



Non-Performance Assessment Settlement Summary

Last Updated: October 23, 2023

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Purpose

The purpose of this document is to provide added transparency to the Non-Performance Assessment settlement calculations. Nothing in this document supersedes any rules detailed in the Tariff, RAA, Operating Agreement, or PJM Manuals. In the event any explanation set forth in this document is deemed to be inconsistent with PJM's governing documents, the rules detailed in the Tariff, RAA, Operating Agreement, or PJM Manuals control.

Identification of Assessed Resources

The list of resources to be assessed is discussed in OATT, Attachment DD, Section 10A (a) and Manual 18, Section 8.4A Non-Performance Assessment.

Calculation of Balancing Ratio

The calculation of the Balancing Ratio is discussed in OATT, Attachment DD, Section 10A (c) and Manual 18, Section 8.4A. The following section provides additional clarification regarding the calculation of the Balancing Ratio.

The Actual Generation and Storage Performance used in the determination of the Balancing Ratio is calculated as metered output + real-time ancillary service adjustment.

- The metered output is the MW values provided through Power Meter and calculated according to the Revenue Data for Settlements methodology in Manual 28, Section 1A.
- The real-time ancillary service assignment accounts for regulation, synchronized reserves, secondary reserves, or non-synchronized reserves.
 - The adjustments made to the actual performance for these real-time ancillary services capture any movement off the economic basepoint of the resources to provide the service. This is consistent with the calculation of Resource Actual Performance. More details on the specific calculations are in the "Calculation of Resource Actual Performance" section below.
 - Tier 1 reserves estimates are not included in the real-time ancillary service adjustment because these resources are not moved off their economic basepoint to account for these reserves. Effective with the implementation of Reserve Price Formation on 10/1/2022, the Tier 1 and Tier 2 reserve products were consolidated into one, uniform, Synchronized Reserve product. As a result, only those resources reduced from their economic basepoint to provide the service are included in the real-time ancillary service adjustment.

The Net Energy Import used in the determination of the Balancing Ratio is calculated as the total imports less exports as reported through ExSchedule, not netted by participant, and is floored at zero MW.

Balancing Ratio data availability

A preliminary Balancing Ratio will be posted in Data Miner within 3 business days of a Performance Assessment Interval. The preliminary Balancing Ratio will not include the DR or PRD Bonus Performance value or the effect of any retroactive replacements. This value is not final and is subject to change.

The final Balancing Ratio will also be posted in Data Miner with the issuance of the PJM monthly bill 3 months after the Performance Assessment Interval.

Calculation of Resource Expected Performance

The calculation of Expected Performance is discussed in OATT, Attachment DD, Section 10A (c) and Manual 18, Section 8.4A. The following section provides additional clarification regarding the calculation of Expected Performance.

- For a committed generation resource, the Expected Performance is calculated as CP Committed MW (total RPM or FRR commitments, in UCAP terms) times the PAI Balancing Ratio.
- For a committed CP demand resource, the Expected Performance is equal to the CP Committed ICAP MW. Demand Resources are committed at a resource level, but are comprised of individual registrations. In some cases, a subset of a Demand Resource's registrations are dispatched during a PAI. If this occurs, the demand resource's Committed ICAP is pro-rated by the sum of the registered reduction MW of the dispatched registrations compared to the total registered reduction MWs for the resource.
- For a committed CP EE resource, the Expected Performance is equal to the CP Committed ICAP MW.
- For a committed PRD resource, the Expected Performance is equal to the Nominal PRD Value committed in the PAI Area, adjusted to account for any PRD registrations in the PAI that were not subject to compliance measurement. For more information, please refer to Section 3A.6.2A of Manual 18.
- For uncommitted capacity resources (including PJM-internal resources that fully delist in RPM) and energy-only resources, the Expected Performance is zero.

The committed amount in the calculation of a resource's Expected Performance reflects the results of any approved retroactive replacements for RPM commitments. The rules for retroactive replacement capacity transactions for RPM commitments are discussed in Manual 18, Section 8.8.

Calculation of Resource Actual Performance

The calculation of Actual Performance is discussed in OATT, Attachment DD, Section 10A (c) and Manual 18, Sections 8.4A and 8.6. The following section provides additional clarification regarding the calculation of Resource Actual Performance for a generation resource.

