



Non-Performance Assessment Settlement Calculation – Additional Detail

June 1, 2020

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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. The following section provides additional clarification regarding the identification of resources subject to a Non-Performance Assessment in the event of a triggering Emergency Procedure.

Following the conclusion of the Emergency Procedure that initiated the Performance Assessment Interval (PAI), the list of resources to be considered in the assessment is compiled.

Identification of Generation Resources to be assessed

The list of generation resources to be evaluated is determined based on the reason the event is called. The reason the event was called (capacity or transmission) is based on the type of Emergency Procedure that triggered the PAI. For example, load shed directives due to transmission constraints are considered transmission related PAIs and the issuance of Emergency Load Response procedures are considered capacity related PAIs.

- In the event of a transmission related PAI, the list of generation resources to be assessed is determined based on the resource's calculated ability to help the transmission constraint (i.e. dfax). Resources with a dfax that indicates that increasing the output of the resource provides relief to the constraint are considered in the assessment.
- In the event of a capacity related PAI (i.e. Emergency Load Response Event), the list of resources to be assessed is determined based on the area where the event was called. Generation resources, including Energy Only Resources, located in the area are subject to the assessment.

If the Emergency Action area is PJM-wide then External Generation Capacity Resources (prior to the 2020/2021 Delivery Year only) and Net Energy Imports are included in this assessment. Effective with the 2021/2022 Delivery Year, External Generation Capacity Resources can be included in the assessment of non-RTO wide events if the external resource would have helped resolve the declared Emergency Action.

Identification of Demand Resources to be assessed

Any Demand Resources with registrations dispatched by PJM via the DR Hub tool in response to the PAI are included in the Non-Performance Assessment. Economic Load Response Resources, including Regulation or Synchronized Reserve only registrations, located in the area in which the PAI was triggered are also considered in the assessment.

Identification of Energy Efficiency (EE) Resources to be assessed

EE resources are modeled on a zonal basis in the Capacity Market and are not modeled in the Energy Market. For that reason, EE resources are only assessed in the event of a Capacity related PAI called at a zonal or higher basis. EE resources cannot be assessed for sub-zonal events due to the current resource modeling practice.

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 assignment.

- 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, tier 2 synchronized 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.

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, there is an Expected Performance that is used to calculate a resource’s shortfall (called Expected Performance MW Shortfall) and an Expected Performance that is used to calculate a resource’s bonus performance (called Expected Performance MW Bonus). The Expected Performance MW Shortfall is calculated as CP Committed MW (in UCAP terms) times the PAI Balancing Ratio. The Expected Performance MW Bonus is calculated as a resource’s CP Committed MW plus the Base Committed MW (in UCAP terms) times the PAI Balancing Ratio. Base Committed MW are no longer applicable starting 6/1/2020.

For a committed CP demand resource, the Expected Performance is equal to the CP Committed ICAP MW. For a committed base demand resource, the Expected Performance is equal to the Base Committed ICAP MW for a PAI during the summer period (June through September) and is zero MW for a PAI during the non-summer period. 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. A committed base EE Resource is only subject to a Non-Performance Assessment for a PAI during the summer period of June through September.

The committed amount in the calculation of a resource's Expected Performance reflects the results of any approved retroactive replacements. The rules for retroactive replacement capacity transactions are discussed in Manual 18, Section 8.8. An FRR commitment is replaced through an update to an FRR Capacity Plan as opposed to submitting a replacement capacity transaction. To provide comparable treatment for resources committed to the FRR Alternative, an FRR commitment is allowed to be replaced retroactively by allowing a retroactive update to the FRR Entity's FRR Capacity Plan on the same terms that an RPM commitment is allowed to be replaced retroactively.

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 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 operating off of the economic basepoint to provide the Tier 2 Synchronized Reserves assignment.

Non-Synchronized Reserve MW

The non-synchronized reserve adjustments account for any economic MWs held offline for Non-Synchronized reserves. Resources are credited based on the LMP desired MW values, which can be more or less than the actual NSR assignment on the resource.

The LMP desired MW values described in M-28 are used to adjust for the NSR assignment. The LMP desired basepoint represents where the resources would have been economically dispatched absent an NSR assignment.

Net Energy Imports

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.

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.

