Balancing Operating Reserve (BOR) Credit Reform: PJM / IMM Proposal Overview

November 2024

Problem Statement / Issue Charge

- The issue charge was initiated by PJM and the Independent Market Monitor in February, 2022.
  - Targeted changes to the treatment of CTs were made in Fall 2022, then work was deferred until Fall 2023.
- It aims to clarify the rules around the payment of BOR Credits to resources that do not operate as expected and strengthen incentives for resources to operate consistent with PJM's directions.
  - There is a need to address IMM and FERC concerns with the payment of significant BOR credits to resources that don't follow PJM dispatch instructions

Root Causes

The root causes of elevated BOR Credits being paid to resources that are not following dispatch are:

- The existing metrics used to determine if a resource is following dispatch fail to measure how well a unit follows dispatch over consecutive intervals, rather than just a single interval
- Lack of specificity in the tariff around what it means to be "Operating as Requested by PJM" and therefore eligible to receive BOR credits. The consequences are unclear for the following scenarios:
    - coming on late or early for a PJM commitment
    - going offline early or too late
    - Taking a unit over as self-scheduled in the middle of a PJM commitment

Additional Observations

During solution development, PJM and the IMM identified several additional shortcomings in the Balancing Operating Reserve Credit calculation that need to be addressed.

1. Overly punitive outcomes for not following dispatch in some instances
   - Stems from the asymmetry in the MW used on the cost and value (revenue) sides of the equation

2. Unequal treatment across resources that deviate from dispatch in terms of cost recovery
   - Differing opportunities to recover costs depending on whether the unit had a DA commitment or not and whether it was over or under generating

   See slides 6 - 9 of the 3/11/2024 MIC special session presentation for more on the above shortcomings

3. Incomplete and/or double accounting of revenues from other markets or LOC payments that leads to over or understated BOR credits

Main Elements of the Proposed Solution

1	Adjustments to the periods for which resources will be eligible to receive Balancing Operating Reserve Credits
2	Use of a new Tracking Ramp Limited Desired MW metric to measure how well a unit follows dispatch across consecutive intervals.
3	Structural changes to the Balancing Operating Reserve Credit calculation to: • Simplify the calculations while still ensuring uplift is limited to the amount that would have been owed if the unit had been producing the desired MW. • Increase transparency of the financial impact of not operating as desired • Ensure more complete accounting of revenues and costs and prevent double recovery of costs
4	Conforming changes to the calculation of generator deviations

This proposal is jointly supported by PJM and the IMM.

1. Changes to Eligibility Rules

Current Eligibility for BOR Credits

Only PJM-scheduled units are eligible for BOR credits

- Eligibility **begins** at the start of the PJM commitment
  - If the unit isn't online at start of commitment, eligibility starts once online
  - Units without a soak process are eligible for ~30 min prior to start of commitment if they are ramping in preparation for commitment, but this is a subjective check
- Eligibility **ends** a) after ramp down when PJM releases the unit b) when the unit is taken over as self-scheduled or c) when the unit trips.

Rules around eligibility when a unit is early or late for its commitment, as well as when a unit is taken over in the middle of its commitment, need to be clarified / strengthened.

Notable Revisions to **Start** of BOR Credit Eligibility

- Eligibility will begin at the start of the PJM commitment even if the unit is not online.
  - This allows better recognition of the costs and revenues that would have stemmed from operating as requested by PJM

Scenarios impacted by this change		
Scenario	**Classification**	**BOR Credit Impact of the Change**
Unit is late for their DA commitment due to PJM action	Operating as Requested	Will be made whole for any buy out of their DA commitment before they come online.
Units that are late for their commitment due to market participant action	Not Operating as Requested	BOR credits may be decreased since the calculation will recognize net revenues that could have been earned had the resource operated as requested.
Unit comes online much earlier than requested by PJM	Not Operating as Requested	Unit is not made whole for extra intervals. Non-soak units that come online early are limited to being made whole for MW up to Eco Min in the 20 minutes preceding the start of the PJM commitment. (20 minutes is the time within which 90% of resources without a soak process have reached Eco Min. The intent is to cover ramping costs.)

Notable Revisions to **End** of BOR Credit Eligibility

Eligibility will continue through the end of the DA commitment / RT min run time and terminate thereafter, rather than terminating immediately, if the unit stops running for PJM before the end of the commitment.

Scenarios impacted by this change		
Scenario	**Classification**	**BOR Credit Impact of the Change**
PJM releases a resource prior to the end of its DA commitment	Operating as Requested	Will be made whole for any buy out of their DA commitment.
Unit trips before the end of its DA commitment or RT min run time	Not Operating as Requested	BOR credits may be decreased since any profits gained during the entirety of the DA commitment/min run time (via the MW produced or buying out of the DA market) can now offset the start-up costs for the segment thus reducing potential uplift. Additionally, if the unit is desired below DA MWh, any profit or loss associated with the buy back MWh will be considered in the BOR calculation.
Unit is taken over to run for company before the end of its DA commitment or RT min run time	Not Operating as Requested	

