7 | N | N |
| VLY STRM1 | 138 | 63.0 | LIPA | 54.9 | N | N |
| VLY STRM2 | 138 | 63.0 | LIPA | 55.1 | N | N |
| VOLNEY | 345 | 45.0 | N. Grid | 36.5 | N | N |
| W 49 ST | 345 | 63.0 | Con Ed | 54.1 | N | N |
| WADNGRV1 | 138 | 56.4 | LIPA | 25.1 | N | N |
| WATERCURE230 | 230 | 40.0 | NYSEG | 14.4 | N | N |
| WATERCURE345 | 345 | 40.0 | NYSEG | 9.4 | N | N |
| WATKINS | 115 | 39.0 | N. Grid | 8.4 | N | N |
| Wethersfield | 230 | 40.0 | NYSEG | 9.1 | N | N |
| WHAV | 138 | 40.0 | O&R | 29.2 | N | N |
| WILDWOOD | 138 | 63.0 | LIPA | 27.0 | N | N |
| WILLIS 230 | 230 | 40.0 | NYPA | 13.5 | N | N |
| WOOD ST. | 115 | 40.0 | NYSEG | 19.7 | N | N |
| WOODARD | 115 | 23.0 | N. Grid | 15.6 | N | N |
| YAHNUNDASIS | 115 | 16.0 | N. Grid | 6.6 | N | N |

## 2020 RNA Transmission Security Violations

The NYISO identified Reliability Needs resulting from the transmission security evaluations. The transmission security Reliability Needs include both thermal loading criteria violations on the BPTF as well as dynamic stability criteria violations. For thermal loading, several 345 kV circuits in the Con Edison service territory are overloaded under N-1-1 conditions beginning in year 2025 and increasing through 2030. Additionally, the Con Edison 345 kV system has 345 kV circuit overloads under N-1-1-0 conditions beginning in 2025 and increasing through 2030. For N-1-1, Figure 24 shows the state transmission security violations for the top 10 contingency combinations. For N-1-1-0, Figure 25 only reports the controlling contingency combination of the loss of Ravenswood 3 followed by Dunwoodie – Mott Haven (72) 345 kV.

The NYISO observed dynamic stability criteria Reliability Needs for the entire study period. The criteria violations include transient voltage response violations and loss of generator synchronism. The transient voltage response violations are primarily in the Con Edison area but extend into areas adjacent to their service territory. The loss of generator synchronism is observed in generators within or near the Astoria and Greenwood load pockets, and is primarily driven by the delayed voltage recovery in the local area. Figure XX shows the contingency events resulting in loss of generator synchronism as well as the buses with transient voltage response violations.

