2022 RNA MARS (Resource Adequacy) Assumptions Matrix

#	Parameter	2020 RNA *(2020 GB)* Study Period: 2024 (y4) -2030 (y10)	2021-2030 CRP and 2021 Q2 STAR *(2020 GB updated as applicable)* Study Period: 2024-2030 and 2021(y1) -2025 (y5), respectively	2022 Q1 STAR **and** 2021 Q3 / Q4 STAR (2021 GB updated as applicable) Study Periods: 2022 (y1)-2026-2027 (y5)	2022 RNA **(2022 Gold Book)** Study Period: y4 (2026)-y10 (2032)
Key Assumptions and Reports					
1	**Links to Key Assumptions Presentations and Final Reports**	2020 RNA Report and Appendices, final as of November 2020:	2021-2030 CRP Report, final as of December 2, 2021. 2021-2030 CRP Appendices	**2022 Q1 STAR key assumptions** presented at the Jan 25, 2022 ESPWG [link] **2021 Q4 STAR key assumptions** presented at the Oct 23, 2021 ESPWG [link] **2021 Q3 STAR key assumptions** presented at the July 23, 2021 ESPWG [link] **Final STAR Reports: [link]**	March 1 **TPAS/ESPWG**: preliminary schedule March 24 **LFTF/ESPWG/TPAS:** Load Forecast, New Load Shapes, Scenarios April 1 TPAS/ESPWG: resource adequacy assumptions matrix, including preliminary topology, Inclusion Rules application April 21 LFTF: load forecast uncertainty presentation (LFU) April 26 **ESPWG/TPAS:** updated inclusion rules, updated scenarios, updated schedule May 5 TPAS/ESPWG and May 23 ESPWG/TPAS: RPP Manual and modeling improvements June 23 OC**:** RPP Manual redline for OC approval

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Load Parameters					
1	**Peak** Load Forecast	Adjusted 2020 Gold Book NYCA baseline peak load forecast. The GB 2020 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.	Adjusted NYCA baseline peak load forecast based on the November 19, 2020 Load Forecast Update. Reference: Nov 19, 2020 ESPWG/LFTF/TPAS presentation: [link] Same method.	Adjusted 2021 Gold Book NYCA baseline peak load forecast. It includes five large loads from the queue, with forecasted impacts. **Note**: the large loads forecast was updated in January 2022 and captured in the 2022 Q2 STAR models. The GB 2021 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.	Adjusted 2022 Gold Book NYCA baseline peak load forecast. It includes five large loads from the NYISO interconnection queue, with forecasted impacts. The GB 2022 baseline peak load forecast includes the impact (reduction) of behind-the-meter (BtM) solar at the time of NYCA peak. For the BtM Solar adjustment, gross load forecasts that include the impact of the BtM generation will be used for the 2022 RNA, as provided by the Demand Forecasting Team , which then allows for a discrete modeling of the BtM solar resources using 5 years of inverter data.
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: Load Bin 1: 2006 Load Bin 2: 2002 Load 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. Calculated an average 8,760h MW shape based on the 5 years of historical production data to	Same	Same method	**New Load Shapes** *(see March 24 LFTF/ESPWG):* Used Multiple Load Shape MARS Feature 8,760-hour historical gross load shapes were used as base shapes for LFU bins: Load Bins 1 and 2: 2013 Load Bins 3 and 4: 2018 Load Bins 5 to 7: 2017 Peak adjustments on a seasonal basis. For the BtM Solar adjustment, gross load forecasts that include the impact of the BtM generation will be used for the 2022 RNA, as provided by the Demand Forecasting Team

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		determine gross load forecast values.			
3	Load Forecast Uncertainty (LFU) The LFU model captures the impacts of weather conditions on future loads.	2020 LFU Updated via Load Forecast Task Force (LFTF) process. Reference: April 13, 2020, LFTF presentation: [link]	Same	Updated LFU values resulted from bin structure method change in representing the load bins (*i.e.*, using 'equal area' instead of 'equal distance' for Zscore calculation) Additional details: May 24, 2021, LFTF presentation: [link]	Same method Updated LFU values, *(as presented at the April 21, 2022 LFTF)*
Generation Parameters					
1	**Existing** Generating Unit Capacities (*e.g., thermal units, large hydro)*	2020 Gold Book values. Use summer min (DMNC vs. CRIS). Use winter min (DMNC vs. CRIS). Adjusted for RNA inclusion rules. Note: Units with CRIS rights and 0 DMNC are modeled at 0 MW	Same	Same method	Same method
2	**Proposed New Units Inclusion** Determination	GB2020 with Inclusion Rules Applied	Same method	Same method	Same method *See April 26, 2022 TPAS/ESPWG*
3	Retirement, Mothballed Units, IIFO	GB2020 with Inclusion Rules Applied	Same method	Same method	Same method *See April 26, 2022 TPAS/ESPWG*
4	Forced and Partial Outage Rates (*e.g., thermal units, large hydro)*	Five-year (2015-2019) 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.	Same	Same method	Same method