Eligibility Design Components

#	Design Component	Proposal
1	**Eligibility for Balancing Operating Reserve Make Whole Credits**	
1a	Eligibility During Ramp Up	Status Quo for resources with a soak process. Resources without a soak process are eligible for make whole (capped at RT Eco Min MW) up to 20 minutes prior to start of commitment only if incremental energy offer price mw pairs remain less than or equal to the first hour of PJM commitment. (No need to check if resource is ramping during that 20 minutes) If deemed to be ineligible, incremental and no load costs will be ineligible for make whole however, start up costs will still be eligible for make whole payments in the first hour/interval of commitment based on the committed schedule.
1b	Eligibility During Commitment Period	Eligibility begins at the first interval of PJM commitment for the run. Once a resource is committed by PJM, it is eligible for BOR credits from the first interval of the PJM commitment until the later of the expiration of its DA commitment/min run time or when PJM releases it. One exception: If a unit trips, its eligibility will end at the later of when it trips or the end of its DA commitment/min run time Three differences from today's eligibility window: - If unit self-schedules in middle of DA commitment/min run, the unit will remain eligible for those hours This allows any revenues earned in this period to offset the startup costs that the unit will be made whole for. - If PJM releases unit prior to end of DA commitment, it will remain eligible beyond release through end of the DA commitment This will ensure the resource is eligible to be made whole for any buy out of day ahead position. - Units with soak time will be eligible at start of commitment rather than later of first interval of commitment or when unit hits eco min; Prevention of double counting of ramping and soak costs will occur by modifying when Tracking Desired starts to calculate and the inputs to the BOR calculation rather than by modifying the start of the commitment period as is done today

Eligibility Design Components

#	Design Component	Proposal
1c	Eligibility During Ramp Down	Remove universal 3 hour limit and replace with resource type-specific limit based on 90th percentile evaluation of historical shut down times. -Coal Resources/Solid Fuel NUG/OIL/GAS Steam Resource = 120 Minutes, -CT Resources = 30 Minutes, -Combined Cycle Resources = 45 Minutes -Wind/Solar/Pump Storage/Run of River - as specified as self scheduling notification times as documented in M11 Section 2.3.3 and Battery = 20 Minutes -Nuclear = Not eligible PJM and the IMM will perform analysis every two years utilizing historical shut down time data only for PJM or pool scheduled commitments. From this sample population, the 90th percentile shall be used to determine eligibility thresholds to be agreed upon by PJM and the IMM. This process shall be documented in manual 28. Analysis results will be shared with stakeholders prior to new thresholds becoming effective. Resource is eligible if incremental energy offer price mw pairs remain less than or equal to the last hour of PJM commitment.
1d	Eligibility During extensions	If a unit is released within 30 minutes of end of DA commitment / min run, no new segment is created. This is considered a late or staggered release rather than a new extension. If unit is released > 30 min beyond end of DA commitment or min run, then it is considered an extension and a new segment begins.

2. Changes to Determination of Following Dispatch

Status Quo Determination of 'Following Dispatch'

Currently PJM calculates how well a unit follows dispatch by comparing its RT MW to the PJM Desired MW. PJM Desired MW is one of these three metrics:

Methodology	Description
Dispatch Signal	Dispatch Signal calculated by RT SCED (Real-Time Security Constraint Economic Dispatch) and sent to generators.
Ramp Limited Desired (RLD) *(used most frequently)*	The MW value that the unit should have achieved between Dispatch Signals or RT SCED case approvals.
LMP Desired *(used when resource is significantly deviating or reduces flexibility in real-time)*	The LMP Desired is the MW level on the incremental offer curve where the Dispatch Run LMP intersects the offer curve. Not a ramp-limited value.

Challenges of Status Quo Desired Metrics

The weakness of the existing Desired MW metrics is their lack of ability to determine if the unit is actually following dispatch over a period of time

- The Dispatch Signal and the Ramp Limited Desired use actual generation as the starting point for their calculation. When a unit does not follow dispatch, these metrics do not reflect where the unit should have been over time.
  - May result in a unit being made whole for more MW than PJM really desired from the unit
  - Resources with slow ramp rates and limited intention to follow the basepoint can still receive significant uplift payments. This issue may also impact faster responding units.

In addition, using LMP Desired when determining MWs eligible to be made whole can be overly punitive

- LMP Desired ignores ramp limits and therefore it does not consider whether resources could have realistically achieved that MW level based on ramping capability.