Figure 31: Transmission Security N-1-1 Violations of the 2020 RNA Base Case

| Transmission Security N-1-1 Violations of the 2020 RNA Base Case | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Zone | Owner | Monitored Element | Normal Rating (MVA) | Contingency Rating  (MVA) | 1st Contingency | 2nd Contingency | 2025 Summer Peak Flow (%) | 2030 Summer Peak Flow (%) |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Sprainbrook-Dunwoodie 345 kV (W75) | Tower F38 & F39 | - | 112 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Loss of Ravenswood 3 | Stuck breaker at W 49th St 5 | - | 104 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Loss of Astoria Energy 2 | Stuck breaker at W 49th St 5 | - | 103 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Bayonne-Gowanus 345 kV (G27) | Stuck breaker at W 49th St 5 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Loss of Bayonne | Stuck breaker at W 49th St 5 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Farragut-Gowanus 345 kV (42) | Stuck breaker at Sprainbrook RS4 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Dunwoodie-Mott Haven 345 kV (71) | Stuck breaker at Sprainbrook RS4 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Dunwoodie-Mott Haven 345 kV (72) | Stuck breaker at Sprainbrook RS4 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Loss of Ravenswood 3 | Stuck breaker at Sprainbrook RS4 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Loss of Astoria Energy 2 | Stuck breaker at Sprainbrook RS4 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | Sprainbrook-Dunwoodie 345 kV (W75) | Tower F38 & F39 | - | 112 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | Farragut-Gowanus 345 kV (42) | Stuck breaker at Sprainbrook RS5 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | Dunwoodie-Mott Haven 345 kV (71) | Stuck breaker at Sprainbrook RS5 | - | 102 |
| J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | Dunwoodie-Mott Haven 345 kV (72) | Stuck breaker at Sprainbrook RS5 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | Loss of Ravenswood 3 | Stuck breaker at Sprainbrook RS5 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | Loss of Astoria Energy 2 | Stuck breaker at Sprainbrook RS5 | - | 102 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | Bayonne-Gowanus 345 kV (G27) | Stuck breaker at Sprainbrook RS5 | - | 101 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | Loss of Bayonne | Stuck breaker at Sprainbrook RS5 | - | 101 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | - | - | - | - |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | - | - | - | - |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Loss of Ravenswood 3 | Dunwoodie-Mott Haven 345 kV (72) | 110 | 118 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Loss of Ravenswood 3 | Stuck breaker at Mott Haven 7 | 110 | 118 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Loss of Ravenswood 3 | Stuck breaker at Mott Haven 3 | 110 | 118 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Loss of Ravenswood 3 | Stuck breaker at Dunwoodie 8 | 107 | 115 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Dunwoodie-Mott Haven 345 kV (72) | Loss of Ravenswood 3 | 109 | 114 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Dunwoodie-Shore Road 345 kV (Y50) | Stuck breaker at Dunwoodie 7 | - | 104 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Freshkills 345/138 kV (TB1) | Dunwoodie-Mott Haven 345 kV (72) | - | 102 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Freshkills 345/138 kV (TB1) | Stuck breaker at Mott Haven 3 | - | 102 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Freshkills 345/138 kV (TB1) | Stuck breaker at Mott Haven 7 | - | 102 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Bayonne-Gowanus 345 kV (G27) | Dunwoodie-Mott Haven 345 kV (72) | - | 102 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Loss of Bayonne | Dunwoodie-Mott Haven 345 kV (72) | - | 102 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Sprainbrook-W 49th St 345 kV (51) | Stuck breaker at Sprainbrook RS4 | 101 | 101 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Sprainbrook-W 49th St 345 kV (52) | Stuck breaker at Sprainbrook RS5 | 101 | 101 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Loss of Ravenswood 3 | Dunwoodie-Mott Haven 345 kV (71) | 108 | 116 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Loss of Ravenswood 3 | Stuck breaker at Mott Haven BTE | 108 | 116 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Loss of Ravenswood 3 | Stuck breaker at Mott Haven 2 | 108 | 116 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Dunwoodie-Mott Haven 345 kV (71) | Loss of Ravenswood 3 | 108 | 114 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Loss of Ravenswood 3 | Stuck breaker at Dunwoodie 3 | 105 | 113 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Dunwoodie-Shore Road 345 kV (Y50) | Stuck breaker at Dunwoodie 5 | - | 103 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Dunwoodie-Mott Haven 345 kV (71) | Stuck breaker at Sprainbrook RS4 | - | 102 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Dunwoodie-Mott Haven 345 kV (71) | Stuck breaker at Sprainbrook RS5 | - | 102 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Freshkills 345/138 kV (TB1) | Dunwoodie-Mott Haven 345 kV (71) | - | 101 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Freshkills 345/138 kV (TB1) | Stuck breaker at Mott Haven BTE | - | 101 |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (72) | 785 | 925 | Freshkills 345/138 kV (TB1) | Stuck breaker at Mott Haven 2 | - | 101 |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | Mott Haven-Rainey 345 kV (Q11) | Loss of Ravenswood 3 | - | 108 |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey West 345 kV (Q12) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | Mott Haven-Rainey 345 kV (Q12) | Loss of Ravenswood 3 | - | 108 |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | Loss of Ravenswood 3 | Stuck breaker at Rainey 4W | - | 101 |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | Loss of Ravenswood 3 | Stuck breaker at Rainey 7W | - | 101 |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | - | - | - | - |
| J | ConEd | Mott Haven-Rainey East 345 kV (Q11) | 785 | 925 | - | - | - | - |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Loss of Ravenswood 3 | Stuck Breaker at Goethals 5 | 102 | 130 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Loss of Ravenswood 3 | Gowanus - Goethals 345 kV (25) | - | 128 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Loss of Ravenswood 3 | Stuck Breaker at Goethals 3 | - | 128 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Loss of Ravenswood 3 | Stuck Breaker at Goethals 9 | - | 127 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Loss of Ravenswood 3 | Stuck Breaker at Gowanus 6 | - | 114 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Sprainbrook-W 49th St 345 kV (51) | Stuck Breaker at Goethals 5 | - | 110 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Sprainbrook-W 49th St 345 kV (52) | Stuck Breaker at Goethals 5 | - | 110 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Sprainbrook-W 49th St 345 kV (51) | Stuck Breaker at Goethals 3 | - | 108 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Sprainbrook-W 49th St 345 kV (52) | Stuck Breaker at Goethals 3 | - | 108 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Sprainbrook-W 49th St 345 kV (51) | Gowanus - Goethals 345 kV (25) | - | 108 |
| J | ConEd | Goethals-Gowanus 345 kV (26) | 518 | 738 | Sprainbrook-W 49th St 345 kV (52) | Gowanus - Goethals 345 kV (25) | - | 108 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Loss of Ravenswood 3 | Gowanus - Goethals 345 kV (26) | 103 | 130 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Loss of Ravenswood 3 | Stuck Breaker at Goethals 8 | 102 | 130 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Sprainbrook-W 49th St 345 kV (51) | Gowanus - Goethals 345 kV (26) | 101 | 111 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Sprainbrook-W 49th St 345 kV (52) | Gowanus - Goethals 345 kV (26) | 101 | 111 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Sprainbrook-W 49th St 345 kV (51) | Stuck Breaker at Goethals 8 | - | 110 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Sprainbrook-W 49th St 345 kV (52) | Stuck Breaker at Goethals 8 | - | 110 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Dunwoodie-Mott Haven 345 kV (72) | Gowanus - Goethals 345 kV (26) | - | 107 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Dunwoodie-Mott Haven 345 kV (72) | Stuck Breaker at Goethals 8 | - | 107 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Dunwoodie-Mott Haven 345 kV (71) | Gowanus - Goethals 345 kV (26) | - | 106 |
| J | ConEd | Goethals-Gowanus 345kV (25) | 518 | 738 | Dunwoodie-Mott Haven 345 kV (71) | Stuck Breaker at Goethals 8 | - | 105 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Loss of Ravenswood 3 | Tower W89 & W90 | 106 | 109 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Dunwoodie-Mott Haven 345 kV (71) | Tower W89 & W90 | - | 105 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Dunwoodie-Mott Haven 345 kV (72) | Tower W89 & W90 | - | 105 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Freshkills 345/138 kV (TB1) | Tower W89 & W90 | - | 105 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Gowanus 345/138 kV (14TR) | Tower W89 & W90 | - | 104 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Sprainbrook-W 49th St 345 kV (51) | Tower W89 & W90 | - | 104 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Sprainbrook-W 49th St 345 kV (52) | Tower W89 & W90 | - | 104 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Bayonne-Gowanus 345 kV (G27) | Tower W89 & W90 | - | 104 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Loss of Bayonne | Tower W89 & W90 | - | 104 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (N7) | 366 | 423 | Freshkills 345/138 kV (TA1) | Tower W89 & W90 | - | 104 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Loss of Ravenswood 3 | Tower W89 & W90 | 103 | 107 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Farragut-Gowanus 345 kV (42) | Tower W89 & W90 | - | 106 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Sprainbrook-W 49th St 345 kV (51) | Tower W89 & W90 | - | 105 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Sprainbrook-W 49th St 345 kV (52) | Tower W89 & W90 | - | 105 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Bayonne-Gowanus 345 kV (G27) | Tower W89 & W90 | - | 105 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Loss of Bayonne | Tower W89 & W90 | - | 105 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Gowanus 345/138 kV (14TR) | Tower W89 & W90 | - | 104 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Freshkills 345/138 kV (TA1) | Tower W89 & W90 | - | 103 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Dunwoodie-Shore Road 345 kV (Y50) | Tower W89 & W90 | - | 102 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Dunwoodie-Mott Haven 345 kV (71) | Tower W89 & W90 | - | 102 |
| I | ConEd | Sprainbrook/Dunwoodie 345/138 kV (S6) | 309 | 438 | Dunwoodie-Mott Haven 345 kV (72) | Tower W89 & W90 | - | 102 |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | Loss of Ravenswood 3 | Sprainbrook/Dunwoodie 345/138 kV (N7) | - | 106 |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | Loss of Ravenswood 3 | Stuck breaker at Sprainbrook RN3 | - | 106 |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | Loss of Ravenswood 3 | Stuck breaker at Sprainbrook RN4 | - | 106 |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | Loss of Ravenswood 3 | Stuck breaker at Sprainbrook RN5 | - | 106 |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | Loss of Ravenswood 3 | Stuck breaker at Sprainbrook RN6 | - | 106 |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | - | - | - | - |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | - | - | - | - |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | - | - | - | - |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | - | - | - | - |
| I | ConEd | Dunwoodie 345/138 kV (W73) | 310 | 388 | - | - | - | - |

