New York ISO
Independent System Operator

Order 2222 DER Aggregation Operating Reserves – Market Design Concept Proposed Introduction

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Agenda

- Background
- Hybrid Storage Resource Reserves Design
- Draft Application to DER Aggregations
- Next Steps

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Background

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Operating Reserves

- **Operating Reserves help maintain the reliability of the system by providing backup generation in the event that the NYISO experiences a real-time power contingency**
  - The minimum amount of Reserves procured is determined by various reliability requirements. These reliability requirements require a combination of 10-minute reserve products to replace lost capacity following a contingency, and 30-minute reserve products to restore the 10-minute products
  - Operating Reserve procurement must adhere to NYSRC (New York State Reliability Council) rules, NERC (North American Electric Reliability Corporation) requirements, and NPCC (Northeast Power Coordinating Council) requirements
- **Reserves are location-dependent, requiring procurement of reserve quantities within specific regions**
  - There are 5 Operating Reserve regions including NYCA. Some reserve regions are nested within other reserve regions
  - The region-specific requirement ensures that the Operating Reserve is properly geographically located such that transmission constraints do not limit the ability to deliver reserves

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Operating Reserves

- **NYISO procures 3 types of Operating Reserves:**
  1. 10-minute Spinning Reserves
     - Can be provided by qualified resources that are synchronized to the grid and can change output level within 10-minutes
  2. 10-minute total reserves
     - Can be provided by qualified resources that can be started, synchronized, and loaded within 10-minutes and resources that are synchronized to the grid and can change output level within 10-minutes
  3. 30-minute Reserve (spinning and non-synchronized)
     - Can be provided by qualified resources that: (i) are currently synchronized and can change output level within 30-minutes, or (ii) can be started, synchronized, and loaded within 30-minutes
- **Operating Reserve providers submit bids ($/MW) in DAM for eligible reserve products, and must be available for Operating Reserves in Real Time.**
  - Providers receive the reserve clearing price when scheduled for an Operating Reserves product
  - Providers receive the real-time LBMP when converted from Operating Reserves to Energy
- **Self-Committed Fixed and ISO-Committed Fixed Generators are not eligible to provide any kind of Operating Reserves**

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DER Participation Model (2019)

- **The NYISO's 2019 DER and Aggregation market design provided that an Aggregation is eligible to provide Spinning Reserve only when all of the generating units use inverter-based energy storage technology and meet the criteria set forth in the ISO Procedures.**
  - Under this design, Aggregations may, alternatively, be eligible to provide non-synchronous reserves, depending on the capabilities of all comprising DER
- **The NYISO's market design allows for provision of an Operating Reserves product only if each DER comprising an Aggregation is capable of providing the product.**
  - For example, an Aggregation with 3 energy storage resources each capable of providing spinning reserves, and 2 solar facilities (which are ineligible to provide any Operating Reserve product) would be ineligible as an Aggregation to provide spinning reserves, even though 3 out of the 5 facilities in the Aggregation are technically capable of providing the service.
- **This design was accepted by FERC in 2020, and the NYISO has designed its initial DER deployment software based on this rule.**

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Order No. 2222 Proceeding

- **In its initial Order No. 2222 compliance filing, the NYISO proposed to comply with the Commission's directive by maintaining its original design as proposed and accepted in the 2019 DER model.**
- **June 2022 Order:**
  - "…we find that any DERs that an Aggregator uses to satisfy NYISO's relevant technical, operational, and/or performance requirements should be allowed to provide ancillary services through aggregation."
  - "…so long as some of the DERs in the Aggregation can satisfy the relevant requirements to provide certain ancillary services (e.g., the one-hour sustainability requirement), we find that those DERs should be able to provide those ancillary services through aggregation, in accordance with the goal of Order No. 2222 to allow distributed energy resources to provide all services that they are technically capable of providing through aggregation."