Regulation MW

The regulation adjustments account for the regulation signal being sent to the resource in real-time operations and any additional movement off the economic basepoint to provide regulation.

The Regulation Bias Factor (the real-time operations signal) is used as a multiplier to the resource's assignment to adjust for the regulation a resource was asked for in real-time. The regulation bias factor is a normalized representation of the regulation signal, ranging from +1 for a full raise signal to -1 for a full lower signal. A regulation bias factor is calculated for each regulation signal (RegA and RegD).

Regulation high and low limits are used to adjust for any requested movement off the resource's economic setpoint to move resource into the regulation band. If a resource needs to be moved up or down additional MW off the

economic setpoint to allow the resource to operate in the available regulation band, those MW will be adjusted for in the regulation calculation.

Synchronized Reserve MW

The synchronized reserve adjustments account for MWs the resource is backed down below the dispatch run LMP¹ Desired MW to provide the Synchronized Reserves assignment.

Secondary Reserve MW

The secondary reserve adjustments account for MWs the resource is backed down below the dispatch run LMP¹ Desired MW to provide the Secondary Reserves assignment. The secondary reserve adjustments for off-line resources providing Secondary Reserves are determined in the same manner as described below for Non-Synchronized Reserve MW.

Non-Synchronized Reserve MW

The non-synchronized reserve adjustments account for any economic MWs held offline for Non-Synchronized reserves. The NSR adjustment is equal to the dispatch Run LMP¹ desired MW values, which can be more or less than the actual NSR assignment on the resource. The dispatch run LMP¹ desired MW represents where the resources would have been dispatched absent an NSR assignment.

Net Energy Imports

For RTO wide events, Actual Performance for a Market Participant's Net Energy Imports is calculated as Net Energy Imports by Market Participant minus Net Energy Exports by Market Participant minus energy delivered from participant's External Generation Capacity Resources. If this value is negative, the participant's Actual Performance is zero MW.

Delisted Capacity Resources

The reported metered output for resources that have approved delisting transactions in Capacity Exchange is reduced by any energy exported in Real-Time.

Supporting MSRS Reports for Actual Performance:

The Non-Performance Assessment Unit Performance Details report in MSRS provides the details about a customer account's owned capacity resource's actual performance and Ancillary Service adjustments during a Performance Assessment Interval.

¹ Effective with the implementation of Fast Start Pricing on 9/1/2021, the 5-minute LMP from the Dispatch Run (as generated by RT SCED) applicable to the PAI interval is used

Allocation of Expected and Actual Performance due to Modeling Differences and Joint Ownership

Manual 18, Section 8.4A states that the metered output of jointly owned generation resources is allocated to each owner pro rata with each owner's share of the total Installed Capacity of the resource.

This methodology applies to the allocation of metered output as well as the allocation of other inputs (real-time regulation and reserves) used to calculate actual performance. This methodology is also used to allocate the scheduled MW for penalty and scheduled MW for bonus described in the calculation of excused MW section below. Additionally, in cases where a resource is on a partial outage (forced or planned), the installed capacity used in the allocation is reduced by the outage MWs.

This allocation methodology is also used for scenarios where the modeling of a generator is different between the capacity market and energy market. The example below illustrates the scenario where multiple Capacity Resources are aggregated into a single market unit for energy and reserve market purposes.

Energy and Reserve Market	Actual Performance	Capacity Market	Owned MW	Allocated Actual Performance
CC Unit 1	200	CC Unit 1	100	57
		CT Unit 2	100	57
		CT Unit 3	150	86

Calculation of Excused MW

The consideration of excusals from Performance Assessment Intervals is discussed in OATT, Attachment DD, Section 10A (d) and Manual 18, Section 8.4A. The following section provides additional clarification regarding the calculation of excusals.

Excusals due to PJM approved planned or maintenance outages

In accordance with section 10A (d) of Attachment DD of the Open Access Transmission Tariff, a Non-Performance shortfall can be excused to the extent that the generator MWs were unavailable due to a generator planned or maintenance Outage approved by PJM. Forced outages are not excused.

