

PJM Manual 13:

Emergency Operations

Revision: 92

Effective Date: December 20, 2023

2.2 Reserve Requirements

PJM schedules reserves on a day-ahead basis and operates in real-time to ensure Contingency/Primary (10 minute) Synchronized/Spinning and Secondary/Operating reserve requirements are maintained. Day Ahead and Real Time Reserve Requirements are as follows:

	Reserve Service		
	Synchronized Reserve (SR)	Primary Reserve (PR)	30-Minute Reserve (30-Min)
Reliability Requirement	Largest Single Contingency	150% of Synchronized Reserve Reliability Requirement	Greater of (Primary Reserve <u>Reliability</u> Requirement, <u>3000-MW minimum operating reserve</u> , or largest active gas contingency)

The table above defines the Reliability Requirement for both the PJM RTO and active subzone. In the event the largest single contingency in the active subzone is greater than the RTO, the RTO Reliability Requirement will be set to the active subzone value. For more information on active subzones, refer to PJM Manual 11: Energy and Ancillary Service Market Operations.

As system conditions dictate, PJM Dispatch will load Synchronized and Primary Reserves. Members are expected to take actions as indicated in PJM’s Balancing Operations Manual (M-12): Section 4.1.2 “Loading Reserves”.

- PJM periodically evaluates the Synchronized and Primary reserve estimates in real time via the Instantaneous Reserve Check (IRC) process documented in PJM Balancing Operations Manual (M-12): Section 4.1.1 “Monitoring Reserves”.

Note:

PJM must schedule sufficient Regulating Reserves to satisfy control standards. Regulating Reserves shall be made up of not less than 75% Spinning Reserves, and resources allocated to regulating reserves shall not be included as part of Contingency Reserves.

PJM schedules sufficient Contingency Reserves to satisfy the Reliability First (RF) Regional Criteria. Contingency Reserves shall not be less than the largest contingency. Contingency Reserves must be

made up of at least 50% Spinning Reserves. No more than 33% of Contingency Reserves should be interruptible load. (NERC Standard BAL-002-3)

In order to meet Reliability First (RF) Regional Criteria, PJM may schedule additional Contingency Reserves on a temporary basis in order to meet the Largest Single Contingency, as necessary to account for resource performance. PJM shall post details regarding additional scheduling of reserves in Markets Gateway.

The Regulation Requirement for the PJM RTO is defined in section 4, Providing Ancillary Services, of PJM M-12, Balancing Operations.

RF Contingency and Synchronized Reserve requirements are reviewed and set on an annual basis.

PJM schedules reserves on a day-ahead and real-time basis to ensure Contingency/Primary Synchronized/Spinning and Secondary/Operating reserve requirements are maintained. Reserves are scheduled on a sub-zonal basis to recognize transmission constraints while scheduling sufficient localized reserves in the active subzone as further described in Manual 11: Energy and Ancillary Service Market Operation. The cost of capacity or energy is allocated among the Market Buyers as described in the PJM Manual for Operating Agreement Accounting (M-28).

PJM identifies its Most Severe Single Contingency by surveying the greatest MW loss due to a single contingency. PJM monitors and reviews both generation and transmission element losses based on system model configurations to identify contingencies. PJM updates these models appropriately for scheduled outages that can change the monitored contingency.

The minimum operating reserve used in determining the 30-Minute Reserve Reliability Requirement is calculated based on the following formula:

$$\text{minimum operating reserve} = \text{load forecast peak} * (\text{average underforecasted load forecast error} + \text{average generator forced outage rate})$$

The load forecast peak component of the minimum operating reserve calculation is the daily maximum load forecasted for the operating day in the most current load forecast available when the day-ahead market runs.

The average underforecasted load forecast error component of the minimum operating reserve calculation is based on a three-year average of load forecast error where load is underforecasted in the forecast generated eight hours prior to the expected peak. PJM focuses on only underforecasted load forecast errors because underforecasted load can result in a capacity deficiency. PJM computes the underforecasted load forecast error based on the 80th percentile of a historical rolling three-year underforecast average.

The forced outage rate component of the minimum operating reserve calculation is based on a rolling three-year average of forced outages that occur from 18:00 of the scheduling day (day - 1) through the operating day at 20:00. This duration covers the timeframe after the Reserve Adequacy Run through the evening peak period for which the system is scheduled. Forced outages that occur prior to 18:00 of the scheduling day are accounted for in the commitment plan.

PJM staff performs the calculations annually to determine the average underforecasted load forecast error and the average generator forced outage. The calculations cover the three-year window from November 1st (year - 4) through October 31st (year - 1) where “year” is the calendar year in which the calculated values go into effect. The results are made public via a posting on PJM’s website. The updated calculated values are implemented annually on January 1st.

The 30-Minute Reliability Requirement in a reserve sub-zone is calculated as the greater of the sub-zone Primary Reserve Reliability Requirement and the largest sub-zone active gas contingency.

In the event PJM forecasts a credible natural gas pipeline contingency(s), as described in Section 3.9 of this manual, the hourly 30-minute Reserve Reliability Requirement is calculated as the greater of:

- The 30-minute Reserve Reliability Requirement, as defined above, plus any increase to the 30-minute Reserve Reliability Requirement to address operational uncertainty or any increase to the 30-minute Reserve Reliability Requirement due Hot or Cold Weather Alert or escalating emergency procedures, as described in PJM Manual 11: Energy & Ancillary Services Market Operations, Section 4.3 OR
- The sum of the Economic Max of Resources defined as part of the largest credible natural gas pipeline contingency.

PJM commits generation real-time on an economic basis, considering resource characteristics (start-up, min run, starts per day) and anticipated system changes (load curve, interchange, must-run generation) while honoring system constraints.

PJM issues capacity emergencies across the entire PJM RTO except for PJM Load Dump Warnings/Actions, which are solely issued on a Control Zone basis. However, transmission constraints may force Emergency Procedure warnings/actions to be issued on a Control Zone or a subset of a Control Zone. For example, if known transmission constraints would prohibit delivery of Maximum Emergency generation capacity from one Control Zone to another, a Maximum Generation Alert would not be issued for the Control Zone with undeliverable energy.