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Order No. 2222 Proceeding

- **NYISO Request for Clarification/Rehearing (July 2022):**
  - The NYISO proposes to permit the Aggregator for each heterogeneous DER Aggregation to choose during market registration whether the Aggregation will provide 10-minute synchronized Operating Reserves, or 10-minute non-synchronized Operating Reserves or 30-minute Operating Reserves.
  - The NYISO will then permit all of the DER that participate in the heterogeneous DER Aggregation that are capable of providing the selected Operating Reserve product, or that are capable of providing a higher quality Operating Reserve product to provide Operating Reserves.
  - The Aggregator is responsible for updating the Operating Reserve Limit (ORL) as necessary in Real Time to appropriately communicate reserve product availability to the NYISO.
  - An Aggregation may only provide one of the three available Operating Reserve products when enrolled and may only change such declaration through re-enrollment.
    - NYISO's co-optimization permits higher quality reserve products to be used to address NYISO's need for lower quality Reserve products when appropriate

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Order No. 2222 Proceeding

- **April 2023 Order:**
  - "As NYISO commits to do in its filing, we direct NYISO to make an additional compliance filing following its stakeholder process, and by no later than December 31, 2024, to address the compliance directive from the First Compliance Order concerning ancillary services, as further explained in the Rehearing Order."
  - "Until it submits this additional compliance filing, we further direct NYISO to submit an informational filing within six months of the date of issuance of this order, and informational filings every six months thereafter, to provide updates to the Commission on the progress of this stakeholder process and on compliance with the directive from the First Compliance Order concerning ancillary services."

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Prior Discussions (2022)

- NYISO delivered two presentations in 2022 to summarize the high-level market design concepts addressing Operating Reserve eligibility for heterogenous Aggregations:
  - NYISO FERC Order No. 2222 Compliance – Part 3
  - NYISO FERC Order No. 2222 Compliance – Part 2

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Hybrid Storage Resource Reserves Design

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HSR Reserves Fundamentals

- **A Hybrid Storage Resource (HSR) is comprised of at least two Generators: one Energy Storage Resource and one or more of a wind Intermittent Power Resource, and/or a solar Intermittent Power Resource, and/or a landfill gas Intermittent Power Resource, and/or a Limited Control Run-of-River Hydro Resource**
- **NYISO intends to apply to DER Aggregations the fundamental market enhancements (e.g., opportunity to provide an ORL) created as part of its Hybrid Storage Resources development effort.**
  - Given the potential for DER Aggregations to be comprised of a more diverse mix of technologies, certain design features and considerations will differ as discussed in later slides
- **HSRs may only provide synchronized reserves, reflective of the storage component's capability.**
  - The NYISO may call upon synchronized reserves to satisfy a non-synchronous reserve product requirement if necessary
  - Reserves must be sustainable for a minimum of 1 hour, per NPCC/NERC reliability standards

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HSR Reserves Fundamentals

- **HSRs will have the ability to update their UOL and Operating Reserve Limit (ORL) (enhancement as part of HSR development) after RT market close via new software being developed for DER (GOCP) that will allow electronic submission of derates to the ISO.**
  - The NYISO will require an HSR operator to submit an initial ORL during the registration of an HSR in the NYISO markets.
  - The NYISO will require an HSR operator to submit an Operating Reserve Limit ("ORL") with each DAM and RTM offer, updated as needed to reflect changes to the HSR's synchronized reserve capability.
- **An HSR Operator may derate its HSR's ORL below its DAM Reserves Schedule and/or RT Reserves offers after RT market close if it is unable to meet its DAM schedule or RT Reserves offer due to:**
  - Reserve Pick Up (RPU)
  - Out of Merit (OOM)
  - Unexpected equipment outage
  - IPR output deviates from forecast, inhibiting ESR capabilities in later intervals
  - SOC fluctuations due to price arbitrage and Energy injections

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Draft Application to DER Aggregations

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Operating Reserves in Practice – Aggregations

- **The NYISO's revised market design will enable an Aggregation of heterogenous DER, with differing individual capabilities, to provide the services they are qualified to provide in an Aggregation, within the bounds of NYISO's software capabilities and consistent with applicable reliability standards.**
- **Consistent with the treatment applied to existing Generators, an Aggregation's reserve award will be a function of its operating characteristics and the NYISO's nested Reserve design, co-optimized unit commitment and economic dispatch, and system needs.**
  - The NYISO simultaneously co-optimizes Energy, 10-minute synchronous Reserves, 10-minute Non-Synchronous Reserves, 30-Minute Reserves, and Regulation Service in its SCUC, RTC and RTD market software
  - The NYISO's nesting of Reserves by location and type permits higher quality Reserves products to be used to address the need for lower quality Reserves products while minimizing as-bid production costs.
  - The market software also considers physical limitations on each resource's capability. For example, an Aggregation with available MWs but limited ramp capability may be awarded a 10-minute reserve schedule consistent with its ability to ramp over 10 minutes and may also be awarded a 30-minute reserve schedule based on its ability to continue to ramp from minute 10 to minute 30 (i.e., 20 minutes).

