

Operating Reserve Background

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Agenda

- Purpose
- Operating Reserve Overview
- Operating Reserve Products
- Reserve Performance
- Next Steps

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Purpose

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- **Review the current NYISO operating reserves market design with stakeholders.**
 - Intended to help facilitate discussions of potential reserve product enhancements as part of various 2019 projects.

Operating Reserve Overview

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Ancillary Services Overview

- **Ancillary services support the transmission of energy from resources to load, while maintaining reliable operations.**
 - Operating reserves are a type of ancillary service.
- **Operating reserves are provided at market-based prices.**
 - Reserve providers bid into the market and reserves are scheduled as part of the optimization process.

Operating Reserves Overview

- **Operating reserves are needed to respond to generation and transmission contingency events**
 - Operating reserves can be converted to energy in the event of a real-time power system need.
- **Generation contingencies require a combination of 10-minute reserve products to replace lost capacity, and 30-minute reserve products to be able to restore the 10-minute products to prepare for other potential events.**
- **Transmission contingencies require either 10 or 30 based upon time required to restore flows**
 - To restore IROL interface exceedances by more than 5% requires 10-minute reserve
 - To restore SOL actual LTE exceedances requires 10-minute reserves
 - To restore SOL from LTE to normal requires 30-minute reserves

IROL – Interconnection Reliability Operating Limit

SOL- System Operating Limit

LTE – Emergency limit (Winter and Summer)

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Operating Reserves Overview

- **Operating reserves are a location-dependent ancillary service, so the NYISO must procure a set amount of reserves within NYCA and within specific regions.**
 - The NYISO must consider transmission constraints when determining where reserves are located and scheduled.
- **The amount of reserves procured are determined by considering various reliability requirements, including:**
 - New York State Reliability Council (NYSRC) reliability rules.
 - North American Electric Reliability Corporation (NERC) requirements.
 - Northeast Power Coordinating Council (NPCC) requirements.
 - NPCC requires reserve to be sustainable for 1 hour from the time of activation¹.

1. See NPCC directory 5, Requirement 5.13

Operating Reserve Products

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Operating Reserve Products

- **10-Minute Spinning Reserve:**
 - Currently synchronized to the NYS power system
 - Can change output or reduce demand level in 10 minutes
 - If a resource is capable of providing this product, it is capable of providing all reserve products
 - Eligible Suppliers include:
 - ISO-Committed Flexible and Self-Committed Flexible Generators (except for BTM:NG Resources comprised of more than one generating unit dispatched as a single aggregate unit)
 - Demand Side Resources not supporting load reduction through the use of a Local Generator
 - Load reduction facilitated using inverter-based energy storage technology is eligible

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Operating Reserve Products

- **10-Minute Non-Synchronized Reserve:**
 - Can be started, synchronized, and change output level or reduce demand within 10 minutes
 - If a resource is capable of providing this product, it is also capable of providing 30-Minute Reserve
 - Eligible Suppliers include:
 - Offline generators bidding as ISO-Committed Flexible and Self-Committed Flexible
 - BTM:NG Resources comprised of more than one generating unit dispatched as a single aggregate unit are eligible
 - Demand Side Resources (including those facilitating load reduction through the use of a Local Generator)

Operating Reserve Products

- **30-Minute Reserve (Spinning and Non-Synchronized):**
 - **Spinning:** Currently synchronized and can change output level or reduce demand within 30 minutes
 - **Non-synchronized:** Can be started, synchronized, and change output level or reduce demand within 30 minutes
 - Eligible Suppliers include:
 - ISO-Committed Flexible and Self-Committed Flexible Generators
 - BTM:NG Resources comprised of more than one generating unit dispatched as a single aggregate unit are eligible
 - Demand Side Resources
 - Those facilitating load reduction through the use of a Local Generator shall only be eligible to provide non-synchronized 30-minute reserves

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Operating Reserve Requirements

- The table below provides the currently applicable reserve requirements by location (NYCA [all load Zones (A-K)], East of Central-East or EAST [Load Zones (F-K)], Southeastern New York or SENY [Load Zones (G-K)], and Long Island or LI [Load Zone K])