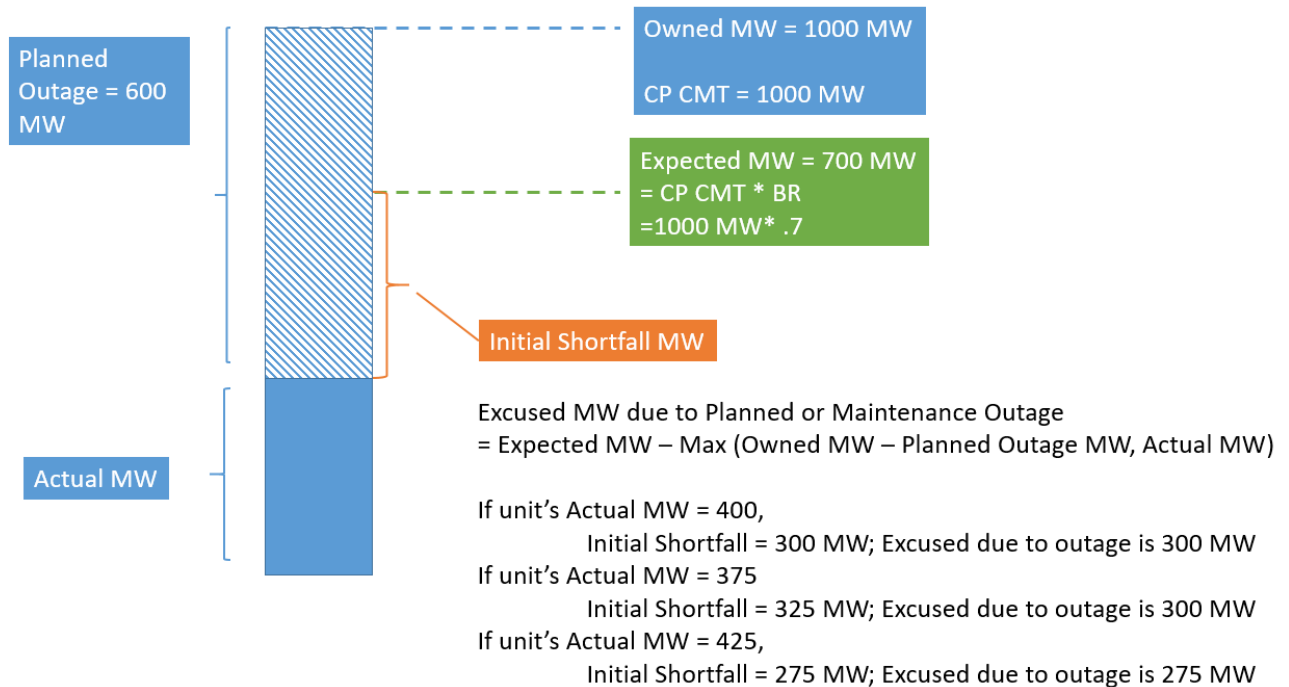
The PJM approved planned and maintenance outages are obtained from eDART. Similar to the allocation of Actual MW due to modeling differences between the energy market (Markets Gateway) and the capacity market (Capacity Exchange), the Planned Outage MW is also allocated using pro rata shares of Installed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

$$\text{Excused MW due to Planned or Maintenance Outage} = \text{Expected MW} - \text{Maximum (Owned MW – Planned Outage MW, Actual MW)}$$

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 Excused MW due to Outage.

See the illustrative example below.



Excusals due to Security Constrained Economic Dispatch

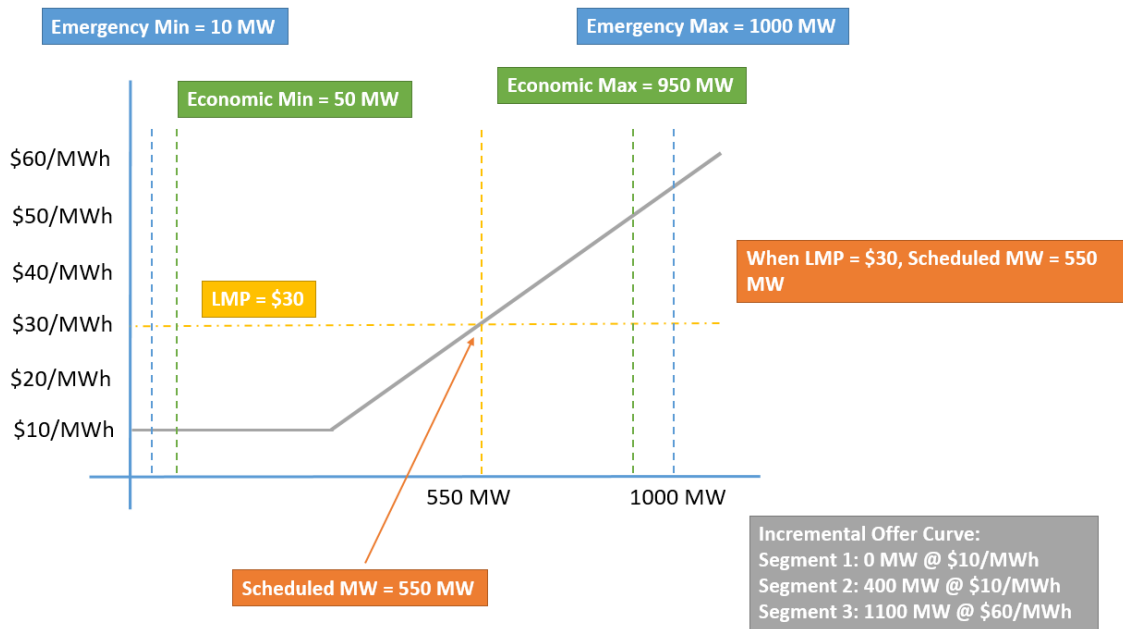
In accordance with section 10A (d) of Attachment DD of the Open Access Transmission Tariff, a Non-Performance shortfall can be excused to the extent that the generator was not scheduled by PJM or was online, but scheduled down due to the security constrained economic dispatch. However, the tariff language 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.