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Service Eligibilities

Concepts consistent with FERC-approved 2019 DER market design

- An Aggregator may declare, during the enrollment of an Aggregation, the ancillary services that an Aggregation will provide to the NYISO market based on the technical capabilities of its comprising DER.
- In order to change the service(s) that an Aggregation provides to the market, the applicable Aggregator must update the existing Aggregation via the Aggregation System monthly enrollment process.
  - Changes to an Aggregation are subject to review by the NYISO and applicable Distribution Utility
  - Details about the enrollment/update process will be available in the forthcoming Aggregation System User's Guide
- An Aggregator must declare, during the enrollment of an Aggregation, the maximum Operating Reserve Limit for the Aggregation.
  - Any future modification to the ORL will be capped at this maximum value
- Operating Reserve Limit ("ORL"): The capability, in MW, of a Hybrid Storage Resource to produce Energy for at least one hour if its Operating Reserve schedule is converted to Energy. The capability of a Hybrid Storage Resource to provide Operating Reserves shall be based on the capability of its Energy Storage Resource.
  - Definition to be modified for Aggregations

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Concepts consistent with FERC-approved 2019 DER market design

Service Eligibilities

- **Demand Side Ancillary Service Program (DSASP) Resources "may provide either Spinning Reserves and Regulation service or Non-Synchronized Reserves, but not both" (Ancillary Services Manual section 6.2.3.1).**
  - This logic will apply to Aggregations
- **An Aggregation may elect to provide any of the following combinations of ancillary services, based on the technical capabilities of its comprising DER:**
  - No ancillary services (Energy only, or Energy & Capacity only), or
  - Regulation, or
  - Synchronized reserves (10- & 30-minute), or
  - Regulation & synchronized reserves, or
  - 10-minute non-synchronous reserves, or
  - 30-minute non-synchronous reserves
- **Reminder: An Aggregation that is comprised solely of one DER 'type' must participate as an Aggregation of the applicable 'type,' and shall be subject to the rules associated with that participation model.**
  - E.g., an Aggregation comprised solely of wind facilities shall participate as a Single Resource Type Wind Aggregation, and shall therefore not be eligible to provide Operating Reserves or Regulation in the NYISO markets

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Concepts consistent with FERC-approved 2019 DER market design

Service Eligibilities

- **Individual DER 'technical capability' requirements:**
  - Regulation (no minimum sustainability requirement) and/or synchronized reserves (minimum 1-hour sustainability):
    - Demand Side Resource (DSR) facilitating load reduction through curtailment only, or
    - A DSR facilitating curtailment by behind-the-meter inverter-based storage, or
    - Inverter-based storage
  - Non-synchronous reserves (minimum 1-hour sustainability)
    - Ability to start and synchronize to the grid within 10 or 30 minutes depending on product
    - A Generator that is:
      - 1) not an IPR (Wind, Solar, or Landfill Gas), ***and***
      - 2) not an inverter-based storage device or a DSR facilitating load reduction through curtailment only, or by behind-the-meter inverter-based storage

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Service Eligibilities

Concepts consistent with FERC-approved 2019 DER market design

- Consistent with the Regulation or Operating Reserves Verification testing procedures outlined in Ancillary Services Manual sections 4.11.2 and 6.12.2, respectively, the NYISO will require an Aggregation to demonstrate its elected ancillary service(s) capabilities during first month of active enrollment in NYISO markets.

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Operating Reserve Limit (ORL) for Aggregations

- **Aggregation UOL must be provided upon enrollment in the Aggregation System.**
  - Aggregation UOL = (Aggregation Injection MW + Aggregation Demand Reduction MW)
  - Should an Aggregation's UOL vary between Summer and Winter, the Aggregator will be responsible for reflecting this update on a seasonal boundary to support feasible dispatch
- **The Aggregator is responsible for maintaining an ORL that is less than or equal to the difference between an Aggregation's scheduled Energy MW (plus Regulation Capacity MW if applicable) and the Aggregation's UOL for the applicable season.**