The PJM approved planned and maintenance outages are obtained from eDART. Similar to the allocation of Actual MW due to modeling differences between the energy market (Markets Gateway) and the capacity market (Capacity Exchange), the Planned Outage MW is also allocated using pro rata shares of Installed Capacity in the event

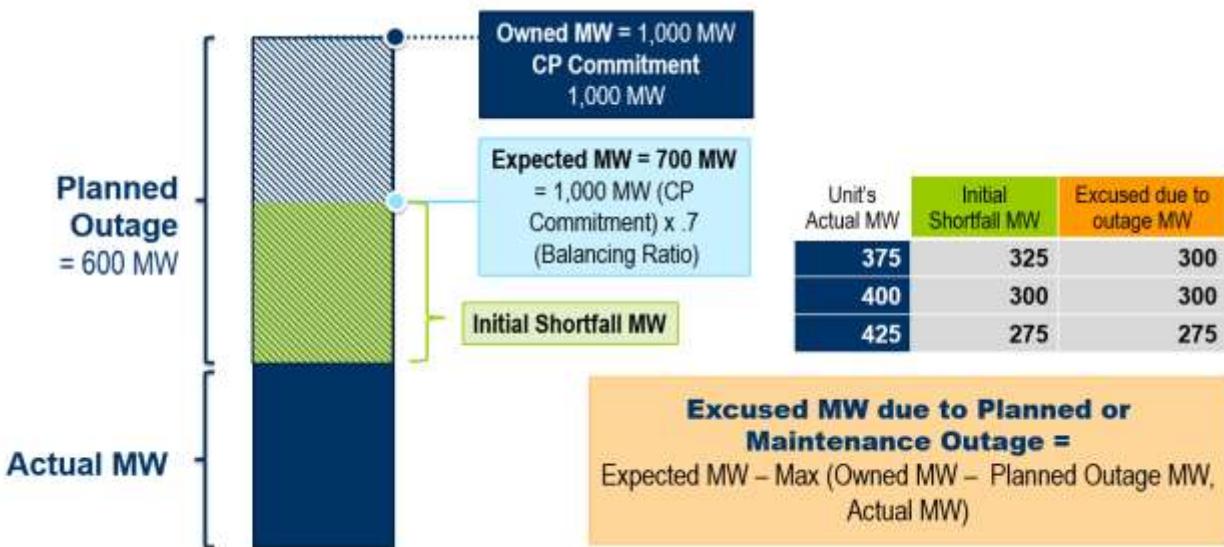
modeling differences exist between the outage reporting tool (eDART) and the capacity market modeling (Capacity Exchange).

The calculation of the Excused MW due to PJM approved planned or maintenance outages is equal to:

Excused MW due to Planned or Maintenance Outage = Expected MW - Maximum (Owned MW – Planned Outage MW, Actual MW)

Units have the ability to output more MW than reported to be available when just considering the Owned MW adjusted for the outage ticket. For that reason, the maximum value between the actual output and the Owned MW adjusted for the outage is used to determine the Excuse MW due to Outage.

See the illustrative example below.



Supporting MSRS Reports for Outages:

The Non-Performance Assessment Resource Outage Details Report in MSRS provides the details about a customer account's owned capacity resource's outage(s) during a Performance Assessment Interval. The Non-Performance Assessment Resource Charge Details report provides details on the excused MWs associated with any PJM approved planned or maintenance outages.

Excuses due to Security Constrained Economic Dispatch

In accordance with section 10A (d) of Attachment DD of the Open Access Transmission Tariff, a Non-Performance shortfall can be excused to the extent that the generator was not scheduled by PJM or was online, but scheduled down due to the security constrained economic dispatch. However, the tariff language prohibits the excusal of resources from non-performance penalties for MW that were not scheduled or scheduled down by PJM due to operating parameter limitations submitted in the resource's energy market offers or due to having a market-based