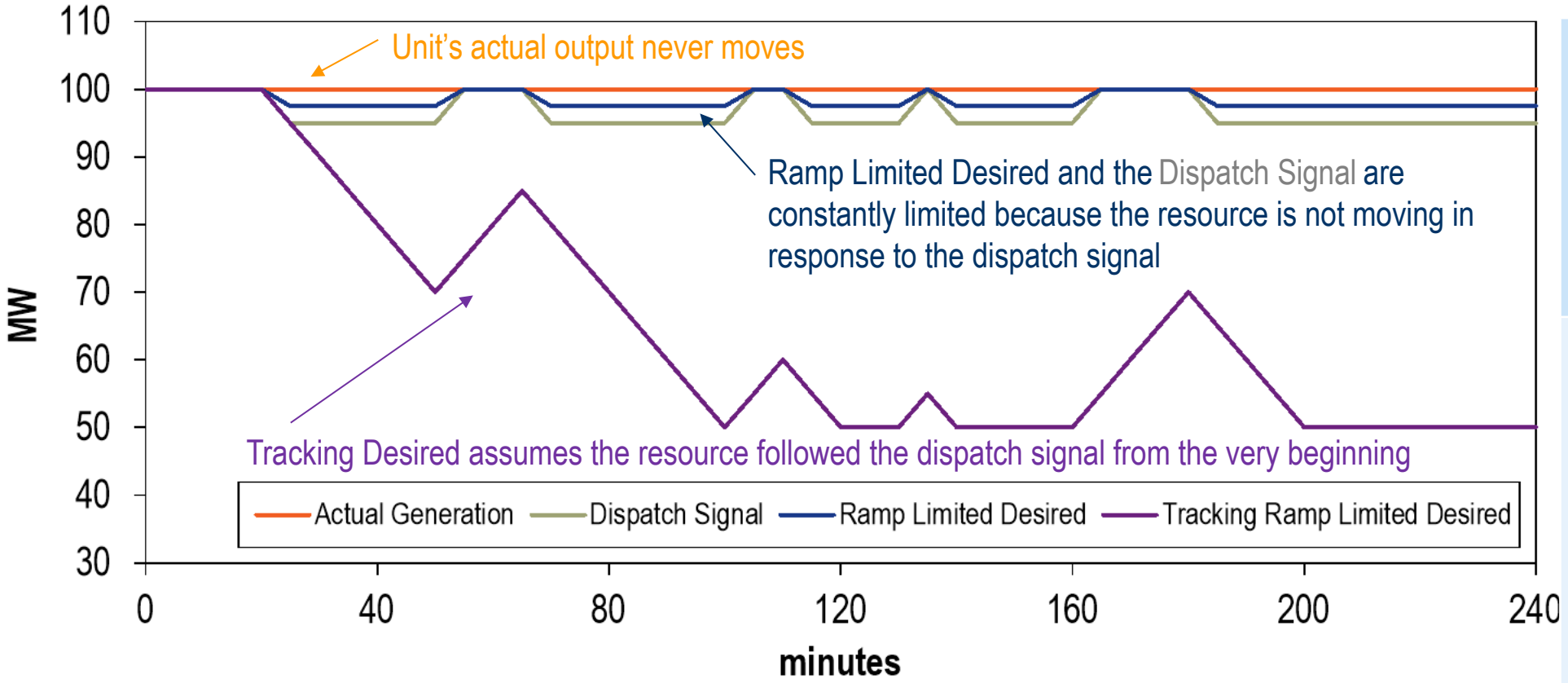
Proposed Change to Desired MW

- A new Tracking Ramp Limit Desired (TRLD) MW metric will be created
  - FERC accepted the use of this new metric in the Regulation Market Redesign filing
  - This proposal extends its use to BOR credits as well
- This value would replace ***all*** desired MW values in the calculation of BOR credits and deviation charges
  - Simplifies the calculation and provides additional transparency to market participants
  - More accurately measures how closely a resource is following dispatch over a period of time than the Status Quo metrics
  - Acknowledges ramping limitations unlike the LMP Desired MW value that is currently used when resources are significantly deviating

Tracking Desired MW Example

Rather than using the unit's SE MW as the starting point, the new desired MW metric accounts for the previous instructions over multiple intervals. It is still bound by LMP and the unit's bid in parameters.

Illustration of Desired MW metrics for a unit that never moves in response to the PJM dispatch signal



Compared to the dispatch signal or Ramp Limited Desired, actual generation is close to the desired MW and the unit looks like it is following dispatch

Tracking Desired shows the unit could have been operating much lower had it followed PJM dispatch over consecutive intervals. This metric shows the resource did not operate where PJM would have wanted the unit.

Tracking Ramp Limited Desired Calculation Details

The Tracking Ramp Limited Desired MW Calculation is:

- $D_t = D_{t-1}$ +/- $Ramp_t$

Where:

- D = Tracking Ramp Limited Desired MW
- t = Calculation interval. When t-1 = 0, D = Actual Output.
- *Ramp* = Increase/decrease in output based on market conditions. The ramp will be calculated using the dispatch LMPs solved in every RTSCED case and the ramp rates and eco min / max values submitted by the units.

Adjustments are then made to respect:

- Regulation and Reserve Assignments
- Manual dispatch instructions

Tracking Ramp Limited Desired Implementation Details

- Refer to the ‘Component 6 option Details’ tab in the matrix for calculation details
- A simulation spreadsheet has been created to allow participants to better understand how the tracking desired MW will behave under hypothetical conditions: Tracking Ramp Limited Desired calculator spreadsheet

Desired MW Design Components

#	Design Component	Proposal
6	**MW used for Desired MW and When Each One is Used**	
6a	Ramp-Limited Desired MW	Replace Ramp Limited Desired MW with Tracking RLD MWh in the Desired MW calculation
6b	Dispatch signal MW	Replace Dispatch Signal MW with Tracking RLD MWh in the Desired MW calculation
6c	Dispatch LMP Desired MW (non-ramp limited)	Replace Dispatch LMP Desired MW with Tracking RLD MWh in the Desired MW calculation
6e	DA MW (only used on the deviation charge side)	Status Quo minus scenario B in status quo. Scenario B (generator with DA schedule that either trips or does not run in real-time) will be assessed against Tracking RLD MWh.
6f	Other	Tracking Ramp Limited Desired (RLD) MWh: A Ramp limited, RT dispatch LMP desired MW value that builds off of the prior interval's desired MW value rather than the unit's SE value. See Component 6 Options Details tab in the matrix for additional details on how this value is calculated.