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Aggregation Scheduling

- **The Aggregator is responsible for maintaining an Aggregation's bid UOL at greater than or equal to the sum of:**
  - Scheduled Energy MW
  - Regulation Capacity MW
  - Operating Reserve Limit
- **If an Aggregator is unable to maintain a bid UOL as detailed above, the Aggregator must submit a derate to the Aggregation's UOL in the GOCP for the duration needed.**
- **The NYISO will not maintain/collect a State of Charge (SOC) for a DER Aggregation, even if the Aggregation contains one or more withdrawal-eligible generators.**
  - An Aggregator must operate any withdrawal-eligible generators in its Aggregation in such a manner that it can sustain an Energy schedule at its declared ORL if its scheduled reserves are converted to Energy
    - I.e., for hours during which the Aggregation is scheduled to provide a reserve product, do not discharge full storage output unless able to satisfy ORL with other generation
      - If necessary, submit a derate to the Aggregation's ORL to reflect the current, reduced capability

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Aggregation Operating Reserve Limit

- Determining the Operating Reserve Limit for an Aggregation of heterogenous DER with differing technical capabilities.

Product selection based on DER eligibilities – consider:
- Spinning or Non-synchronous
- Regulation

Maximum MW value of ORL on enrollment/offers – consider:
- UOL of Aggregation
- Range of scheduled Energy MW
- Regulation Capacity

Risk tolerance adjustment (with hourly offers) – consider:
- Withdrawal-eligible generator state of charge
- Intermittent Power Resource forecasts
- Equipment outage
- Reserve Pickup or Out of Merit

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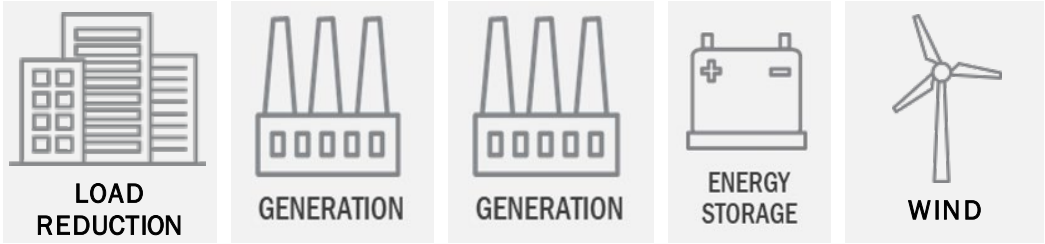
Aggregation Operating Reserve Limit Example



	Technical Capability	Ramp Rate	Enrolled UOL	Enrolled Maximum ORL
Aggregation 'A'	Spinning Reserves & Regulation	2 MW/min	30 MW	10 MW

- During DAM and RTM, actual bid UOL and ORL will depend on Regulation Capacity offers and the contributions of all comprising DER to the Aggregation's scheduled Energy MW.
- The ramp rate will be considered during the NYISO's optimization for reserve requirements and may make the Aggregation eligible to provide additional reserve products if needed by the NYISO.

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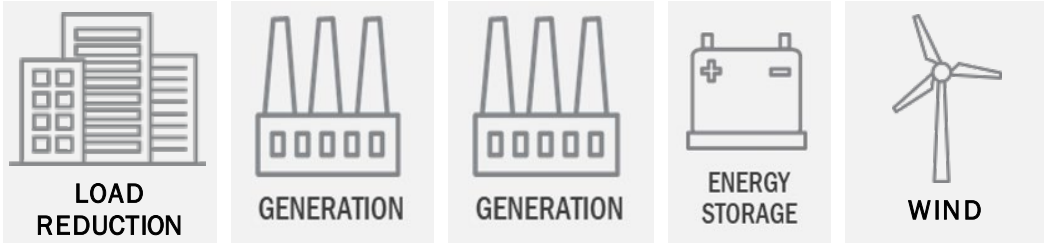
Aggregation Operating Reserve Limit Example



DER	Technical Capability	Ramp Rate	MW Capability
Load Reduction	Spinning	1 MW/min	5 MW Curtailment
Generation	10-minute NS	0.5 MW/min	5 MW Injection
Generation	30-minute NS	0.5 MW/min	5 MW Injection
Energy Storage	Spinning & Regulation	1 MW/min	+/- 5 MW
Wind	N/A	N/A	10 MW