Figure 32: Transmission Security N-1-1-0 Violations of the 2020 RNA Base Case

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Transmission Security N-1-1-0 Violations of the 2020 RNA Base Case | | | | | | | | |
| Zone | Owner | Monitored Element | Normal Rating (MVA) | Contingency Rating  (MVA) | 1st Contingency | 2nd Contingency | 2025 Summer Peak Flow (%) | 2030 Summer Peak Flow (%) |
| I/J | ConEd | Dunwoodie-Mott Haven 345 kV (71) | 785 | 925 | Loss of Ravenswood 3 | Dunwoodie-Mott Haven 345 kV (72) | 132 | 149 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (51) | 844 | 1029 | Loss of Ravenswood 3 | Dunwoodie-Mott Haven 345 kV (72) | - | 106 |
| I/J | ConEd | Sprainbrook-W49th St 345 kV (52) | 844 | 1029 | Loss of Ravenswood 3 | Dunwoodie-Mott Haven 345 kV (72) | - | 106 |

# Appendix E – Additional Exploratory Scenario Analysis

Additional to the scenarios described in the body of the RNA report, the NYISO performed two exploratory scenarios:

1. Further Simplified External Areas Model - Resource Adequacy only

* Starting with the simplified external model described in footnote 8 and also in the assumptions matrix in Appendix D, the NYISO removed all load and generation from external areas along with removing interfaces between external areas, followed by inserting fixed amounts of capacity in each external area.

1. Different Load Shape - Resource Adequacy only
   * The Resource Adequacy Base Cases use historical load shapes from 2002, 2006, and 2007. The Climate Change Phase 1 study developed forward-looking hourly load shapes. This exploratory scenario identified that additional collaboration with the Load Forecast Task Force and other stakeholders will be initiated, to identify if and how future-looking load shapes would better represent an ever-changing system.

## Further Simplified External Areas Model

During the 2020 RNA, the External Areas Model for the RNA Base Case was simplified to consolidate five PJM (mid-Atlantic) areas into a single area and eight ISO-NE areas into a single area.

This further simplified scenario evaluates an alternative model for the external, non-NYCA, regions in the MARS model. Starting in this RNA, the NYISO simplified the representation of each external region so that they are represented by a single area, as shown in Figure 25 in the main report. This scenario expands on this work by evaluating if additional simplifications to the external region model can be made while maintaining consistent results.

To achieve this objective, the NYISO performed the following actions in each external region to simplify the representation and to model a system in which the NYCA receives no emergency assistance:

* Removing all load and generation from each external region;
* Remove pool-to-pool ties between external regions; and
* Disable the ability of UDRs to return from the host external region, while still allowing emergency assistance over the interface if the resource is otherwise unavailable.