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		For new units or units that are in service for less than three years, NERC 5-year class average EFORd data are used.			
5	Planned Outages	Based on schedules received by the NYISO and adjusted for history	Same	Same method with updated data	Same method with updated data
6	Fixed and Unplanned Maintenance	Scheduled maintenance from operations. Unplanned maintenance based on GADS data average maintenance time – average time in weeks is modeled.	Same	Same method	Same method
7	Summer Maintenance	None	None	None	None
8	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.	Same	Same method	Same method
8	Existing Landfill Gas (LFG) Plants	Actual hourly plant output over the period 2015-2019. Program randomly selects an LFG shape of hourly production over the 2015-2019 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.	Same	Same method	Same method

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9	Existing **Wind** Units (>5 years of data)	Actual hourly plant output over the period 2015-2019. Probabilistic model is incorporated based on five years of input shapes with one shape per replication being randomly selected in Monte Carlo process.	Same	Same method	Same method
10	Existing **Wind** Units (<5 years of data)	For existing data, the actual hourly plant output over the period 2016-2020 is used. For missing data, the nameplate normalized average of units in the same load zone is scaled by the unit's nameplate rating.	Same	Same method	Same method
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.	Same	Same method	Same method
11b	Proposed **Offshore Wind** Units	None passed inclusion rules	Same	None passed inclusion rules	Inclusion Rules Applied to determine the generator status. Power curves based on 2008-2012 NREL from 3 different sites: NY Harbor, LI Shore, LI East, and GE updates of the NREL curves reflecting derates.
12a	Existing **Utility-scale Solar Resources**	Inclusion Rules Applied to determine the generator status. Probabilistic model chooses from 5 years of production data output shapes covering the period 2015-2019 (one shape per replication is randomly selected in Monte Carlo process.)	Same	Same method	Same method

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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.	Same	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. For new units in zones that do not yet have existing solar plants: model based on the BtM solar profiles from that zone	Same method
13	Projected **BtM Solar Resources**	Will use 5-year of inverter production data and apply the Gold Book energy forecast. 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 TPAS/ESPWG meeting materials	Same method	Same method	**Supply side:** Five years of 8,760 hourly MW profiles based on sampled inverter data The MARS random shape mechanism is used: one 8,760 hourly shape (of five) is randomly picked for each replication year. Similar with the past planning modeling and aligns with the method used for wind, utility solar, landfill gas, and run-of-river facilities. **Load side:** Gross load forecasts will be used for the 2022 RNA, as provided by the forecasting group.
14	Existing **BTM-NG Program**	These are former load modifiers to sell capacity into the ICAP market. Modeled as cogen type 1 (or type 2 as applicable) unit in MARS. Unit capacity set to CRIS value, load modeled with weekly pattern that can change monthly.	Same	Same method	Same method

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15	Existing **Small Hydro** Resources (*e.g.*, run-of-river)	Actual hourly plant output over the past 5 years period (i.e., 2015-2019). 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.	Same	Same method	Same method
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 (2015-2019). Methodology consistent with thermal unit transition rates.	Same	Same method	Same method
17	Proposed front-of-meter **Battery Storage**	None passed inclusion rules Behind-the-meter impacts at peak demand are captured in the baseline load forecast.	Same	Inclusion Rules: none passed Behind-the-meter impacts at peak demand are captured in the baseline load forecast.	GE MARS ES model is used. Units are given a maximum capacity, maximum stored energy, and a dispatch window.

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18	Existing Energy Limited Resources (**ELRs)**	N/A	Existing gens' elections were made by August 1st of each year and are incorporated into the model as hourly shapes consistent with operational capabilities. Resource output is aligned with the NYISO's peak load window when most loss-of-load events are expected to occur.	Same method	**New method:** GE developed MARS functionality to be used for ELRs. Resource output is aligned with the NYISO's peak load window when most loss-of-load events are expected to occur.
Transaction – Imports/ Exports					
1	Capacity Purchases	Grandfathered Rights and other awarded long-term rights Modeled using MARS explicit contracts feature.	Same	Same method	Same method
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	Same	Same method	Same method