Desired MW Design Components

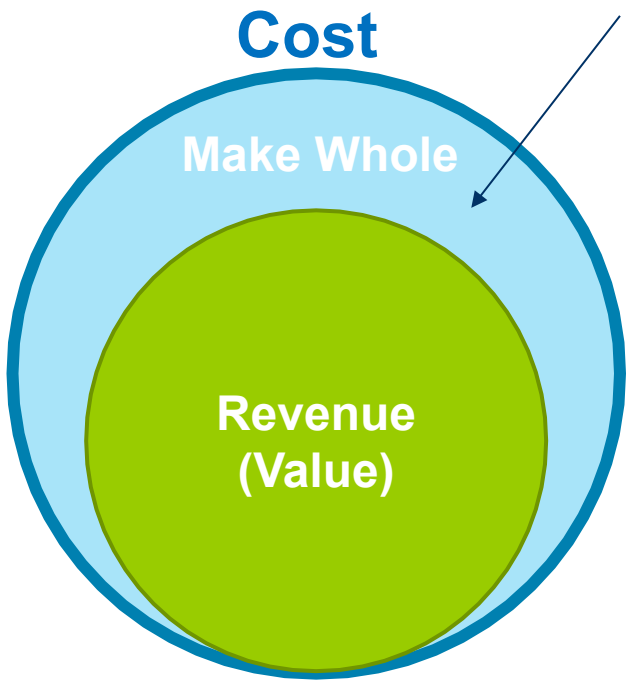
#	Design Component	Proposal
7	MW Reference Point for Determining Deviations from Dispatch and % Off Dispatch	% Off Dispatch is determined by comparison of RT MWh to Tracking RLD MWh in all scenarios except those defined in design component 6e above, which will use DA MWh as the reference point instead. If a resource is online and TRLD is unable to be calculated based on available schedule/offer then deviations are to be assessed against DA.
10	Real Time Visibility into deviations and unit performance	No real time visibility. Tracking Ramp Limited Desired MW and MWh values will be provided via MSRS reports at the same time as the associated Balancing Operating Reserve Charges and Credits reports.

3. Main Changes to the Structure of the BOR Credit Calculation

Operating Reserve Make Whole Credits: General Formula

BOR credits are paid for pool scheduled resources when their revenues do not cover the costs represented in their offers.

Make Whole Credit = Cost minus Value (floored at zero)



Cost = Total resource offer amount for generation, including startup and no-load costs as applicable

Value = Amounts credited in the energy markets and net profit from the ancillary services markets

Existing BOR Credit Calculation: Incentives for following dispatch

The existing calculation limits the uplift paid to units that don't follow dispatch via the MW values used on the Cost and Value sides of the equation.

Make Whole Credit	=	Cost			-	Value								
↳	=	RT MW Used	*	$/MWh Offer	-	(Balancing Value MW Used	-	DA MW)	*	RT LMP	+	DA Revenue	+	DA Operating Reserve Credit
↳	=	Min(Operating Reserve Desired MW, RT MW)	*	$/MWh Offer	-	(Max (Min(DA MW, Op Res Desired MW), RT MW)	-	DA MW)	*	RT LMP	+	DA MW * DA LMP	+	DA Operating Reserve Credit

*Net profit from the ancillary service markets has been omitted from the value side of the equation for simplicity

This minimizes the cost that can be recovered through the make whole calculation to no more than the MW actually desired by PJM. If the resource over generates, it will not be made whole for any MW beyond what was requested.

This maximizes the positive value that can be used to offset any costs, reducing the uplift when the resource over generates (a form of not following dispatch).

Similarly, when the resource generates below the desired MW (another form of not following dispatch), it excludes any negative buy out from the resource's DA position beyond that which was the result of PJM's dispatch instructions, thus reducing uplift and shifting the cost responsibility to the generator.

Issues with the Existing Calculation Structure

- Lack of transparency – it is difficult for participants to understand how much BOR credit was forgone as a result of not following dispatch
- In some instances, the calculation may overstate the net revenues of resources that are not following dispatch
  - Stems from asymmetry in the MW used on the cost and value sides of the equation.
  - This can result in the make whole credit calculation recognizing a net profit that is far in excess of (or a net loss that is far less than) what the resource could have earned even if it followed dispatch in that interval.
    - Excess profit offsets losses in other intervals within the segment and therefore can reduce the make whole credit owed to the resource
- There is unequal treatment across resources that deviate from dispatch in terms of cost recovery.