NYISO Operating Reserve Locational Requirements				
Product	NYCA	EAST	SENY	LI
10-Minute Spinning Reserve	½ A = 655 MWs NYSRC Rule	¼ A = 330MWs NERC, NPCC Rule	0 MWs	0 MWs
10- Minute Total Reserve	A = 1310 MWs NYSRC Rule	1200 MWs NYSRC Rule	0 MWs	120 MWs NERC, NPCC Rule
30- Minute Reserve	2*A = 2620 MWs NYSRC Rule	1200 MWs NERC, NPCC Rule	1300 MWs NYSRC Rule	270-540 MWs NYSRC Rule

*A = Most Severe NYCA Operating Capability Loss (1310 MWs)

For further information on the locational reserve requirements, please see the document at the following link:
http://www.nyiso.com/public/webdocs/markets_operations/market_data/reports_info/nyiso_locational_reserve_reqmts.pdf

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Bidding

- Suppliers are selected based on their response rates, applicable upper operating limit, and their Energy Bid (which will reflect their opportunity costs) through co-optimized commitment and dispatch processes that minimize the total production cost of Energy, Regulation Service, and Operating Reserves.
- Generators seeking to provide reserves must bid flexibly (using ISO-Committed Flexible, or Self-Committed Flexible bid modes)
 - For the Day-Ahead Market, Generators bidding as “flexible” must provide an availability bid for reserves¹, otherwise the bid will be rejected.

1. For details, please refer to the Market Participants Users Guide at the following link:

<https://www.nyiso.com/documents/20142/3625950/mpug.pdf/c6ca83ca-ee6b-e507-4580-0bf76cd1da1b>

Bidding

- In the Day-Ahead Market, resources capable of providing Spinning Reserve, 10-Minute Non-Synchronized Reserve, and/or 30-Minute Reserve may only submit Availability Bids (\$/MW) for each hour of the upcoming day.
 - Resources do not bid a “MW” value for reserves in the Day-Ahead Market.
- Day- Ahead Bid Screen

Product	MW	\$/MW
10 Minute Spinning Reserves		<input type="text"/>
10 Minute Non-Synchronized Reserve		<input type="text"/>
30 Minute Spinning Reserve		<input type="text"/>
30 Minute Non-Synchronized Reserve		<input type="text"/>

Bidding

- The NYISO will automatically select Operating Reserves Suppliers in real-time from eligible Resources. All Suppliers will automatically be assigned a real-time Operating Reserves Availability Bid of \$0/MW.
- Real-time energy bids created from Day-Ahead bids, based on accepted Day-Ahead reserve bids cannot be increased.

Scheduling

- **The NYISO's market software normally reevaluates resource schedules every 5 minutes in RTD and makes commitment decisions every 15 minutes in RTC.**
 - RTC includes a look-ahead time horizon of 2.5 hours which it uses to provide advisory commitment and dispatch for resources.

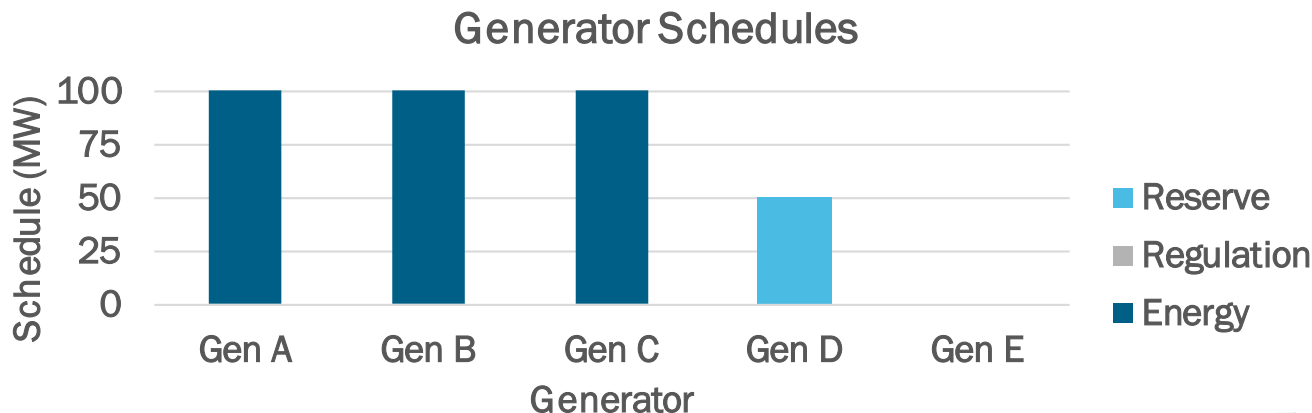
Scheduling Example

- Assume the following Resource Characteristics:

Generator	Minimum Generation Point (MW)	Upper Operating Limit (MW)	Energy Bid (\$)	Reserve Bid (\$)	Response Rate (MW/min)
Gen A	10	100	10	0	20
Gen B	10	100	20	0	20
Gen C	10	100	30	0	20
Gen D	0	100	40	0	10
Gen E	0	100	50	0	10

Scheduling Example

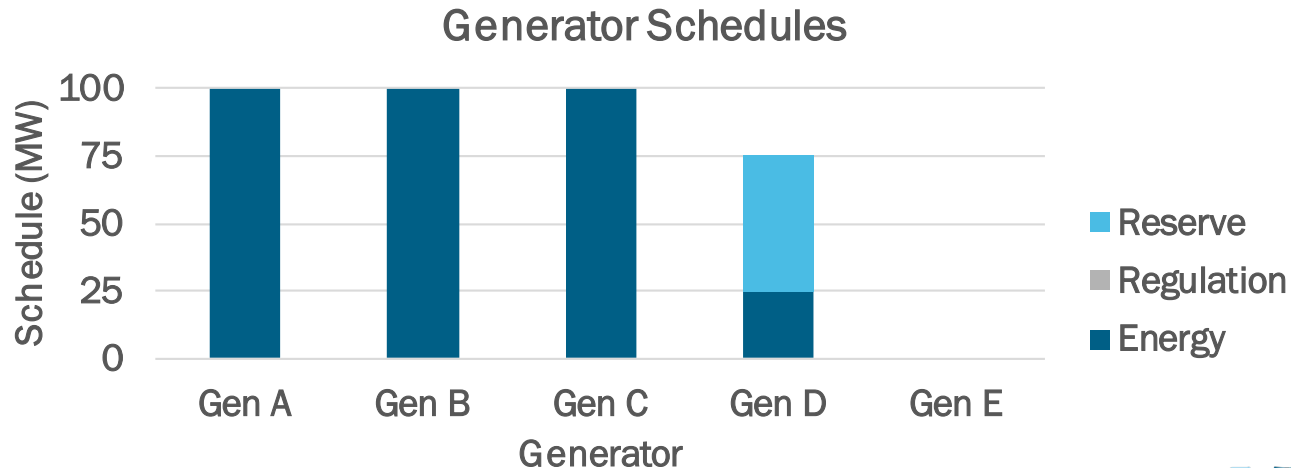
- In the first interval, the load is 300 MW, while the 10-minute spinning reserve requirement is 50 MW.
 - Generator D fulfills the 50 MW reserve requirement, while the other resources collectively provide 300 MW of energy.



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Scheduling Example

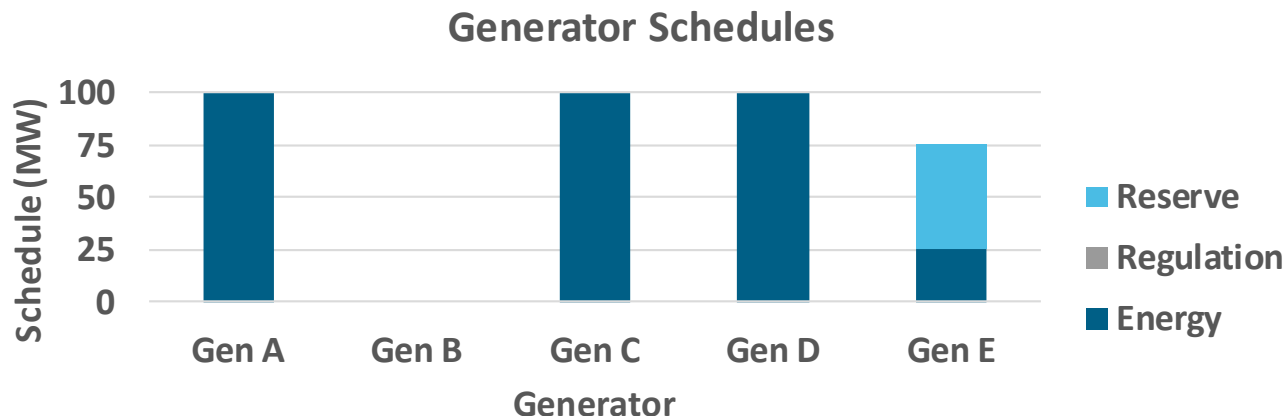
- In the second interval, the load increases from 300 MW to 325 MW, while the reserve requirement remains 50 MW.
 - Generator D now provides energy in addition to the 50 MW reserve requirement.