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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	Same	Same method	Same method
4	UDRs	Updated with most recent elections/awards information (VFT, HTP, Neptune, CSC)	Same	Same method	Same method Added CHPE HTP (from Hydro Quebec into Zone J) at 1250 MW (summer) starting 2026
5	External Deliverability Rights (EDRs)	**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 ESPWG/TPAS 2. April 6, 2020 TPAS/ESPWG	Same	Same	Same
6	Wheel-Through Contract	**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.	Same	Same	Same

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MARS Topology: a simplified bubble-and-pipe representation of the transmission system					
1	Interface Limits	Developed by review of previous studies and specific analysis during the RNA study process.	Same	Same method	Same method
2	New Transmission	Based on TO- provided firm plans (via Gold Book 2020 process) and proposed merchant transmission; inclusion rules applied.	Same	Same method	Same method
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.	Same	Same method	Same method
4	UDR unavailability	Five-year history of forced outages	Same	Same method	Same method
5	Other		Topology changes implemented due to the Post-RNA (CRP) Base Case updates [link]: 1. ConEdison's LTP updates January 23, 2021 ESPWG [link] 2. Status change of seven ConEdison Series Reactors proposed as backstop solution to the 2020 Q3 STAR needs solicitation: [link] 3. 2021 Q2 STAR key assumptions: [link]	MARS topologies below reflect updated Western NY interfaces to account for the large loads impacts; and updates to align with the 2021 Operations Studies.	Preliminary topology below Topology changes summary, as compared with the 2021-2030 CRP MARS topology: 1. Dysinger East and Group A limits decreased to reflect Large Loads in western NY (as forecasted in the 2022 Gold Book Table I-14 [link] 2. West Central reverse emergency thermal limits increased mainly due to a rating increase on a limiting element – also as identified in the 2022 Operating Study 3. Ontario – NY updated per input from Ontario ISO 4. Added 1,250 MW (May through October) related with the HVDC from Quebec to New York City

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					(Champlain Hudson project) starting 2026 5. Updated Long Island limits per PSEG-Long Island's input 6. Updated UPNY-ConEd to align with around 300 MW smaller delta associated in the 2021 Operations UPNY-ConEd Voltage Study with the status of the M51, M52, 71, 72 Series Rectors (assumed in service for this RNA)
Emergency Operating Procedures (EOPs): Special Case Resources (SCRs) (Load and Generator) 5% Manual Voltage Reduction 30-Minute Operating Reserve to Zero 5% Remote Controlled Voltage Reduction Voluntary Load Curtailment Public Appeals Emergency Assistance from External Areas 10-Minute Operating Reserve to Zero					
1	Special Case Resources (SCR)	SCRs sold for the program discounted to historic availability ("effective capacity"). Monthly variation based on historical experience. Summer values calculated from the latest available July registrations, held constant for all years of study. **15 calls/year** Note: also, combined the two SCR steps (generation and load zonal MW)	Same method Based on the July 2020 SCR enrollment	Same method Based on the July 2021 SCR enrollment	Same method Based on the July 2021 SCR enrollment

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2	EDRP Resources	Not modeled: the values are less than 2 MW.	Same	Same	Same
3	Operating Reserves	655 MW 30-min reserve to zero 1,310 MW 10-min reserve to zero	Same	Same	Updated per NYISO's recommendation (approved at the May 4, 2022 NYSRC ICS [link]) to maintain (or no longer deplete/use) 350 MW of the 1,310 MW 10-min operating reserve at the applicable EOP step. Therefore, the 10-min operating reserve MARS EOP step will use, as needed each MARS replication: 960 MW (=1,310 MW – 350 MW)
4	Other EOPs *e.g., manual voltage reduction, voltage curtailments, public appeals, external assistance, as listed above*	Based on TO information, measured data, and NYISO forecasts	Same Used 2020 elections, as available	Same method Used 2021 elections, as available	Same method Used 2022 elections, as available
External Control Areas • The top three summer peak load days of an external Control Area is modeled as coincident with the NYCA top three peak load days. • Load and capacity fixed through the study years. • EOPs are not represented for the external Control Area capacity models. • External Areas adjusted to be between 0.1 and 0.15 days/year LOLE • Implemented a statewide emergency assistance (from the neighboring systems) limit of 3500 MW					
1	PJM	Simplified model: The 5 PJM MARS areas (bubbles) were consolidated into one	Same	Same method	Same method
2	ISONE	Simplified model: The 8 ISO-NE MARS areas (bubbles) were consolidated into one	Same	Same method	Same method

