# Comparison of Reserve Practices across RTOs: Offline and Supplemental Reserves

Emily Barrett
Sr. Lead Market Design Specialist
Reserve Certainty Senior Task Force
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# Disclaimer

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*As such, PJM cannot guarantee the perfect accuracy of the information in this presentation.*

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# Offline Supplemental Reserve Products and Procured Quantities

# Under the recently approved FERC filing, all Day-Ahead Ancillary Service awards are settled using a call-option design.

| Reserve Product | Eligible Resources | Procured Quantity |
|---|---|---|
| Day-Ahead Ten-Minute Non-Sync Reserve | • Must be either committed for energy or have a combined start up and notification time <= 10 minutes<br>• Must have a minimum run time and a minimum down time <= 1 hour | The Primary Reserve requirement is 100% of the Most Severe Single Contingency multiplied by a performance factor. Up to 75% of the PR requirement may be met by Non-Sync Reserves based on historical performance. |
| Day-Ahead Thirty-Minute Reserve | • Must be either committed for energy or have a combined start up and notification time <= 30 minutes<br>• Must have a minimum run time and a minimum down time <= 1 hour | Thirty-Minute Reserve Requirement is additionally 50% of the second largest contingency. |
| Day-Ahead Energy Imbalance Reserves | • Must be either committed for energy or have a combined start up and notification time <= 30 minutes<br>• Must have a minimum run time and a minimum down time <= 1 hour | Day-Ahead Energy Imbalance Reserves are procured to supply the difference between the ISO forecasted load and physical generation committed through the Day-Ahead energy market. |

# MISO

| Reserve Product | Eligible Resources | Procured Quantity |
|---|---|---|
| Supplemental Reserve | • Must be either committed for energy or have a combined start up and notification time <= 10 minutes | The Primary Reserve requirement is 100% of the Most Severe Single Contingency. Up to 50% of the PR requirement may be met by non-synchronized contingency reserves. |
| Short-Term Reserve | • Must be either committed for energy or have a combined start up and notification time <= 30 minutes<br>• Minimum run-time <= 4 hours | Thirty-Minute Reserve Requirement is dynamically set by the MISO Uncertainty Model, which considers uncertainties associated with load, wind, solar, generation derates/forced outages, and Net Scheduled Interchange. Dynamic reserve requirements are set hourly based on the Uncertainty Model. Initially, the Thirty-Minute Reserve Requirement was set to 150% of the Most Severe Single Contingency. |

# NYISO

| Reserve Product | Eligible Resources | Procured Quantity |
|---|---|---|
| 10-Minute Non-Synchronized Reserve | • Must be either committed for energy or have a combined start up and notification time <= 10 minutes | The Primary Reserve requirement is 100% of the Most Severe Single Contingency. Up to 50% of the PR requirement may be met by non-synchronized contingency reserves. |
| 30-Minute Non-Synchronized Reserve | • Must be either committed for energy or have a combined start up and notification time <= 30 minutes | The Total Operating Reserve Requirement must be greater than or equal to twice the largest single contingency. NYISO will also increase the Total Operating Reserve Requirement to manage uncertainties associated with intermittent renewable generation as necessary. |

# SPP

| Reserve Product | Eligible Resources | Procured Quantity |
|---|---|---|
| Supplemental Reserve | • Must be either committed for energy or have a combined start up and notification time <= 10 minutes | The Primary Reserve requirement is 100% of the Most Severe Single Contingency multiplied by a performance factor. Up to 50% of the PR requirement may be met by non-synchronized contingency reserves. |
| Uncertainty Reserve | • Must be either committed for energy or have a combined start up and notification time <= 60 minutes | Uncertainty Reserve requirements are calculated based on the forecasted net load change over one hour and the historical net load forecast error. The Uncertainty Reserve requirement is set hourly and is posted each day by SPP. |

# Performance Evaluation and Consequences for Non-Performance

# Performance Evaluation for Offline Reserves

| | |
|---|---|
| **ISO NE** | No explicit or separate performance evaluation occurs as reserves are structured as call-options. |
| **MISO** | A resource's Short-Term Reserve obligation will be considered met if the resource reaches EcoMin and becomes dispatchable within the Short-Term Reserve response period. |
| **NYISO** | Offline reserves are evaluated based on whether they come online and become dispatchable within the response window. |
| **SPP** | Offline Uncertainty Reserve resources are evaluated based on whether they come online and become dispatchable within the response window. |

# Consequences for Non-Performance

| | |
|---|---|
| **ISO NE** | All Day-Ahead Ancillary Service awards are handled through settlement of the call-option. |
| **MISO** | The Market Participant is responsible for buying back its day-ahead position in the hour of failure and the remaining hours of the Operating Day. The resource is also subject to the Offline Short-Term Reserve Deployment Failure Charge, which is equal to the shortfall amount times the energy LMP at the resource's Commercial Pricing Node. |
| **NYISO** | Resources must buy back their day-ahead reserve commitment at the real-time market clearing price. |
| **SPP** | Resources are charged their Real-Time Start-Up Cost plus No-Load Cost plus Energy at minimum cost if those costs have not already been excluded from the Resource's Make Whole Payment. |

# Offer Formulation

# ISO NE

- In their recently approved FERC filing, ISO NE identifies three types of incremental costs that they expect to be reflected in resource offer prices:
    1. Expected Close-Out Charges, based on expected hub energy prices and the calculated strike price
    2. Avoidable Fuel or Charging Costs
    3. Risk Premiums

# MISO

- For Short Term Reserves, only offline resources are able to submit offers
  - MISO states that no additional costs to provide online Short Term Reserves have been identified
- Offers prices for offline Short Term Reserves can be submitted in the range of $0-100/MW

- Offline Uncertainty Reserves may submit offers into the market to reflect their costs
- The offer cap for Offline Uncertainty Reserves is $1,000/MW
- Offline Uncertainty Reserve offers are expected to reflect:
  - start-up and no-load costs
  - minimum energy costs during the larger of the Uncertainty Reserve response time and Minimum Run Time
- Resources that hold an offline uncertainty reserve assignment and are called online are not eligible for a make-whole payment.

# Contact

Facilitator:
Lisa Morelli, Lisa.Morelli@pjm.com

Secretary:
Amanda Egan, Amanda.Egan@pjm.com

SME/Presenter:
Emily Barrett, Emily.Barrett@pjm.com

**Education on Reserve Practices across RTOs/ISOs**

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

# Acronyms

| Acronym | Term & Definition |
|---|---|
| LMP | **Locational Marginal Price** is defined as the marginal price for energy at the location where the energy is delivered or received. For accounting purposes, LMP is expressed in dollars per megawatt-hour ($/MWh). LMP is a pricing approach that addresses Transmission System congestion and loss costs, as well as energy costs. |
| PR | **Primary Reserve** is a reserve service provided by resources that can respond within 10-minutes. It can be provided by both synchronized and non-synchronized resources. |
| ACE | **Area Control Error** is a signal generated by the PJM Control Center and sent to the plants, stations and/or PJM members scheduled to provide regulation to change generation quickly to keep PJM's area control error within allowable limits. It is used to control for small fluctuations in load. |
| MW | A **Megawatt** is a unit of power equaling one million watts (1 MW = 1,000,000 watts) or one thousand kilowatts (1 MW = 1,000 KW). To put it in perspective, under non-severe weather conditions, one MW could power roughly 800 to 1,000 average-sized American homes. |

PJM Glossary

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