Calculation Structure Change

The proposal will remove the complex MW comparisons in the BOR credit calculation and shift to a simplified, three part calculation:

- Step 1: Calculate BOR credits for the segment using **Tracking Desired MWh**.
  - Credit = Cost @ Tracking Desired MWh – Value @ Tracking Desired MWh
  - This represents the amount of uplift the resource would have required if it produced the desired MW

- Step 2: Calculate BOR credits for the segment using **Actual RT MWh**.
  - Credit = Cost @ RT MWh – Value @ RT MWh
  - This is the amount of uplift the resource requires based on how it actually operated.

- Step 3: Compare and set the resource's credit equal to the lesser of the two values.

Impact of Calculation Change

The effect of this change is that resources are made whole to their costs, but the make whole is limited to the amount of uplift the resource would have been entitled to *if the resource provided the desired MW*

- Simplifies the calculations by removing the complex comparisons of MWs embedded within the calculation
- Increases transparency into how much uplift was forgone as a result of not providing the desired MW
- Removes some of the more punitive effects of the calculation that stem from asymmetric MW values being used on the cost and value sides of the equation

Inclusion of Opportunity Costs

- The following revenues are currently included in the revenue eligible to offset costs in the BOR credit calculation:
  - Synchronized Reserve Revenue Above Costs
  - Non-Synchronized Reserve Revenue Above Costs
  - Secondary Reserve Revenue Above Costs
  - Reactive Services Make Whole Credit
  - Market Revenue Neutrality Offset
  - Day-Ahead Revenues
  - Day-Ahead Operating Reserve Credits
- The proposal will add the opportunity costs that are paid through other markets to this list of offsetting revenues in the BOR credit calculation

What Are Opportunity Costs?

- When working through the details of this proposal, PJM and the IMM identified that excluding opportunity costs in the existing BOR credit calculation can lead to artificially inflated make whole payments.
- This is because despite the name, opportunity costs are not physical costs, but rather profits (positive net revenues) the resource gave up in the energy market by providing an alternative service.
  - Example for 1 MW: cost = $8 LMP revenue = $10. Opportunity cost (net profit) = $2.
- PJM pays resources these foregone energy market profits in the market / line item associated with that separate service.
- In this manner, opportunity costs are actually positive net revenues received in the PJM market.

Rationale for Inclusion of Opportunity Costs

- Because the profits that define opportunity costs are actually awarded via PJM revenues, excluding opportunity costs in the BOR credit calculation leads to understating the PJM market revenues the resource received.
- This can lead to making a resource whole for DA buy back, startup or no load costs when it is not necessary because the resource actually earned sufficient revenues to cover those costs when the opportunity cost revenues are factored in.
- See the following examples for illustrations of why this adjustment is necessary:
  - Energy LOC: Item 03 - Operating Reserve Clarification Examples - May
  - Regulation: Item 02 - Operating Reserve Clarifications Examples - June
  - Reserves: Item 03 - Operating Reserve Clarification Examples

Calculation Design Components

#	Design Component	Proposal
2	Impact of deviating from dispatch on the Operating Reserve Make Whole Credit Calculation	Make Whole is Limited to the amount of uplift the unit would have received if it followed the Tracking Desired MWh. This is determined by calculating uplift using Tracking Desired MWh (Step 1 calculation), and then calculating it again using actual RT MWh (Step 2 calculation). The resource receives a credit equal to the lesser of the two for the segment (Step 3 calculation). min[(Cost @ TRLD - Value @ TRLD), (Cost @ Actual - Value @ Actual)]
2a	MW and Cost used in defining the COSTS to be made whole	Step 1 calculation - Tracking RLD MWh; Offer cost used is the cost from the lesser of the committed or final offer. Step 2 calculation - Actual RT MWh; Offer cost used is from the final offer.
2b	MW and revenue used in defining the VALUE that offsets costs to be made whole	Step 1 calculation - Tracking RLD MWh Step 2 calculation - Actual RT MWh

Calculation Design Components

#	Design Component	Proposal
2e	Revenues that Offset Balancing Operating Reserve Credits	Status quo plus all opportunity costs recognized through other markets / settlement calculations (regulation, synch reserve, secondary reserve, reactive, energy LOC for manual dispatch, etc.) will also be included in the revenue to offset costs. This prevents the BOR credit calculation from double compensating the resource for the same MWh covered through those other calculations. For all of these offsetting revenues, the amount included in the step 1 calculation will be the amount the resource would receive if it operated consistent with the TRLD MW. The amount included in the step 2 calculation will be the amount the resource actually received.
2f	Adjustments to prevent double counting of soak costs and revenues	When a unit is soaking during hours it was scheduled to be dispatchable and is eligible for uplift, the costs incurred and revenues received must be removed from the calculation since they are included in the startup cost. - The costs are removed by making the incremental energy offer and no load costs zero. - The revenues are removed by subtracting the value received from those MW. When the unit clears DA, the value is equal to RT MW x DA LMP. When the unit is committed in RT, the value is equal to RT MW x RT LMP. • This additional adjustment is necessary since eligibility will now start at the beginning of the commitment rather than when the unit hits Eco Min. This prevents double counting of revenues and costs. • This applies to step 1 anytime the TRLD MWh indicate that the unit is not dispatchable. • This applies to step 2 anytime the Actual MWh indicate that the unit is not dispatchable.