With the baseline set, the NYISO evaluated the impact of adding fixed, always-available capacity resources to each of the external regions. This analysis revealed the NYCA LOLE was not particularly sensitive to capacity additions in any one region (*e.g.,* adding 600 MW in New England yielded a similar result to adding 600 MW in Ontario), subject to transfer limit constraints (*e.g.,* New England could not provide more than 1,400 MW total).

The next phase of this analysis evaluated the impact of modeling discrete capacity combinations in each external region, as shown in Figure 33. For low levels of total assistance, the results aligned with the single area adjustments previously discussed (*i.e.,* the 1,200 MW cumulative result was similar to adding 1,200 MW to PJM or New England). Figure 33 also includes the observed NYCA LOLE for 2030, when compared to the Base Case results (0.186), between 2,400 and 2,700 MW of always-available assistance replace the external model. The amount of assistance needed through time increased. See Figure 34, showing the 2024 Base Case result (0.016) using between 1,800 and 2,100 MW of assistance.

Figure 33: Amount of Assistance Needed in the Simulation through Time



Figure : NYCA LOLE Response to Emergency Assistance

The next, and final, phase of this exploratory analysis was to apply derates to the amount of available emergency assistance based upon the Area K load, as a proxy for NYCA Load. The derates were applied by utilizing MARS functionality for ambient temperature derates to thermal units. This approach allows for the simplified model to mimic the original model by having potentially less assistance available in the higher load levels. Two derate profiles were tested, shown in Figure 35, on the 2,400, 2,700, and 3,000 MW assistance cases Figure 36 to Figure 38, respectively.

Figure 35: Emergency Assistance Profiles Tested

Figure 36: Base Emergency Assistance Level: 2400 MW

Figure 37: Base Emergency Assistance Level: 2700 MW

Figure 38: Base Emergency Assistance Level: 3000 MW

The NYISO intends to continue refining this analysis with discussion at the Electric System Planning Working Group and other stakeholder forums, as applicable in order to determine potential changes.

## Different Load Shape - Resource Adequacy only

The Resource Adequacy Base Cases use historical shapes from 2002, 2006, and 2007, a practice established in the 2014 RNA. These shapes were selected to represent differing weather conditions, 2006 for extreme hot weather, 2002 for consistent but not extreme weather, and 2007 for typical weather. These shapes are aligned with the load forecast uncertainly levels, 2006 associated with the highest, 2002 with the second highest, and 2007 associated with the remaining uncertainty levels. Prior to the 2014 RNA, resource adequacy analysis was performed using only the 2002 reference shape.

In 2019, the NYISO engaged in the Climate Change Phase 1 Study to develop a set of future-looking hourly load shapes considering various energy efficiency and climate goals. The outputs from the Phase 1 study feeds into the Phase 2 study, which is analyzing reliability impact issues with a potential 2040 power system. The NYISO will continue to explore building on the work from the Climate Change studies for application in future resource adequacy analysis, and intends to collaborate with the Load Forecasting Task Force and other stakeholders forums, as applicable in order to determine potential changes to be studied.

# Appendix F - Historic Congestion

Appendix A of Attachment Y of the OATT states:

*As part of its CSPP, the ISO will prepare summaries and detailed analysis of historic and projected congestion across the NYS Transmission System. This will include analysis to identify the significant causes of historic congestion in an effort to help Market Participants and other interested parties distinguish persistent and addressable congestion from congestion that results from onetime events or transient adjustments in operating procedures that may or may not recur. This information will assist Market Participants and other stakeholders to make appropriately informed decisions.*

The historic congestion information can be found on the NYISO website:

<https://www.nyiso.com/ny-power-system-information-outlook> (Congested Elements Reports)

Also, information on the NYISO’s Economic Planning Studies can be found here:

<https://www.nyiso.com/library> (Planning Reports, Economic Planning Studies (CARIS))

1. NREL’s PVWatts Calculator, credit of the U.S. Department of Energy (DOE)/NREL/Alliance (Alliance for Sustainable Energy, LLC). [↑](#footnote-ref-1)
2. Future station with no LCB rating yet. [↑](#footnote-ref-2)
3. Future station with no LCB rating yet. [↑](#footnote-ref-3)