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.)¹

To calculate the Scheduled MW quantity used in the calculation of a penalty, the 5-minute LMP 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. 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.

¹ 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).

If the LMP > \$60/MWh, the scheduled MWs is capped at the Emergency Max (recognizing that PJM cannot schedule beyond that value). The cap is set at the Emergency Max value rather than the Economic Max value to prevent withholding MW in Emergency limits.

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 cost-based curve, the Scheduled MW value for that cost-based schedule is used.

Calculation of Excused MW due to Economic Dispatch

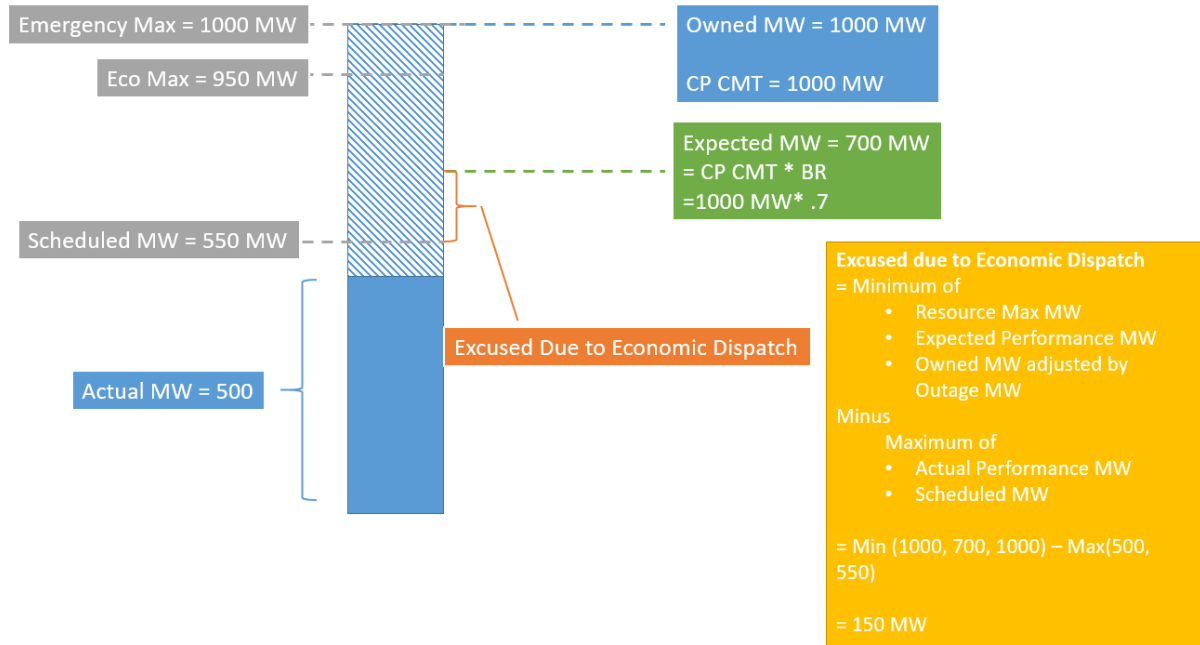
After the Scheduled MW is calculated and the effect of market-based and cost-based offers is considered, the excused MW due to Economic Dispatch can be calculated. The Excused MW due to Economic Dispatch is equal to:

Excused MW due to Economic Dispatch = Minimum (Resource 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 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.



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 Max (1000 MW), (2) Expected Performance (700 MW) and (3) Owned MW adjusted for outage (1000 MW)). Using the Resource 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.

Note: the Excused MW due to Economic Dispatch is referred to as “Excused MW for Not Scheduled” on the MSRS reports.

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 LMP calculated for the PAI interval and the submitted offer curve, 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 $\text{final Shortfall MW} * (\text{RPM CP Committed MW} / \text{total CP Committed MW})$.

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

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

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

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.

Confidentiality issues 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 [Non-Performance Assessment MSRS Reports](#) Presentation from the January, 16 2020 Market Settlements Subcommittee Meeting.