Calculation Design Components

#	Design Component	Proposal
2g	Adjustments for Flexible Resources	If a Flexible Resource that was PJM committed in DA and self-schedules in RT before or after a RT PJM commitment period (min run time), the Step 1 calculation will use the net revenues the resource would have received if it had followed PJM commitment instructions and remained offline during the intervals where the unit was self-scheduled. The Step 2 calculation will reflect the unit's actual operation. If a Flexible Resource that was PJM committed in DA is offline in RT and is deemed ineligible for LOC credits based on changes in its parameters or an increase in its offer per the rules in M28, any buy back in excess of the DA revenue will not be made whole and is the responsibility of the market participant. This is consistent with the status quo since resources currently are not made whole for intervals where they are offline

4. Conforming Changes to Generator Deviations

BOR Generator Deviation Changes

Changes to the BOR Gen Deviation calculations are within the scope of this issue charge to the extent that they are needed to maintain consistency between the BOR credits and BOR generator deviations calculations.

- The BOR credit proposal replaces the use of Ramp Limited Desired and LMP Desired with the new Tracking Desired MWh metric.
- The following changes to BOR deviation calculation are therefore proposed:
  - Replace LMP Desired and Ramp Limited Desired with the new Tracking Desired MWh metric in the calculation of BOR deviations.
  - Replace DA MW with Tracking Desired MWh metric as reference point for deviations for units that tripped or does not run in RT
    - DA MW was previously used because a real-time desired MW was not available in this instance.
    - This change has the added benefit of creating consistency between deviations for MW that are unavailable due to a derate and those that are unavailable due to failure to run.

Changes to Exemptions from Deviations

- The following automatic exemptions will be eliminated because the Tracking Desired MW will appropriately reflect the adjustment to the Desired MW and negates the need for these exemptions.
  - Online resources backed down to provide synchronized reserve or secondary reserve and operating below DA MW.
    - Resources providing these services in offline mode (in the case of secondary reserve) or synchronous condensing mode will remain exempted.
  - Online resources that are manually dispatched up or down for reliability reasons
  - Online resources providing reactive services, unless the MVAR instruction is not captured in their economic dispatch
  - Units operating below 110% of eco min during a Min Gen event
- Despite removal of these exemptions, units that deviate by less than 10% of the desired MW will continue to be exempt.
  - All deviation MW and % threshold exemptions remain unchanged.

Deviation Charge Design Components

#	Design Component	Proposal
9	Threshold for excusing deviations from deviation charges	Status Quo, except remove exception for actual output between ramp limited desired and dispatch signal: 5-minute interval deviations For pool-scheduled resources and dispatchable self-scheduled resources dispatched above eco min: deviations excused where ~~A) Actual Output is between Ramp-Limited Desired MW and Dispatch Signal MW AND~~ ~~B)~~ % Off Dispatch <= 10% For all other resources (mainly applies to non-dispatchable resources, which are assessed deviations against their DA position): Deviations of <= 5% of desired are excused. Hourly deviations For all resources, if hourly average deviations are <= 5MW, deviations are excused

Deviation Charge Design Components

#	Design Component	Proposal
9a	Scenarios where units are automatically exempt from deviations:	All exceptions remain except: 2. Backed down for real time synchronized reserves and operating below DA MW 5. Backed down for real time secondary reserves and operating below DA MW 8. Manually dispatched (up or down) due to reliability / constraint control / reactive and manual instruction is reflected in TRLD 10. Units operating below 110% of eco min during min gen event Despite removal of these exemptions, units that fall within the percentage or MW deviation thresholds defined in component 9 above continue to be exempt.

Other Proposal Changes

Impact of Limiting Flexibility

- The issue charge also sought to clarify the impacts of offering limited flexibility on the determination of following dispatch and BOR credits. This includes:
  - Using the Fixed Gen Flag
    - Tracking Ramp Limited Desired will ignore the use of the Fixed Gen flag
  - Clamping applicable min and max operating limits after being committed
    - Tracking Ramp Limited Desired will use the original limits if they were restricted by more than 5%

Fixed Gen Flag Design Components

#	Design Component	Proposal
3	Use of Fixed Gen Flag	
3a	Impact of its use on Operating Reserve Make Whole Credits	Use of Fixed Gen Flag does not make a unit ineligible for Balancing Operating Reserve Make Whole Credits. The Fixed Gen Flag is ignored in the calculation of the Tracking Desired MW which is used to calculate the uplift the unit would be owed if it was following dispatch. Tracking Desired MW will use the submitted economic limits.
3b	Impact of its use on Deviation Charges	When the unit is <u>not</u> dispatchable in DA and the Fix Gen Flag is used in real-time, it causes the unit to be non-dispatchable and triggers use of DA MW as the desired MW used in the calculation of deviations. When the unit is dispatchable in DA and Fixed Gen Flag is used in real-time, it characterizes the unit as having Limited Dispatchability and triggers use of Tracking Desired in the calculation of deviation MW.

