RCSTF Initial Solution Packages Overview

Emily Barrett
Sr. Lead Market Design Specialist

Markets & Reliability Committee
July 24, 2024

Solution Package 1:
Reserve Requirement Definitions

30-Minute Reliability Requirement

Challenge: The 30-minute reserve requirement does not currently reflect the operational risks that PJM dispatch must account for on a day-to-day basis. Reserve needs are correlated to demand level, and 3,000 MW is often insufficient to meet reliability needs.

Change the 3,000 MW quantity the 30-minute Reliability Requirement to better capture day-to-day risks in alignment with current operational practice, using the methodology previously used under the Day-Ahead Scheduling Reserve:

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

Extended Reserve Requirements

Challenge: Extending one of the extended reserve requirements to address operational uncertainty would cascade into all three, and could force the over-procurement of unneeded reserves.

For example, if PJM needed to procure additional 30-minute reserves to address operational uncertainty, that would require also procuring the same amount of additional SR and PR.

Clarify that Synchronized Reserve, Primary Reserve and 30-Minute Reserve extended reserve requirements (i.e., Step 2B of each ORDC) can be increased independently. Product substitution and nesting rules would still apply as they do in status quo.

Clarifying Revisions to Manual 13 Section 2.2
Red-lines Since the First Read

The load forecast peak component of the minimum operating reserve calculation is the daily maximum load forecasted for the operating day from the most current load forecast available for the Day-Ahead Market run. This value is applied when calculating the 30-Minute Reserve Reliability Requirement in the Day-Ahead Market and shall be the same in the Real-Time Market.

PJM staff performs the calculations annually to determine the average underforecasted load forecast error and the average generator forced outage rate. 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 will be presented to stakeholders at the PJM Operating Committee and subsequently posted on PJM's website. The updated calculated values are implemented annually on January 1st.

Solution Package 2:
Synchronized Reserve Deployment

Deployment: Challenges to Address

- Communication delays caused by the All-Call
- Inconsistency between how instructions are given during a spin event and during normal dispatch
- Confusion on what PJM is requesting from resources during a spin event
- Dispatchers lack tools to deploy less than 100% of the reserves held

Deployment Proposed Solution

- Dispatcher initiates the reserve event, entering the amount of reserves to be deployed
- **Reserve deployment instructions to generators will be transmitted as an update to basepoints.** Deployed reserve MWs are added to the current output of each resource and sent out immediately through telemetry
  - The automated notification that we are in a spin event, and the All-Call notification will still be issued.
- For demand response resources, deployment instructions continue to go through DR Hub
- While the event persists, dispatch instructions to dispatch-following resources with a reserve deployment assignment would be the greater of a) the original deployment instruction sent at the start of the event or b) the new economic dispatch point calculated by SCED

Less than 100% Reserve Deployment Proposed Solution

- To the extent possible, all resources will be deployed pro rata
  - Example: A resource has a 10 MW SR assignment and PJM deploys 80% of held reserves. The resource would be instructed to deploy 8 MW.
- Inflexible generation resources will be deployed to the greater of a) EcoMin and b) the pro rata reserve deployment instruction*
  - Example: A condenser has an EcoMin of 10 MW, a 30 MW SR assignment, and PJM deploys 50% of held reserves. The resource would be instructed to deploy 15 MW.
  - Example: A condenser has an EcoMin of 20 MW, a 30 MW SR assignment, and PJM deploys 50% of held reserves. The resource would be instructed to deploy 20 MW.
- Resources without a dispatchable range will be deployed to their SR assignment*

