RCSTF PJM Reserve Requirements: Challenges & Proposed Solution

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Introduction

- Overview of operational needs during normal days and actions that need to be taken during Conservative Operations days
- Near term solutions that can better align operational needs with the existing reserve products and clearing (i.e., reduce the need for out of market actions)

Current 30-Minute Reserve Requirement

- Currently, the 30-minute Reserve Requirement is the greater of:
  - 3,000 MW
  - Primary Reserve Requirement, or
  - Active Gas Contingency
- A flat requirement (i.e., 3,000 MW) does not reflect how risk changes based on operational conditions
- Any time peak load is greater 74,257 MW, 3,000 MW of 30-Minute Reserves is not sufficient to manage operational risk

Dispatch Actions during Winter Storm Gerri

Risk-based scheduling approach – load forecast, outages, natural gas availability

- Units with extended start times were evaluated and started early to ensure units were online before extreme cold weather settled in. Strategy was to have units warm and ready to ramp up.
- Evaluated units that have not operated in the past eight weeks for consideration for additional start time

Reliability cases were conducted, and units were committed for reliability based on anticipated congestion and capacity projections.

Both Flexible and Inflexible Day-Ahead CTs were given advance notice for projected run period for additional time to procure fuel and to notify PJM if they would not be able to operate.

- Considerations were given to min. down time on units to determine if they would be able to come back in time for higher projected loads.
- Extended holiday weekend gas nomination period was considered when making commitments to gas units.

Day-Ahead Unit Scheduling During Winter Storm Gerri

	Day-Ahead	
	Self-Scheduled Units	Committed Unit for Conservative Operations
Date	*Sum of Eco Max*	
Jan. 13	72,693	< 1,000
Jan. 14	67,200	< 9,000
Jan. 15	67,088	10,140
Jan. 16	68,977	15,189
Jan. 17	68,823	14,009
Jan. 18	63,056	< 2,000

Reflecting Operational Reliability Needs in the Market

- Objective is to capture operational needs for maintaining reliability in the markets
- Operations must take the actions necessary to ensure reliability, so the sooner we can get reforms in place, the better
- In the near term, we propose tackling two issues that are relatively low-hanging fruit:
  - 30-Minute Minimum Reserve Requirement as defined today is not sufficient to capture day-to-day risk
  - PJM Manual language limits PJM's flexibility in extending our extended reserve requirements during emergency operations

Reserve Requirement Reforms

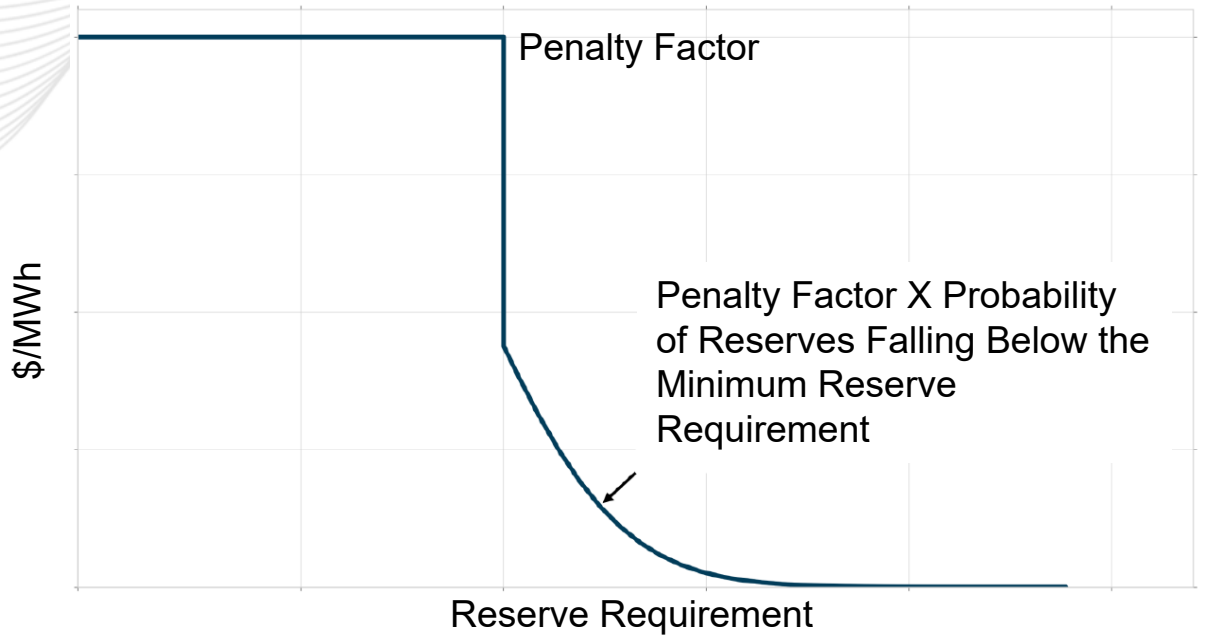
- **Near-term:**
  - Incremental improvements based on the existing reserve products and definitions
  - Better align reserve procurement quantities with operational needs
- **Mid- and Long-term:**
  - Explore new reserve products to better capture existing and emerging operational uncertainties
  - Further align reserve procurement quantities with operational needs driven by the changing resource mix
  - Ensure that reserve products appropriately value flexibility
  - Continue work to improve data quality and confidence in reserve availability and fuel security