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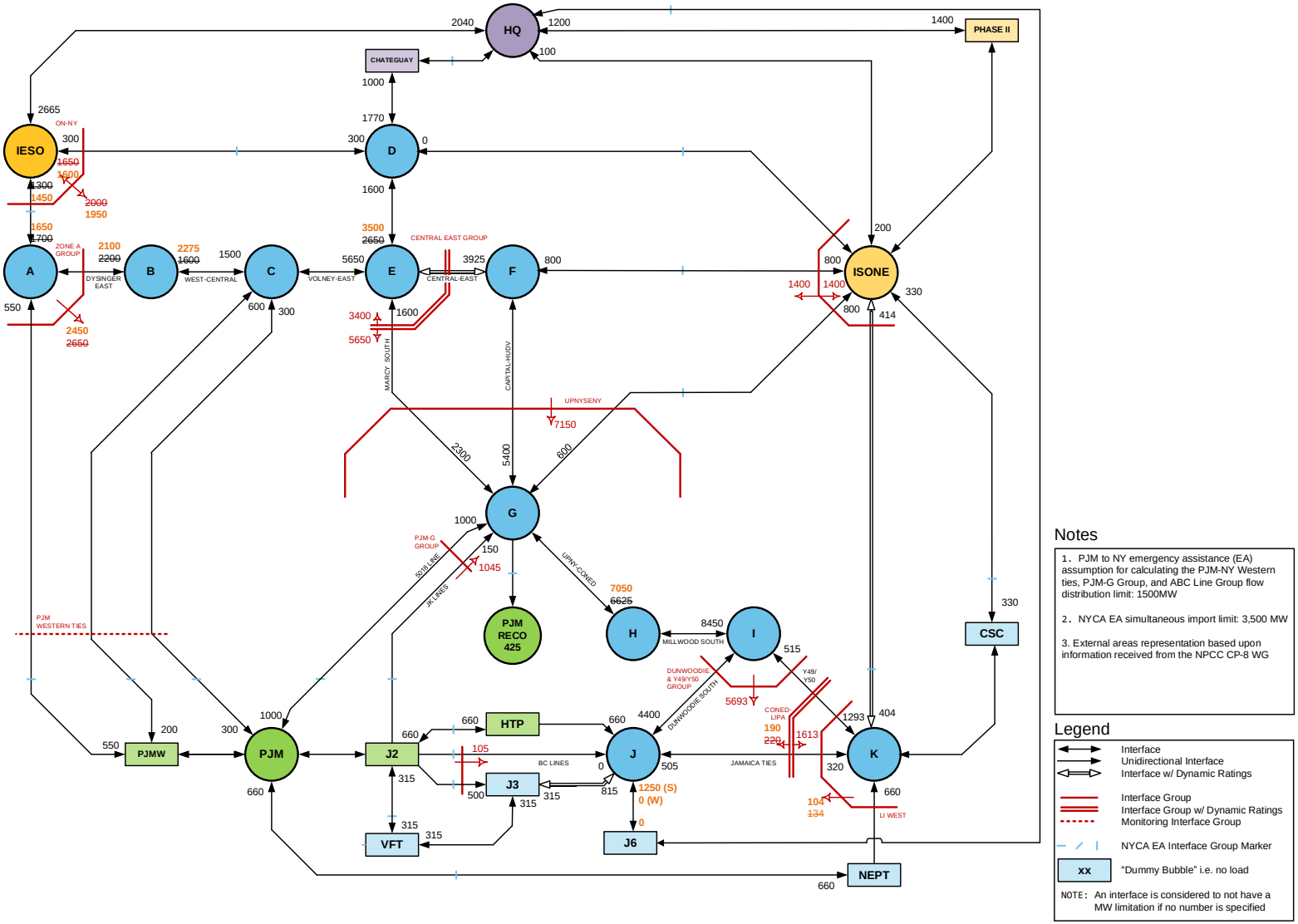
3	HQ	As per RNA Procedure External model (load, capacity, topology) provided by PJM/NPCC CP-8 WG. LOLE of pool adjusted to be between 0.10 and 0.15 days per year by adjusting capacity pro-rata in all areas.	Same	Same method	Same method
4	IESO	As per RNA procedure external model (load, capacity, topology) 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.	Same	Same method	Same method
5	Reserve Sharing	All NPCC Control Areas indicate that they will share reserves **equally** among all members before sharing with PJM.	Same	Same method	Same method
6	NYCA Emergency Assistance Limit	Implemented a statewide limit of **3,500 MW**	Same	Same	Same
Miscellaneous					
1	MARS Model Version	3.29.1499	3.30.1531	4.3.1796	4.10.2035



Draft MARS Topology for 2022 RNA Base Cases: Study Years 4 through 10 (2026-2032)