**Due to these constraints, actual reserves deployed may be greater than the pro rata calculation*

Contact

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

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

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

RCSTF Initial Solution Packages

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

Appendix A: Informational Items for Reserve Requirements Package

OATT and OA Definitions

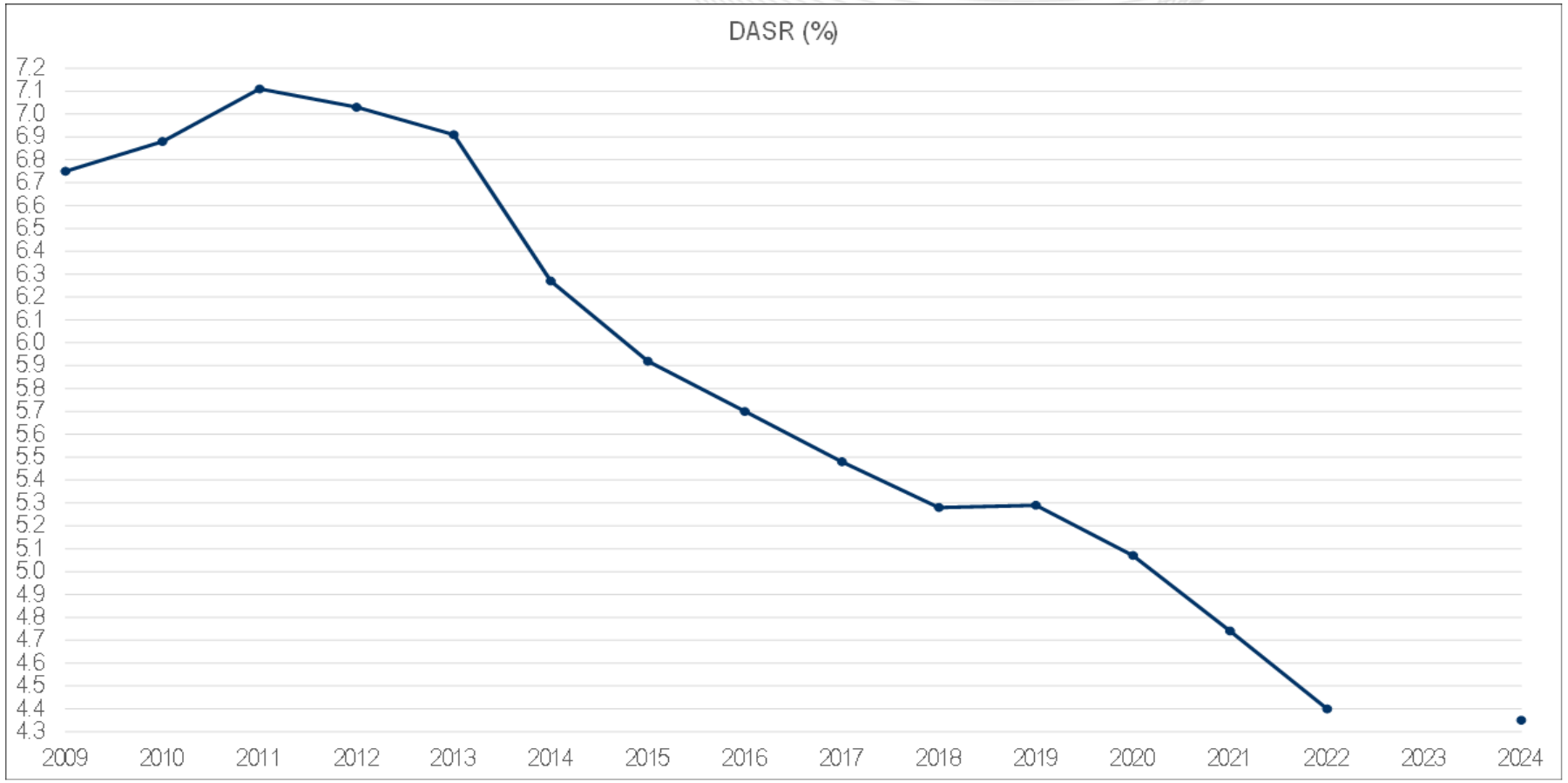
30-minute Reserve Requirement: "30-minute Reserve Requirement“ shall mean the megawatts required to be maintained in a Reserve Zone or Reserve Sub-zone, as Secondary Reserve, absent any increase to account for additional reserves scheduled to address operational uncertainty. The 30-minute Reserve Requirement is calculated in accordance with the PJM Manuals. The requirement can be satisfied by any combination of Synchronized Reserve, Non Synchronized Reserve or Secondary Reserve resources.

Extended 30-minute Reserve Requirement: "Extended 30-minute Reserve Requirement" shall equal the 30-minute Reserve Requirement in a Reserve Zone or Reserve Sub-zone, plus 190 MW, plus any additional reserves scheduled under emergency conditions necessary to address operational uncertainty. The Extended 30-minute Reserve Requirement is calculated in accordance with the PJM Manuals.