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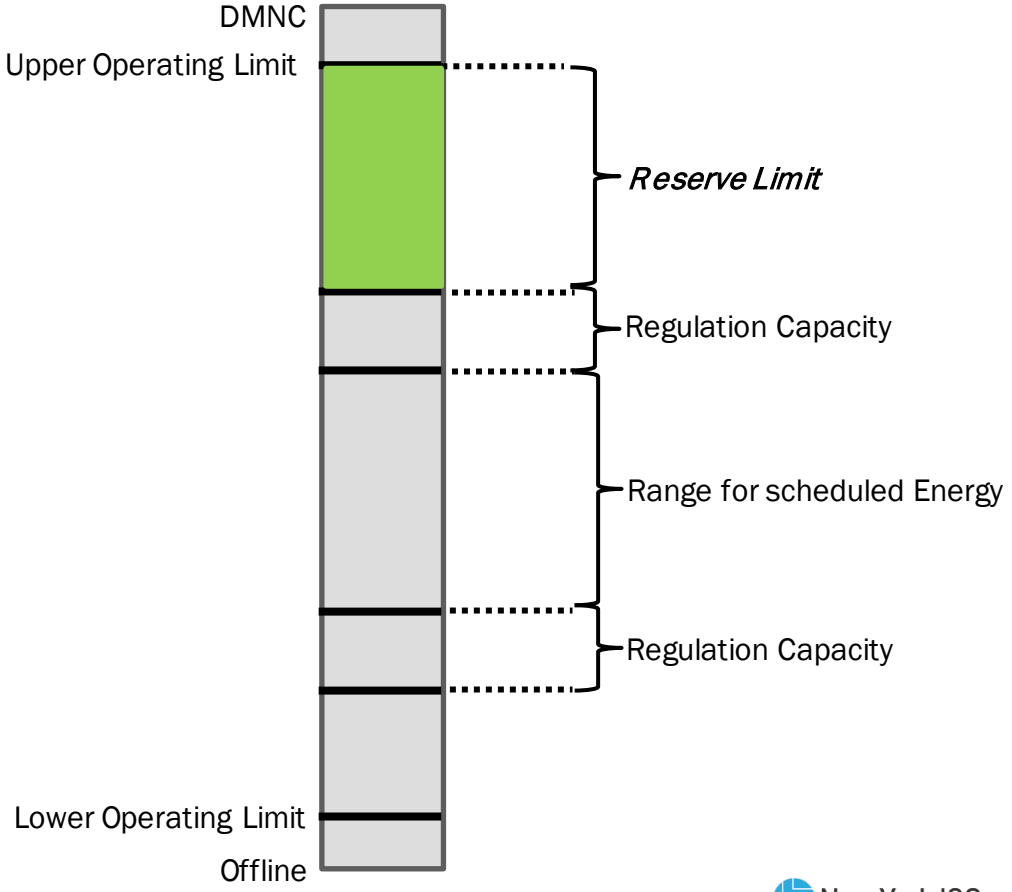
Aggregation Operating Reserve Limit

- An Aggregator must submit the ORL with each offer to the DAM and RTM.
- An Aggregator must also update the ORL after RTM close if needed to derate reserve capability.
  - Numerical examples to follow in a future presentation



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Load Curtailment & Operating Reserve Limit

- **Aggregator considerations for load curtailment interactions with the ORL:**
  - Maintain curtailment capability for the duration of an hour
    - NYISO requires Operating Reserves to be sustainable for a minimum of 1 hour – curtailment capability of an Aggregation is based on a 5-minute ECBL, and must be monitored to verify ongoing viability of providing reserves
  - Monitor state of charge of local inverter-based storage to facilitate curtailment, if applicable
    - NYISO does not monitor the state of charge of withdrawal-eligible generators in an Aggregation – a behind the meter storage device used to facilitate curtailment should be monitored by the Aggregator to verify a state of charge to support reserves when scheduled
  - An Aggregation's reserve offer, when comprised of load curtailment MWs, shall only be eligible for economic energy settlement if the reserve is activated during intervals when the real-time LBMP at the Aggregation's Transmission Node meets or exceeds the Monthly Net Benefits Threshold (MNBT)

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Next Steps

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Next Steps

- Please provide questions or feedback on today's contents to heisenhardt@nyiso.com no later than Thursday, August 31.
- Additional discussion of market design concept proposal incorporating stakeholder feedback to be reviewed at ICAPWG in September.
  - Examples of Operating Reserve Limit derate in an Aggregation
- Final market design concept proposed targeting end of October, to support NYISO informational filing requirement with FERC.

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Our Mission & Vision

Mission

Ensure power system reliability and competitive markets for New York in a clean energy future

Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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