

PJM Manual 11:

Energy & Ancillary Services Market Operations

Revision: 130

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4.3 Reserve Requirement Determination

PJM models a reserve requirement at the RTO and sub-zonal level in whole MW for each hour of the operating day based on the greatest MW loss of all potential Largest Single Contingencies on the system and the minimum required operating reserves. The table below describes the reliability and reserve requirements for each Reserve Service.

	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, 3000 <u>MW minimum operating reserve</u> , or largest active gas contingency)
Reserve Requirement	SR Reliability Requirement + Extended <u>Synchronized</u> Reserve Requirement	<u>Greater of (PR Reliability Requirement + Extended <u>Primary</u> Reserve Requirement, <u>SR Requirement</u>)</u>	<u>Greater of (30-Min Reliability Requirement + <u>Extended 30-Min</u> Reserve Requirement, <u>PR Requirement</u>)</u>

- 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 Largest Single Contingency in Day-ahead is normally the largest Economic Maximum value for all available schedules or the summation of the largest Economic Maximum value for all available schedules of an active reserve group for the hour.
- The Largest Single Contingency in Real-time is normally the higher of [max of (the largest online generator’s output or Economic Maximum) or the sum of the higher of (Economic Maximum values or outputs of an active reserve group)].
- An active reserve group is a model of a station with multiple generation resources with a total capacity in excess of 800 MW, where there is a single outlet or where a single fault would trip multiple generation resources at the station.

- For purposes of the 30-Minute Reserve Reliability Requirement,
 - the minimum operating reserve is calculated based on the methodology described in PJM Manual 13: Emergency Operations, Section 2.2, and
 - the largest gas contingency is calculated as the summation of the Economic Maximum values of the identified resources as described in PJM Manual 13: Emergency Operations.
- Only those potential Largest Single Contingencies communicated by PJM Operations and modeled in the market clearing software will be eligible to set the applicable reserve requirements used in the market clearing process.
- There are, at times, outage conditions at stations whereby a single fault would trip multiple generators resulting in a loss of generation greater than the Largest Single Contingency. In such instances, PJM will carry an increased Reserve Requirement in equivalent summation of output of those multiple generators in accordance with Reserve Requirements described in PJM Manual 13: Emergency Operations, Section 2.2.
- Unless increased under anticipated heavy load conditions as described below, the extended reserve requirement for all three reserve services (Synchronized Reserve, Primary Reserve and 30-Minute Reserve) is 190 MW as detailed in Step 2A in Section 4.3.3 of this Manual.
- At times, anticipated heavy load conditions may result in PJM operators carrying additional reserves to cover increased levels of operational uncertainty. PJM may extend the 30-Minute Reserve, Primary Reserve and/or Synchronized Reserve Requirements in the Market Clearing Engine during the on-peak period in order to incorporate these actions in Energy and Reserve Pricing when a Hot Weather Alert, Cold Weather Alert, Conservative Operations, or an escalating emergency procedure (as defined in PJM Manual 13: Emergency Operations) has been issued for the Operating Day. Under these conditions, the extended Synchronized Reserve Requirement will be increased to include the additional Synchronized Reserve MW required to account for operational uncertainty as determined by PJM Dispatch. The extended Primary Reserve Requirement will be increased to include the additional Primary Reserve MW required to account for operational uncertainty as determined by PJM Dispatch. and The extended 30-Minute Reserve Requirement will be equal to the existing extended applicable Reserve Requirement plus the sum of any increased to include the additional 30-Minute Reserve MW brought online for that hour by PJM dispatch required to account for operational uncertainty as determined by PJM Dispatch.
 - The Synchronized Reserve Requirement must be less than or equal to the Primary Reserve Requirement which must be less than or equal to the 30-Minute Reserve Requirement. Therefore, the Primary Reserve Requirement will be the greater of the Primary Reserve Reliability Requirement plus the extended Primary Reserve Requirement or the Synchronized Reserve Requirement. The 30-Minute Reserve Requirement will be the greater of the 30-Minute Reserve Reliability Requirement plus the extended 30-Minute Reserve Requirement or the Primary Reserve Requirement.
 - If reserve deliverability issues are anticipated, then the requirements for the active Sub-Zone(s) in which the additional resources are located may be extended. For example, if additional resources are specifically scheduled in the active Sub-zone in anticipation of transmission constraints inhibiting the delivery of reserves into that region, both the active Sub-zone and RTO Reserve Zone requirements would be extended.

- If the additional resources are scheduled in the RTO Reserve Zone, then only the RTO Reserve Zone requirement would be extended.
- The requirements will return to their original values upon exit from emergency procedures or when the additional resources have been released by PJM dispatch.
- PJM will notify market participants of changes to the Reserve Requirements in relation to emergency procedures via the Emergency Procedure Posting Application once the decision to change the Reserve Requirements is made.
- Regardless of the Reserve Requirements modeled in the Market Clearing Engine, PJM operators will continue to initiate emergency procedures based on the Reserve Requirements defined in PJM Manual 13: Emergency Operations.
- Each Reserve Requirement will have an associated reserve demand curve as specified in Section 4.3.3 of this Manual.