

## 2.2 Reserve Requirements

PJM schedules reserves on a day-ahead basis in order to ensure that differences in forecasted loads and forced generator outages does not negatively impact the reliable operation of the PJM Transmission System. PJM operates in real-time to ensure Contingency/Primary (10 minute) and Synchronized/Spinning reserve requirements are always maintained. Day Ahead Scheduling Reserves (Operating), Contingency (Primary) and Synchronized/Spinning Reserve Requirements are as follows:

Area	Ancillary Service Market Area	Day-ahead Scheduling (Operating)	Contingency (Primary)	Synchronized Reserve
RTO	RTO	Annual %	150% Largest Single Contingency	Largest Single Contingency
	Mid-Atlantic & Dominion	N/A	150% of the Largest Single Contingency <sup>1</sup>	Largest Single Contingency <sup>1</sup>
SERC	Dominion	VACAR ARS%	VACAR ARS%	VACAR ARS%

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"](#).

The Day-ahead Scheduling Reserves for RFC are calculated on an annual basis. This calculation considers variables that adversely impact system reliability, specifically, Underforecasted Load Forecast Error (LFE) and Generator Forced Outage Rates (FOR).

$$\text{Day ahead Scheduling Reserve} = \text{Underforecasted LFE} + \text{FOR}$$

### Load Forecast Error Component

The LFE component is based on a 3 year average of Underforecasted LFE. PJM focuses on only Underforecasted Load Forecast errors because underforecasted loads can result in a capacity deficiency. PJM computes the Underforecasted LFE based on the 80<sup>th</sup> percentile of a rolling three year underforecast average.

Effective January 1, 2020~~19~~, the Underforecasted LFE error component of the Day-ahead Scheduling Reserve is ~~2.15~~**2.18**%.

### Forced Outage Rate Component

<sup>1</sup> PJM calculates and utilizes deliverable reserves from resources within the RTO that are outside of Mid-Atlantic & Dominion areas to satisfy the Primary and Synchronized Reserve Requirements in the MA and Dom area. Refer to M-11 Section 4 for additional details.

The FOR component is based on a rolling three year average of forced outages that occur from 18:00 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 Dispatch still has the ability to schedule additional reserves if a Hot Weather / Cold Weather Alert is issued since FOR are typically higher during such timeframes.

Effective January 1, 2020~~19~~ the FOR error component of the Day-ahead Scheduling Reserve is ~~2.92~~~~3.11~~%.

### Day-ahead Scheduling Reserve Requirement (Operating Reserve)

PJM Performance Staff performs Day-ahead Scheduling Reserve Requirement calculations every year during the month of November. The calculations cover the 3 year window from November 1<sup>st</sup> (year – 3) through October 31<sup>st</sup> (current year). The results are communicated to the Market Implementation Committee, Operating Committee and System Operations Subcommittees. The revised reserve calculations are implemented annually on January 1<sup>st</sup>.

Effective January 1, 2020~~19~~ the Day-ahead Scheduling Reserve for RFC and EKPC regions of PJM is ~~5.07~~~~5.29~~% times Peak Load Forecast for RFC plus EKPC.

Dominion Day-ahead Scheduling Reserve is based on their share of the VACAR Reserve Sharing agreement and is set annually.

The RFC, EKPC and Dominion Day-ahead Scheduling Reserve Requirements are added together to form a RTO Day-ahead Scheduling Reserve Requirement.

#### 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 25% of Contingency Reserves should be interruptible load. (NERC Standard<http://www.nerc.com/files/BAL-002-1.pdf> BAL-002-2(i), RFC\_Criteria\_BAL-002-02.)

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

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

<https://www.serc1.org/program-areas/standards-regional-criteria/regional-criteria-and-guidelines> Dominion-VP load is subject to the SERC requirements based on the VACAR Reserve Sharing Agreement which is set annually. For non-Dominion-VP load in the Dominion Control Zone, SERC reserve requirements (non-reserve sharing group) are applicable to the Balancing Authority (PJM). There are sufficient reserves in the RTO to surpass these SERC requirements through the existing reserve methodology.

PJM schedules Day-ahead Scheduling reserves on a day-ahead basis as a single market in the RTO. Primary and Synchronized Reserves are maintained in real-time based on the locational requirements identified above, recognizing transmission constraints while scheduling sufficient localized reserves on a control zone basis to satisfy reserve sharing agreements. 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 Largest 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.

In the event PJM forecasts a credible natural gas pipeline contingency(s), as described in Section 3.9 of this manual, the hourly Day-ahead Scheduling Reserve requirement is calculated as the greater of:

- The Day-Ahead Scheduling Reserve Requirement, as defined above, plus any increase to the Day-Ahead Scheduling Reserve Requirement to address operational uncertainty or any increase to the Day-Ahead Scheduling Reserve Requirement due Hot or Cold Weather Alert or escalating emergency procedures, as described in PJM Manual 11: Energy & Ancillary Services Market Operations, Section 11.2.1,

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.