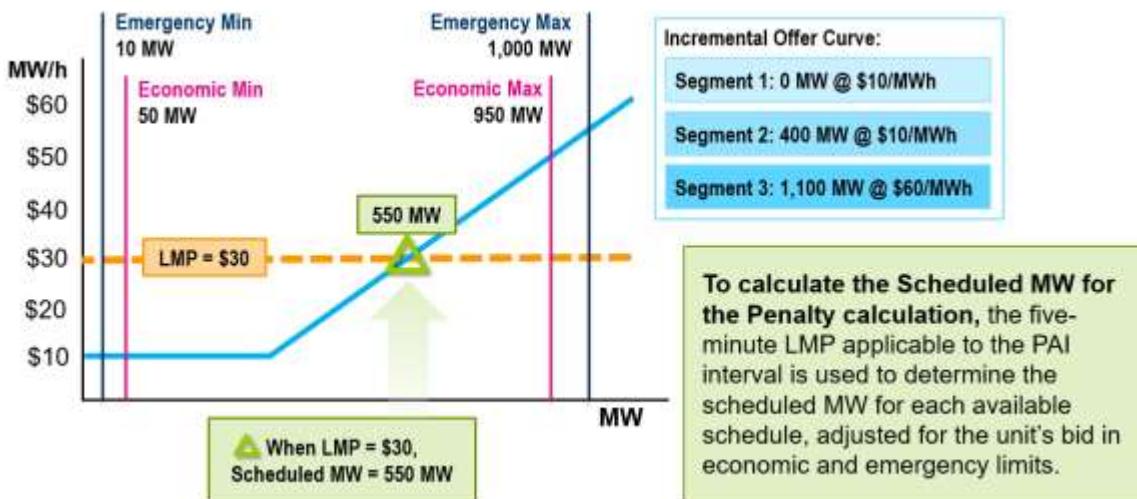
offer greater than the cost-based offer. Any MW on forced outage are not eligible for excusals due to Security Constrained Economic Dispatch.

Calculation of Scheduled MW for Penalty

To ensure MW that were not scheduled or scheduled down due to operating parameter limitations are not excused, PJM calculates an after-the-fact scheduled MW. The basepoint communicated to the resource during the PAI cannot be considered as the scheduled MW because it is influenced by the operating parameters submitted in the resource's offer (ex./ ramp rate, Economic Maximum, Startup Time, etc.)²

To calculate the Scheduled MW quantity used in the calculation of a penalty, the 5-minute dispatch run LMP³ applicable to the PAI interval is used to determine the scheduled MW for each available schedule submitted in Markets Gateway, adjusted for the unit's bid in economic and emergency limits. Note, Manual 18, section 8.4A includes language that requires each energy offer comply with Manual 11, Section 2.3.7. For units that do not have an offer curve or their offer curves are not used in real-time dispatch (i.e. Run of River), their scheduled MW is set to their cleared capacity amount.

See the following example that illustrates how the scheduled MW for a given incremental offer curve is calculated.



In this example, the LMP of \$30/MWh is within the unit's bid in limits, so the scheduled MW is simply the intersection of LMP and the offer curve.

² See FERC Denial of PJM Filed revisions to the PJM Open Access Transmission Tariff (Tariff), Attachment DD, section 10A(d) to excuse a Capacity Performance Resource from Non-Performance Charges, provided the resource is following PJM's dispatch instructions and operating consistent with a ramp rate previously approved by PJM (Docket ER16-1336-000).

³Effective with the implementation of Fast Start Pricing on 9/1/2021, the 5-minute LMP from the Dispatch Run (as generated by RT SCED) applicable to the PAI interval is used.

If the LMP > \$60/MWh, the scheduled MWs is capped at the Emergency Max in effect for the subject interval (recognizing that PJM cannot schedule beyond that value). The cap is set at the greater of (1) the Day-Ahead Scheduled MW (2) the Day-Ahead Emergency Max or (3) the applicable Real-Time Emergency Max value⁴ to prevent withholding MW in Emergency limits and between Day-Ahead and Real-Time.

If the LMP < \$10/MWh, the scheduled MW will be set to the Economic Min if the unit is online or set to 0 if the unit is offline.

Market-based Offers vs. Cost-based Offers

To ensure MW that were not scheduled or scheduled down due to having a market-based offer greater than the cost-based offer, PJM compares the scheduled MW calculated as described above for all available schedules. If a unit was dispatched on its market-based curve, the highest Scheduled MW quantity for all available schedules is used to calculate the Excused MW due to Economic Dispatch. If a unit was dispatched on its price-based PLS curve, the highest Scheduled MW quantity across the price-based PLS and all available cost schedules is used. If a unit was dispatched on its cost-based curve, the Scheduled MW value for that cost-based schedule is used.