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Scheduling Example

- In the next interval, Generator B trips offline, while the load and 10-minute spinning reserve requirement remain at 325 MW and 50 MW respectively.
 - Generator D's reserve schedule is converted to energy and Generator E provides the reserve.



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Operating Reserve Demand Curves

- Reserve clearing prices are determined considering the operating reserve demand curves along with resource bids
 - The current reserve demand curve prices in effect during periods when the EDRP and/or Special Case Resource program have not been activated are outlined below

Location	Product	Shortage (MW)	Shortage Cost (\$/MWh)
East	30 Minute Reserve	All	\$25
	10 Total Reserve	All	\$775
	10 Spin Reserve	All	\$25
LI	30 Minute Reserve	All	\$25
	10 Total Reserve	All	\$25
	10 Spin Reserve	All	\$25
NYCA	30 Minute Reserve	300	\$25
		655	\$100
		955	\$200
		Remainder	\$750
NYCA	10 Total Reserve	All	\$750
	10 Spin Reserve	All	\$775
SENY	30 Minute Reserve	All	\$500
	10 Total Reserve	All	\$25
	10 Spin Reserve	All	\$25

*The current reserve demand curve prices for each region are shown in section 6.8 Reserve Demand Curve Prices in the Ancillary Services Manual and are also set forth in Section 15.4.7 of Rate Schedule 4 of MST:

http://www.nyiso.com/public/webdocs/markets_operations/documents/Manuals_and_Guides/Manuals/Operations/ancserv.pdf



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Reserve Clearing Price Calculation

- Each reserve product and location pair produces a shadow price for procurement of the reserve product.
 - This shadow price is the cost to procure one additional MW of the reserve product in question.
 - The maximum shadow price value is capped based on the pricing values of the operating reserve demand curves (these maximum pricing values are shown in the table below)

Reserve Product	NYCA	EAST	SENY	LI
SPIN	S.P.3 = \$775	S.P.6 = \$25	S.P.9 = \$25	S.P.12 = \$25
10 Total	S.P.2 = \$750	S.P.5 = \$775	S.P.8 = \$25	S.P.11 = \$25
30	S.P.1 = \$25, \$100, \$200, or \$750*	S.P.4 = \$25	S.P.7 = \$500	S.P.10 = \$25

*For the calculation of reserve prices, please see MST section 15.4.4.1

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Reserve Clearing Price Calculation

- Reserve clearing price calculations reflect the cascaded nature of reserve products. This cascading is reflected in the formulas in the following table
- Resources receive the total price equal to the summation of the shadow prices for all of the products that they are providing.

Reserve Product	NYCA	EAST	SENY	LI
SPIN	S.P.1 + S.P.2 + S.P.3	S.P.1 + S.P.2 + S.P.3 + S.P.4 + S.P.5 + S.P.6	S.P.1 + S.P.2 + S.P.3 + S.P.4 + S.P.5 + S.P.6 + S.P.7 + S.P.8 + S.P.9	S.P.1 + S.P.2 + S.P.3 + S.P.4 + S.P.5 + S.P.6 + S.P.7 + S.P.8 + S.P.9 + S.P.10 + S.P.11 + S.P.12
10 Total	S.P.1 + S.P.2	S.P.1 + S.P.2 + S.P.4 + S.P.5	S.P.1 + S.P.2 + S.P.4 + S.P.5 + S.P.7 + S.P.8	S.P.1 + S.P.2 + S.P.4 + S.P.5 + S.P.7 + S.P.8 + S.P.10 + S.P.11
30	S.P.1	S.P.1 + S.P.4	S.P.1 + S.P.4 + S.P.7	S.P.1 + S.P.4 + S.P.7 + S.P.10