High Level Near-Term Proposal Objectives

- Better align the 30-minute reserve requirement to more accurately reflect the operational risks that dispatch must account for on a day-to-day basis
- Allow the extended reserve requirements (i.e., Step 2B on the ORDC) to drive procurement of *needed* reserves to address operational uncertainty without forcing the over-procurement of other reserves

Background: 30-Minute Reserve Requirement

- 3,000 MW minimum reserve requirement was intended to be coupled with a downward sloping ORDC
- 3,000 MW number was roughly twice the most severe single contingency at that time and could be extended due to operating conditions
- The downward sloping ORDC captured load and generation risk, including forecast error and the probability of forced outages, as well as interchange uncertainty
- Development of the curves highlighted that the primary drivers of risk today are forced outages and load forecast error



Operating Reserve Demand Curve (ORDC) Shape as Proposed Under Reserve Price Formation

30-Minute Minimum Reserve Requirement Proposed Solution

- Change the 3,000 MW quantity in the 30-Minute Reliability Requirement to better capture day-to-day operational risks, similar to the previously used methodology in the Day Ahead Scheduling Reserve (DASR) and aligned with current operator practice
- Methodology for setting the 30-Minute Reliability Requirement:

30-Min Requirement = MAX(Load Forecast Peak*(Avg. Load Forecast Error + Avg. Forced Outage Rate), Primary Reserve Requirement, Active Gas Contingency)

Similar to how it was done for DASR, the average load forecast error and average forced outage rates would be calculated annually, based on data from a three year rolling average.

DASR Requirement Calculation from 2022

	Load Forecast Error Component 80th Percentile Absolute Error				Forced Outage Rate Component All Forced Outage Tickets				Day Ahead Scheduling
Season	2019	2020	2021	Rollup	2019	2020	2021	Rollup	Req.
Winter	2.06%	2.05%	1.87%	1.99%	2.81%	2.19%	2.50%	2.50%	4.49%
Spring	1.84%	2.73%	1.95%	2.17%	2.24%	1.71%	2.35%	2.10%	4.27%
Summer	2.48%	1.94%	1.99%	2.13%	2.43%	2.34%	2.81%	2.52%	4.66%
Fall	1.13%	1.37%		1.25%	2.08%	2.38%		2.23%	3.48%
Annual				2.04%				2.39%	4.43%

Source: *https://www.pjm.com/-/media/committees-groups/committees/oc/2021/20211007/20211007-item-09-day-ahead-scheduling-reserve-requirement-update.ashx*