Calculation of Excused MW due to Economic Dispatch

After the Scheduled MW is calculated and the effect of market-based and cost-based offers is considered, the excused MW due to Economic Dispatch can be calculated. The Excused MW due to Economic Dispatch is equal to:

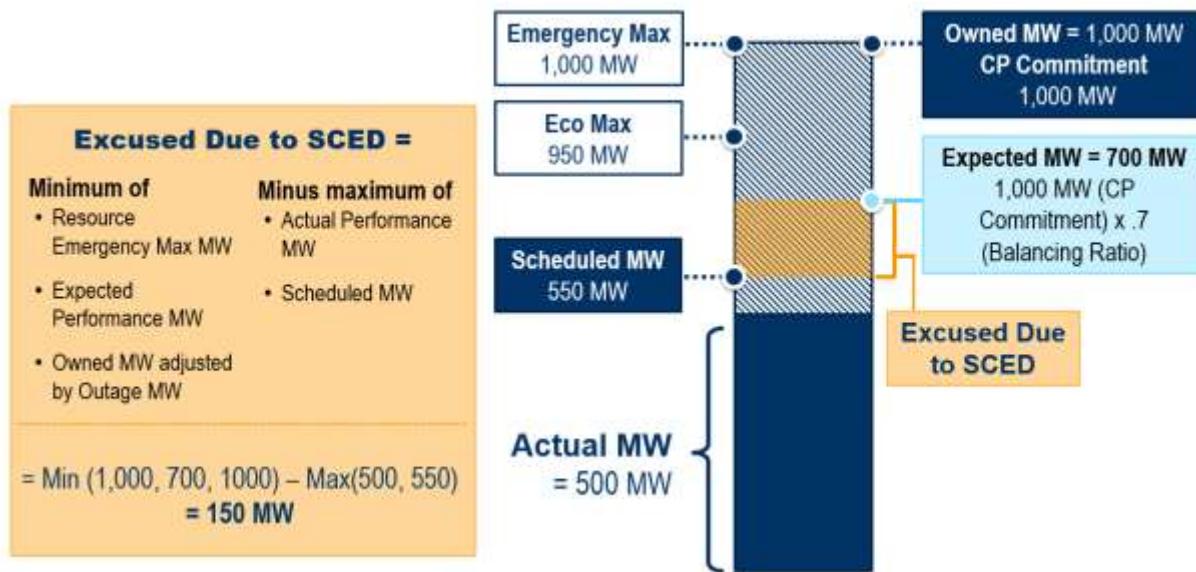
Excused MW due to Economic Dispatch = Minimum (Resource Emergency Max MW, Expected MW, Owned MW adjusted by Outage MW) – Maximum (Scheduled MW, Actual Performance MW)

The equation considers the quantity a unit could have or should have produced and subtracts the scheduled MW (or actual MW if greater than scheduled MW) to determine the excusal MW. The quantity a unit could have produced is determined by using the minimum of (1) the Resource Emergency Max MW, which is the maximum output that could have been scheduled by the real-time SCED engine, (2) the Expected MW, which represents the amount the unit needed to produce in the PAI to avoid penalty, and (3) the Owned MW adjusted by Outage MW, which represents the amount of capacity available given the outage tickets.

The maximum between the calculated Scheduled MW and Actual Performance MW is considered in the event a unit's output is more MW than were economic. Any MW produced over the calculated scheduled MW are therefore not counted toward the excusal.

The figure below illustrates how the different inputs are used in the determination of Excused MW due to Economic Dispatch.

⁴ Per Manual 11, Section 9.1, the Real-Time Emergency Maximum can be updated in Markets Gateway intra-hour and is not subject to the T-65 minute update deadline applicable to other Real-Time updates. As a result, the Non-Performance calculations use the Emergency Maximum value in effect at the time of the subject interval.



In the illustration above, the quantity a unit could have or should have produced is set to the Expected MW quantity of 700 MW (Minimum of (1) Resource Emergency Max (1000 MW), (2) Expected Performance (700 MW) and (3) Owned MW adjusted for outage (1000 MW)). Using the Resource Emergency Max MW of 1000 MW would have resulted in excusing MWs above the Expected quantity. Then, the greater of the Scheduled MW and Actual MW is subtracted from 700 MW to determine the Excused MW due to Economic Dispatch value of 150 MW. Taking the greater of the calculated Scheduled MW and Actual MW ensures MWs produced above the scheduled MW are not considered in the Excused MW due to Economic Dispatch value.