Current 30-Minute Reserve Requirement

- PJM is the NERC Registered Balancing Authority (and RC, TOP, PC, TSP) and has compliance obligations associated with maintaining system reliability.
- 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
- Based on DASR approach, any time peak load is greater than 74,257 MW, 3,000 MW of 30-Minute Reserves is not sufficient to manage operational risk

Day Ahead Scheduling Reserves



Year Effective	DASR (%)
2009:	6.75
2010:	6.88
2011:	7.11
2012:	7.03
2013:	6.91
2014:	6.27
2015:	5.92
2016:	5.70
2017:	5.48
2018:	5.28
2019:	5.29
2020:	5.07
2021:	4.74
2022:	4.40
2023:	None
2024:	4.35

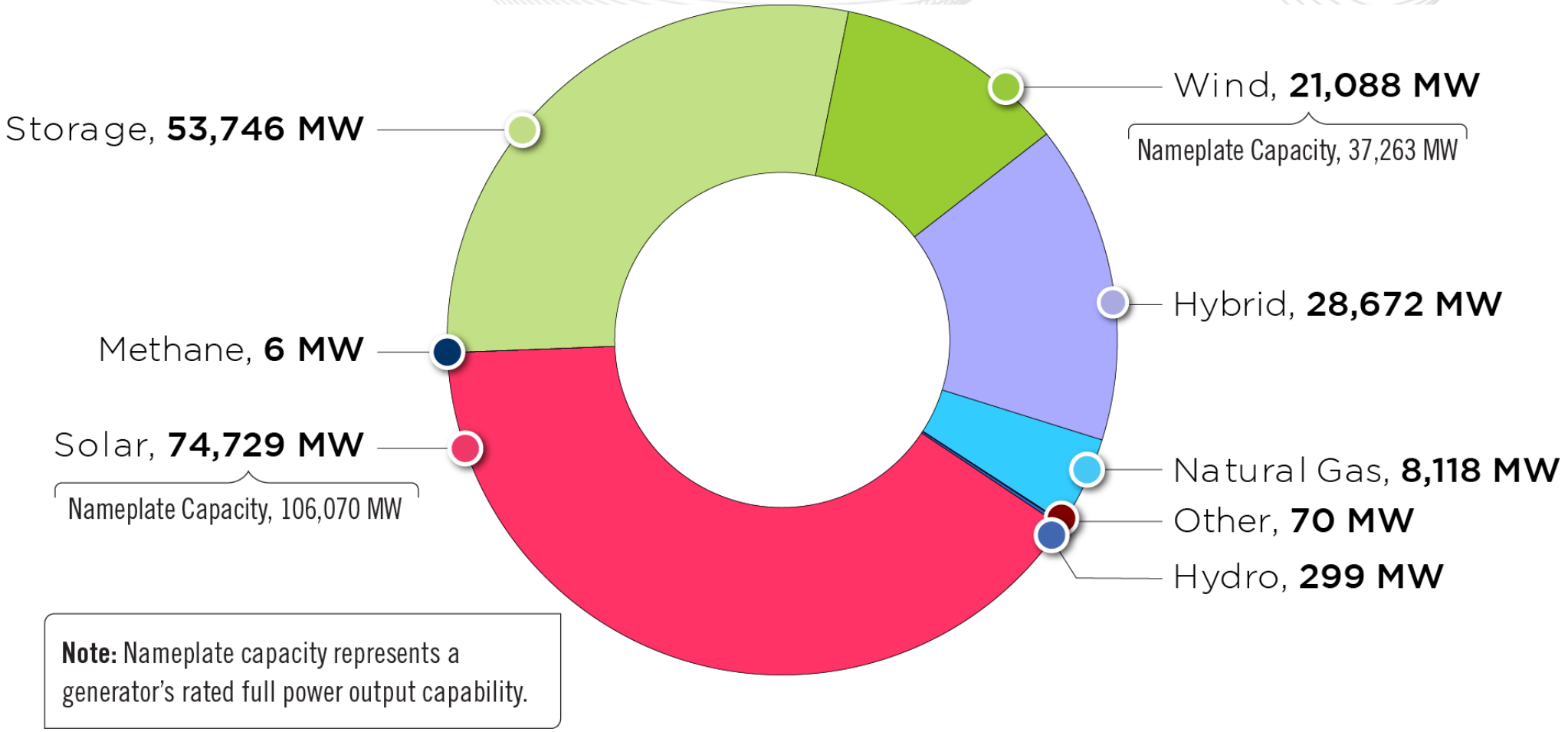
DASR approved in 2008 details included in PJM manuals
https://www.pjm.com/-/media/committees-groups/committees/mic/20140625-energy/20140625-item-04-overview-of-dasr.ashx

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*

Fuel Security: Queued Generation Fuel Mix



Note: Lack of fuel security creates operational risk that must be addressed.