Limited Dispatchable Range Design Components

#	Design Component	Proposal
4	Offering Limited Dispatchable Range	Generators that clamp their limits are defined as those that reduce their applicable maximum operating limit or increase their applicable minimum operating limit in real-time as compared to the time of their DA or RT commitment by more than 5%. For RT only-committed units, instead of comparing to Day-ahead limits, compare to the RT limits submitted at time of commitment. The comparison back to the limits at the time of the RT commitment will only be done for the greater of the min run period and, if one has been specified, the predefined commitment period. A predefined commitment period as directed by PJM dispatch would need to be clearly defined and documented by dispatch at the time of call on.

Limited Dispatchable Range Design Components

#	Design Component	Proposal
		Similar to the use of the Fixed Gen Flag, reducing the dispatchable range does not make a unit ineligible for Balancing Operating Reserve Make Whole Credits. Tracking Desired is used instead of Dispatch LMP Desired to calculate make whole credits. If a generator clamps their applicable minimum or maximum operating limit, the Tracking Desired MW is calculated using the reopened economic limits (that is, the minimum of the Min MW at the time of the commitment and RT Min MW and the maximum of the Max MW at the time of commitment and RT Max (min of the mins, max of the maxes)). If a resource would have been dispatched higher or lower based on the committed limits (the original dispatchable range) than where it was dispatched in RT, any losses associated with the reduction in dispatchable range will be excluded from the BOR Credit which is calculated using the Tracking Desired MWh (Step 1 calculation). That is, any buy back in excess of the DA revenue due to the decrease in max in RT will not be made whole and is the responsibility of the market participant. This only occurs when final Max < Tracking RLD MWh < Committed Max and Tracking RLD MWh < DA MW. In this case, the unit is not made whole for any of the derated MW that were not desired. Any losses due to the increase in min in RT will not be made whole and is the responsibility of the market participant that is reflected in the Tracking Desired MWh. See May MIC special session for further details https://www.pjm.com/-/media/committees-groups/committees/mic/2024/20240513-special/item-03---operating-reserve-clarification-examples---may.ashx
w4a	Impact on Operating Reserve Make Whole Credits	

Limited Dispatchable Range Design Components

#	Design Component	Proposal
4b	Impact on Generator Deviation Charges	If a generator clamps their applicable minimum or maximum operating limit, deviations are calculated by comparing RT MWh to the Tracking Ramp Limited Desired MWh calculated using the reopened limits.

Impacts of Violating PLS Parameters on BOR Credits

The tariff states that a resource that operates outside of its unit-specific parameters will not receive Operating Reserve Credits nor be made whole for such operation when not dispatched by PJM

- This rule lacks clarity on the consequence of violating PLS parameters when operating on a price schedule. This has led to PJM/IMM disagreements.
- The current rules could benefit from clarity on when a parameter violation impacts the calculation of BOR credits and how.

Changes to BOR Credits when Violating PLS Parameters

- A unit running on a price schedule will have its BOR credits impacted in intervals where the PLS parameters were violated if:
  - The unit was was offer capped AND
  - The violated parameter was considered in the offer capping decision (Turn Down Ratio, Min Run Time)
- Clarity has been added around which intervals are impacted and how depending on which PLS parameter was violated (less subjective, more prescriptive rules)
  - If the violated parameter impacts the dispatch level of the resource in a given interval, the unit will remain eligible for the BOR credit calculation but will not be eligible to recover costs in excess of startup costs.
  - If the violated parameter impacts the commitment decision in a way that could lead to running the unit for longer than it otherwise would have, the unit will become ineligible for the BOR credits for the commitment duration.

PLS Violation Design Components

#	Design Component	Proposal
5	Violating Parameter Limits	A Capacity Performance generator will have an impact on its make whole credit calculation for violating its parameter limits if: 1. Running on a cost schedule or a price-PLS schedule OR 2. Running on a price schedule AND it meets all of these conditions: a.The unit is offer capped (it failed TPS, or there is a hot weather alert, cold weather alert or other condition triggering potential use of the Price PLS schedule), but is running on price schedule because it was selected as the cheapest schedule b. The unit had a violation on one of the parameter limited schedules considered in the offer capping decision. That is, it met both of these conditions for that parameter limited schedule: i. The parameter value submitted was outside of the approved parameter limit (including any approved temporary exceptions) ii.The violated parameter is one of the parameters that affects the determination of the cheapest schedule (Turn Down Ratio, Min Run Time) The exact impact depends on the parameter that was violated. (see next slides)

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#	Design Component	Proposal
5a	Impact on Operating Reserve Make Whole Credits	If a parameter that impacts the dispatch level of the resource is violated, the unit will remain eligible for the BOR credit calculation but losses will be set to zero in those intervals as detailed below. If a parameter that impacts the commitment decision is violated, the unit will become ineligible for the BOR credits as detailed below. Retain Status Quo process that allows market participant to request to be made whole for any intervals in which are not eligible to recover losses by providing justification for operating outside of the approved parameter limits.