Another relevant example of this calculation is for intermittent resources that are not required to offer their full committed capacity value in the Energy Market for every hour. Consider a solar resource that has an expected MW = 5 MW (based on a 5 MW commitment in the Capacity Market and a Balancing Ratio = 1) that offers an Emergency Maximum = 0 MW during nighttime hours. If the PAI occurs during nighttime hours, the Excused MW due to Economic Dispatch will be calculated as:

$$\text{Minimum of (Resource Emergency Max, Expected Performance, Owned MW)} - \text{Maximum of (Actual Performance, Scheduled MW)} = \text{Minimum of (0, 5, 5)} - \text{Maximum of (0, 0)} = 0 \text{ MW}$$

This outcome is consistent with the requirement that resources cannot be excused for Non-Performance due to operating parameter limitations.

Supporting MSRS Reports for Economic and Manual Dispatch Excusals:

The Non-Performance Assessment Resource Charge Details Report in MSRS provides the details about a customer account's owned capacity resource's excused MW for not being scheduled during a Performance Assessment Interval. The "Excused MW for Not Scheduled" column will display the sum of any excused MWs due to Manual Dispatch and Excused MW due to Economic Dispatch for the given interval.

Calculation of Final Shortfall

Final Shortfall for Generation Resources

The Final Shortfall for Generation Resources is calculated as the Expected Performance MW minus the sum of the Allocated Actual Performance MW, Excused MW due to Planned or Maintenance Outage and the Excused MW due to Economic Dispatch. There is no netting between positive or negative shortfalls across units (with the exception of those FRR Entities that elected the physical Non-Performance Assessment).

If the Final Shortfall is positive, a Shortfall MW value will be reported on MSRS Non-Performance Assessment Resource Charge Details report and the unit will be assessed a Non-Performance charge. There is no tolerance band applied to the final Shortfall MW. Even if a unit is 0.1 MW short of its expected performance, it will be assessed a non-performance charge.

If the Final Shortfall is negative, the Shortfall MW will be reported as 0 MW on the MSRS Non-Performance Assessment Resource Charge Details report and the unit may be eligible for a Bonus payment. Please review the "Calculation of Bonus Performance" section for more information.

If a unit has an RPM and FRR commitment, the Shortfall MW or Bonus MW is allocated pro rata based on commitment type. Please refer to the "Calculation of RPM vs. FRR Shortfall/Bonus" section for more information.

Impact of Forced Outages

Forced Outages can be excused only by the Balancing Ratio decreasing a unit's Expected Performance; they cannot be excused by a unit not being economic.

Final Shortfall for Demand Resources

The Final Shortfall for Demand Resources is calculated as the Expected Performance minus the Actual Performance. Section 8.6 of Manual 18 allows Capacity Market Sellers with Demand Resources located in the same Emergency Action Area (EAA) to be netted to determine a net EAA Performance Shortfall for the Performance Assessment Interval. Note, only Demand Resources in a Capacity Market Seller's account can be netted. Any Economic Load Response Resources in the same account are not considered in the netting calculation.

Calculation of Bonus Performance

The calculation of bonus performance during Performance Assessment Intervals is discussed in OATT, Attachment DD, Section 10A (g) and Manual 18, Section 8.4A. The following section provides additional clarification regarding the calculation of Bonus MW, specifically how the calculation enforces the requirement that Bonus Performance cannot exceed the megawatt level at which the resource was scheduled by the Office of Interconnection.

Scheduled MW for Bonus

Similar to the Scheduled MW for Penalty calculation discussed in the “Excusals due to Security Constrained Economic Dispatch” section, the Scheduled MW for Bonus is calculated by determining the MW quantity at the intersection of the 5-minute dispatch run LMP⁵ calculated for the PAI interval and the submitted offer curve on which the unit was dispatched, adjusted for the unit’s bid in economic and emergency limits. The Scheduled MW for Bonus calculation differs from the Scheduled MW for Penalty calculation in the following areas:

- 1) Only the offer curve the unit was dispatched on is used in the calculation. There is not a comparison of all submitted schedules.
- 2) The unit’s bid in Economic limits are used to cap or floor the scheduled MW unless PJM issued an Emergency Procedure that allows for dispatch in the Emergency range.