As of Dec. 31, 2023

ISO/RTO Neighbor Comparison

	PJM	SPP	MISO	CAISO	ERCOT
Peak Load MW	165,000	53,243	130,897	52,061	85,464
Metered Solar MWs	10,700	1,437	6,000	26,000	24,000
BTM Solar MW	7,000	500	5,000	17,000	1,500 (growing rapidly)
Wind MW	11,540	32,000	30,000	8,120	39,000
Storage MWs	0	213	0	13,000	7,000
Total Metered IBRs	22,240	33,650	36,000	47,120	70,000
Operating Reserve Requirement	DASR	Uncertainty Risk Team use Operational Capacity Outlook to evaluate risk as part of Multi-day Reliability Assessment	Risk Based: 4% - 11%	Originally DASR, then Net Load Uncertainty, now Condition Based Approach (percent increases based on risk).	Minimum 6500 MW Probabilistic Risk Based Tool under development

Note: Table compiled based on notes from PJM site visits conducted in April/May 2024.

Reflecting Operational Reliability Needs in the Market

- Operations will take the actions necessary to ensure reliability.
- Objective is to capture operations reliability needs in the market commitments, dispatch and pricing
  - Operators must maintain the flexibility to take actions outside the markets.
  - Minimizing out of market actions leads to more consistent, cost-effective commitments/dispatches that are reflected in market prices.
- Revise, the 30-minute Reserve Requirement to be the greater of:
  - Load Forecast Peak*(Avg. Load Forecast Error + Avg. Forced Outage Rate),
  - Primary Reserve Requirement,
  - Active Gas Contingency
- Next Steps – Operations will work to quantify future risk / uncertainty and necessary reserves to maintain reliability; working with markets to ensure commitments, dispatch and pricing

Appendix B: Manual and Tariff Revisions

Reserve Requirement Package

Updates to Section 4.3 Reserve Requirement Determination

- Clarified that each of the reserve services has its own Extended Reserve Requirement, which can be increased discretely
- Clarified that the requirements will continue to nest
- Replaced the 3,000 MW value in the 30-Minute Reliability Requirement with the new minimum operating reserve quantity, and referenced Manual 13 where that calculation is detailed

Updates to Section 2.2 Reserve Requirements

- Detailed how the minimum operating reserve value would be calculated, based on the load forecast peak, average load forecast error and average generator forced outage rate
- Detailed how each quantity in the operating reserve calculation is derived
- Explained the process for calculating the average load forecast error and average generator forced outage rate annually
- Explained how the 30-Minute Reliability Requirement is set in a reserve sub-zone

Reliability Requirement Package

Updates to the Synchronized Reserve Event definition

- Specified that during a Synchronized Reserve Event, resources will be requested to increase energy output by “a directed” amount

Updates to Section 3.2.3A Synchronized Reserve (j)

- Specified that resources will be evaluated based on the amount that a resource was “directed to deploy” during a Synchronized Reserve event, rather than its “assignment”

Updates to Section 4.5.2 Non-Performance

- Specified that resources will be evaluated based on the Synchronized Reserve amounts they are “directed to deploy”
- Removed outdated regulation language

Updates to Section 4.1.2 Loading Reserves

- Updated PJM Actions to specify that the reserve deployment quantities will be added to resource basepoints and sent out immediately during a SR Event
- Added information about demand response SR deployment through DR Hub
- Updated PJM Member Actions to specify that resources shall continue to follow their basepoints, which will reflect the SR deployment instructions, and that if resources holding a SR assignment do not receive a basepoint these resources should immediately deploy their full SR assignment

Updates to Section 6.1 Synchronized Reserve Accounting Overview

- Removed outdated regulation language

Updates to Section 6.2.2 Balancing Synchronized Reserve Market Clearing Price Credit

- Specified that the Synchronized Reserve Shortfall Charge will be based on the Synchronized Reserve amount the resource “was directed to deploy”

Updates to Section 6.3.3 Synchronized Reserve Retroactive Penalty Charge

- Specified that retroactive penalty charge is based on failure to provide the Synchronized Reserve that resources “were directed to deploy”

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.
SCED	**Security Constrained Economic Dispatch** is the optimization engine used to calculate dispatch and reserve assignments and to set prices.
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.

Acronyms

Acronym	Term & Definition
SR	**Synchronized Reserves** is 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** is a reserve capability that can be converted fully into energy within 10 minutes following the request of PJM. The Primary Reserve service can be provided by both Synchronized and Non-Synchronized Reserves.
ORDC	**Operating Reserve Demand Curve** is used to articulate the value of maintaining reserves at specified levels

PROTECT THE POWER GRID

THINK BEFORE YOU CLICK!

pjm

Be alert to malicious phishing emails.

Report suspicious email activity to PJM.

(610) 666-2244 / it_ops_ctr_shift@pjm.com