PLS Violation Design Components

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5a.1	Turn Down Ratio Violation	Similar to today, units with a turn down ratio violation remain eligible for the Operating Reserve Credit calculation, but have any negative net revenues (losses) set to zero in the Step 1 calculation if they violated a parameter limit. Positive net revenues (revenues > offer) for less flexible intervals continue to be used on the value side of the Operating Reserve credit calculation to offset costs in other intervals. - If the parameter violation occurs in DA and RT, the unit is ineligible to recover losses in the Balancing Operating Reserve calculation when Tracking Desired MWh reaches Eco Min or Eco Max in any interval where the violation exists Explanation: ○ If the violated limits didn't impact the dispatch (that is, PJM still desires the unit between the violated min and max), then the unit is eligible to recover losses ○ But once it cannot be determined if PJM would have desired the unit at that level or not (because there aren't valid limits available to use in the Tracking Desired MW calculation), then it becomes ineligible to recover any losses in that interval (net revenue gets floored at 0) - If the parameter violation occurs in RT only (and not at time of commitment), no additional logic is needed to make the unit ineligible to recover losses. Per option 4aA above, Tracking RLD will be calculated using the reopened (and non-violated) limits.

PLS Violation Design Components

#	Design Component	Proposal
5a.2	Min Down Time Violation	Make unit ineligible for the entirety of the commitment that included the parameter violation. The option remains for market participant to make their case for receiving make whole per the existing process in the tariff if the violation didn't impact the commitment of the unit.
5a.3	Min Run Time Violation	
5a.4	Max Daily Starts Violation	
5a.5	Max Weekly Starts Violation	
5a.6	Startup Time(cold/inter/hot) Violation	
5a.7	Notification Time Violation	
5a.8	Max Run Time Violation	Status Quo – No Impact

Other Design Components

- Conforming updates are proposed for Reactive Services Make Whole Credits
  - These credit calculations are patterned off of BOR Credits
  - Updated to use Tracking Desired MW consistent with BOR Credit changes
- Addressed determination of following dispatch during a Market Suspension since Tracking Desired MW cannot be calculated in such instances

Other Design Components

#	Design Component	Proposal
11	Conforming updates to Reactive Service make-whole credits	If unit is brought online for provision of reactive services, the unit will be made whole for all MW up to the lesser of RT MW or Tracking RLD MW: [Min(Real-time MW, Tracking RLD MW) * (Offer - Five Minute real-time LMP at the generator bus)] / 12 If unit is online and manually dispatched up to provide reactive services, the unit will be made whole for the additional MW between the Tracking Desired absent the adjustment (Unadjusted Tracking MW) and the lesser of the Real-time and Tracking RLD MW (which reflect the manual dispatch): [(Min(Real-time MW, Tracking RLD MW) – Unadjusted Tracking RLD MW) * (Offer - Five Minute real-time LMP at the generator bus)] / 12 Similar make-whole will be provided for hybrid and storage resources manually dispatched to consume more for reactive services.
12	Market Suspension	In the event of a market suspension, if PJM and the IMM determine the unit was not following dispatch instructions, the unit will be ineligible for uplift. + Document Status Quo: 1) Unit gets made-whole to Actual RT MWh (use Step 2 only) 2) Deviations will not be assessed BOR Charges since the Status Quo rules dictate that BOR Charges are only assessed to RT Load + Exports during a Market Suspension

Overall Impact of Proposal on BOR Credits

Elements of the proposal will place both downward and upward pressure on uplift payments

- Overall, the proposal will reduce the uplift paid to units that consistently do not follow dispatch and will address the concerns raised by the IMM and FERC.
- Several elements of the proposal will counterbalance the reductions and in some instances could lead to units receiving additional uplift by correcting perceived flaws in the current calculation.

Change	Reduces uplift	Increases uplift
Changes to eligibility	X	X
Use of Tracking Desired MW	X	X
Transition to Step 1 / Step 2 calculations	X	X

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BOR Proposal Overview

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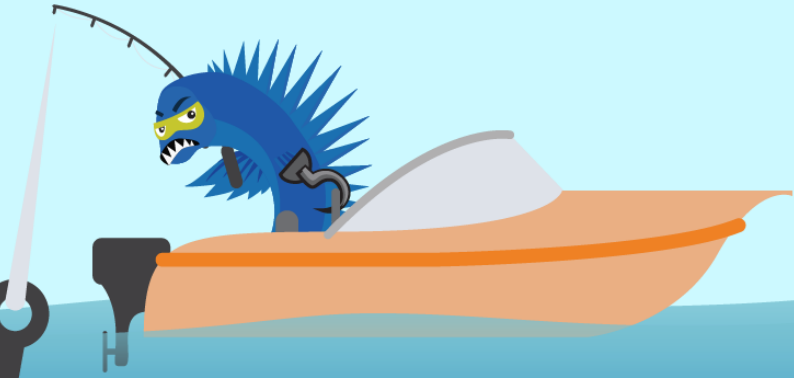
THINK BEFORE YOU CLICK!

pjm



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Report suspicious email activity to PJM.

Call (610) 666-2244 or email it_ops_ctr_shift@pjm.com