Note, Manual 18, section 8.4A includes language that requires each energy offer comply with Manual 11, Section 2.3.7. If the offer does not include the required information, then the Bonus Performance quantity will capped at zero.

Calculation of RPM vs. FRR Shortfall/Bonus

If a market participant has both RPM commitments and FRR commitments on a resource, the final Shortfall MW or Bonus MW will be allocated on a pro-rata basis based on the amount of RPM and FRR CP commitments in unforced capacity terms. A participant’s RPM CP Committed MW and FRR Committed MW on a resource for the day of the PAI are available through the Capacity Exchange system on the Position Details tab.

The Shortfall MW associated with the RPM commitments is labeled as Shortfall MW on MSRS reports and is calculated as final Shortfall MW * (RPM CP Committed MW/total CP Committed MW).

The Shortfall MW associated with the FRR commitments is labeled as FRR Shortfall MW on MSRS reports and is calculated as final Shortfall MW* (FRR CP Committed MW/total CP Committed MW).

The Bonus MW associated with the RPM commitments is labeled as Bonus MW on MSRS reports and is calculated as Bonus MW * (RPM CP Committed MW/total CP Committed MW).

The Bonus MW associated with the FRR commitments is labeled as FRR Bonus MW on MSRS reports and is calculated as Bonus MW* (FRR CP Committed MW/total CP Committed MW).

⁵ Effective with the implementation of Fast Start Pricing on 9/1/2021, the 5-minute LMP from the Dispatch Run (as generated by RT SCED) applicable to the PAI interval is used

If an FRR Entity has elected the Physical Option, only the FRR Shortfall MW and FRR Bonus MW (not the Shortfall MW or Bonus MW associated with RPM commitments) is factored into the calculation of the FRR Entity's Net Performance Shortfall for the PAI. The FRR Entity is still subject to a financial Non-Performance Assessment Charge for the Shortfall MW associated with their RPM commitments or financial Bonus Performance Credit for the Bonus MW associated with their RPM commitments for the PAI.

Allocation of Bonus Performance Credits

The calculation of bonus performance credits is discussed in OATT, Attachment DD, Section 10A (g) and Manual 18, Section 8.4A. The following section provides additional clarification regarding the calculation of Bonus MW, specifically how the calculation is adjusted to reflect Auction Specific MW transactions.

The Buyer of an Auction Specific MW transaction is entitled to receive Capacity Performance bonus credits related to the resource(s) identified in the transaction that over-perform during a Performance Assessment Interval. The Buyer's share of bonus credits for each over performing resource is based on the ratio of the resource's cleared MWs (in UCAP) transferred in the Auction Specific MW Transaction to the greater of the (a) resource's cleared UCAP transferred or (b) Seller's daily Owned UCAP position for the resource.

Confidentiality Considerations on MSRS Reports

Detailed MSRS reports presenting resource information combine data sources from multiple PJM tools and market areas with potentially different resource account ownership (e.g. capacity resource ownership, energy market ownership and outage tool ownership).

Because of concerns in exposing market sensitive information, PJM will limit the data displayed on Non-Performance Assessment reports to data owned by the market participant account.

In cases where the data on a report belongs to different account owners, only the data belonging to the account logged into MSRS will be displayed. In cases where the logged in account is not the owner of a particular data element, that field will contain a null value.

For more information on the data available on detailed reports, please refer to the RPM section of the MSRS Report Documentation on the MSRS Reports Documentation page (<https://www.pjm.com/markets-and-operations/billing-settlements-and-credit/msrs-reports-documentation>).

Revision History

- 10.23.2023 – Updated for FERC Order ER23-1996-000 that updated the Trigger conditions for Performance Assessment Intervals
- 2.10.2023 – Updated to account for Reserve Price Formation implementation effective 10.1.2022 and to provide additional clarification to support Winter Storm Elliott Performance Assessments.
- 5.26.2022 – Added example for calculation of excused MW for intermittent resources. Removed Base Capacity references.
- 9.3.2021 – Updated to graphics (non-substantive), included treatment of calculation of Scheduled MW to account for Fast Start Pricing implementation effective 9.1.2021