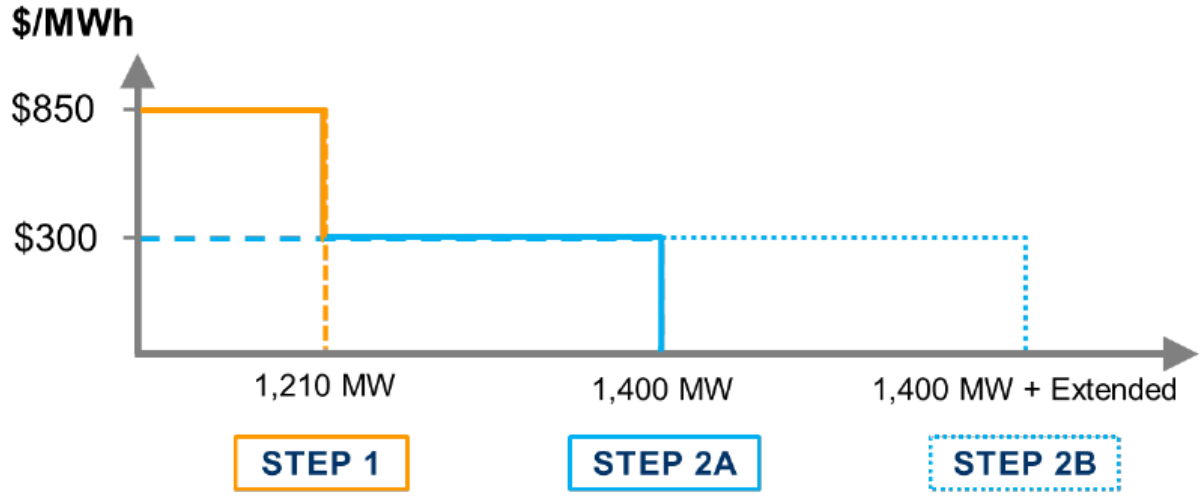
Current M11 Language on Extended Reserve Requirements

PJM Manual 11: Energy & Ancillary Services Market Operations
Section 4: Overview of the PJM Reserve Market

- 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 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 or an escalating emergency procedure (as defined in PJM Manual 13: Emergency Operations) has been issued for the Operating Day. The extended Synchronized Reserve Requirement, extended Primary Reserve Requirement and extended 30-Minute Reserve Requirement will be equal to the existing extended applicable Reserve Requirement plus the sum of any additional MW brought online for that hour by PJM dispatch to account for operational uncertainty.

Proposed Solution for the Extended Reserve Requirements

- Update Manual 11 to clarify that each extended reserve requirement can be extended independently.
  - For example, if PJM extended Step 2B of the 30-minute reserve requirement by 1,000 MW, that would not require that the SR and PR reserve requirements also extended by 1,000 MW.



Summary of Near-Term Reserve Requirement Solutions

- Revise the 30-minute Reliability Requirement to be set by the following calculation:
  - 30-min requirement = Load Forecast Peak*(Avg. Load Forecast Error + Avg. Forced Outage Rate)
- Update Manual 11 to clarify that each extended reserve requirement (i.e., Step 2B of the Synchronized Reserve, Primary Reserve and 30-Minute Reserve ORDCs) can be extended independently.

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Acronyms

Acronym	Term & Definition
SR	**Synchronized Reserves** are a reserve capability that can be converted fully into energy within 10 minutes following the request of PJM. Equipment providing Synchronized Reserve must be electrically synchronized to the power system.
PR	**Primary Reserves** are a reserve capability that can be converted fully into energy within 10 minutes following the request of PJM.
ORDC	**Operating Reserve Demand Curve** is the demand curve used in clearing the reserves markets.
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.
DASR	**Day Ahead Scheduling Reserve** is the reserve product and requirement calculation done prior to Reserve Price Formation.

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