How Reserve Products and Transmission Constraints Interact

- The market software coordinates numerous constraints, including energy, reserve, and transmission constraints.
- The market software may “go short” of Operating Reserves to avoid exceeding the applicable limit for a transmission line constraint if cost effective.
- Transmission constraints may impact the trade-off with regional reserve requirements.
 - Examples of common trade-offs include:
 - Leeds Pleasant Valley transmission constraint and SENY 30 minute reserves
 - Central East VC transmission constraint and East 10 minute reserves

Reserve Performance

Reserve Performance

- The NYISO has the ability to audit reserve providers to ensure resources demonstrate the ability to provide reserve.
- Types of audits performed
 - 10-minute response rate test
 - 30-minute response rate test
 - UOL_N test: Units required to reach bid-in UOL in one hour
- Audit process¹
 - No advance notice is required to be given.
 - If a reserve pick up is run for 10 minutes, this can qualify as a test for every unit scheduled to provide 10-minute reserves.
 - Units are evaluated based on 11 minutes of performance for a 10-minute response rate test, and 33 minutes of performance for a 30-minute response rate test.

1. See Technical Bulletin 142 for details

Reserve Performance

■ Resources subject to audit

- For 10-minute and 30-minute response rate test:
 - NYISO randomly selects resources with a valid real-time energy offer and that bid ISO-Committed Flexible or Self-Committed Flexible.
- For UOL_N test:
 - NYISO randomly selects resources with a valid real-time offer.

■ Frequency of audits

- There are approximately 25-30 audits conducted during each Capability Period.
- Resource selection for an audit is random.
 - NYISO Operations may audit a unit at any time.

Reserve Performance

- If a resource does not perform, or performs poorly, it will fail the audit.
- The following tolerances are allowed in the evaluation of an acceptable demonstration for each test
 - 10-minute test: A variation of 2% of required pickup or 1 MW (whichever is greater) of required pickup may be used. A one-minute tolerance is allowed.
 - Example: A 15 MW pickup is required in 10 minutes. Minimum acceptable performance would be 14 MW in 11 minutes.
 - 30-minute test : A variation of 2% of required pickup or 2 MW (whichever is greater) of required pickup may be used. A three-minute tolerance is allowed.
 - Example: A 30 MW pickup is required in 30 minutes. Minimum acceptable performance would be 28 MW in 33 minutes.
 - UOL_N test : A variation of 2% of UOL_N may be used. The maximum time allowed from the start of test shall be the greater of (i) one hour or (ii) the time required to reach UOL_N at the Generator's emergency response rate plus 10%.

Reserve Performance

- **Upon failing the audit:**
 - NYISO may derate the resources' response rates
 - NYISO may also derate the resources' UOL_N
 - For a GT that fails to start during the audit there would be a derate down to 0 MW
- **Market Mitigation and Analysis Follow up:**
 - MMA will provide the resource with an audit report, which details the tested parameter that the resource failed within two days of failing the audit
 - Resource owner must submit a letter explaining the reasons for failure, and the time and process for correction within five days of receiving the audit report
- **A unit must demonstrate it can pass the next audit to restore their previous response rates or UOL_N whichever is applicable**
 - A GT that fails an audit would not be scheduled online and would not be counted for reserves until it requested the NYISO conduct a new audit

Timeline

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Timeline for 2019 Projects Addressing Reserves

- **More Granular Operating Reserves**
 - Q3 2019 Market Design Complete
 - On-going discussions with stakeholders regarding the potential for an accelerated implementation of the NYC reserve region component of this project
- **Reserve Procurement for Resilience**
 - Q3 2019 Market Design Concept Proposal
- **Ancillary Services Shortage Pricing**
 - Q4 2019 Study Complete

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The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefits to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policy makers, stakeholders and investors in the power system



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