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

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- 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

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 <u>consecutive</u> 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

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

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

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.

- 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. Make whole for early starts is limited to the 20 minutes prior to the start of the PJM commitment. (20 minutes is the time within which 90% of resources without a soak process have reached Eco Min)

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	

2. Changes to 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.

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

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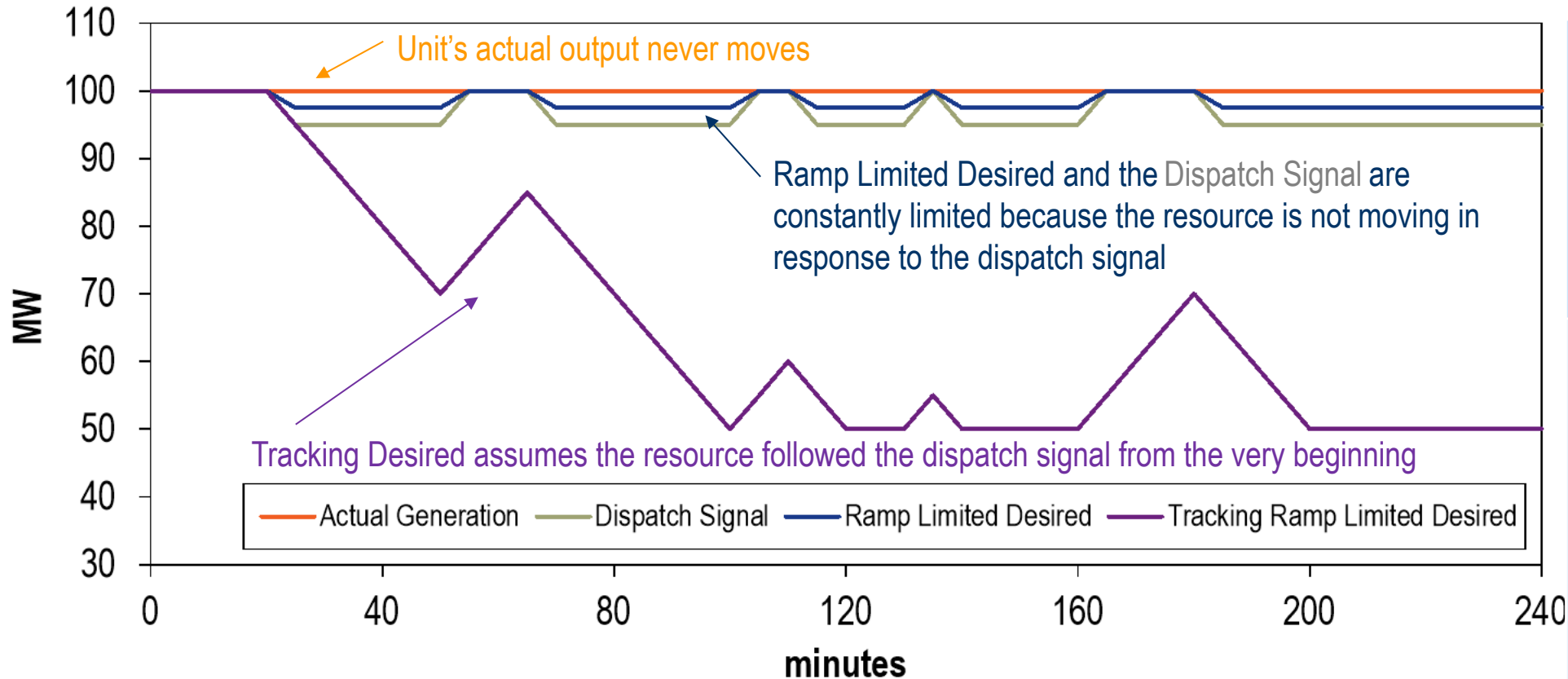
In addition, using LMP Desired when determining MWs eligible to be made whole can be overly punitive

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

- 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

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

Unit's actual output never moves

Ramp Limited Desired and the Dispatch Signal are constantly limited because the resource is not moving in response to the dispatch signal

Tracking Desired assumes the resource followed the dispatch signal from the very beginning

Actual Generation — Dispatch Signal — Ramp Limited Desired — Tracking Ramp Limited Desired

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.

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

- 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](#)

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

*This presentation highlights the more significant changes to the BOR credit calculation. Please refer to the matrix for the complete proposal.

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

Make Whole

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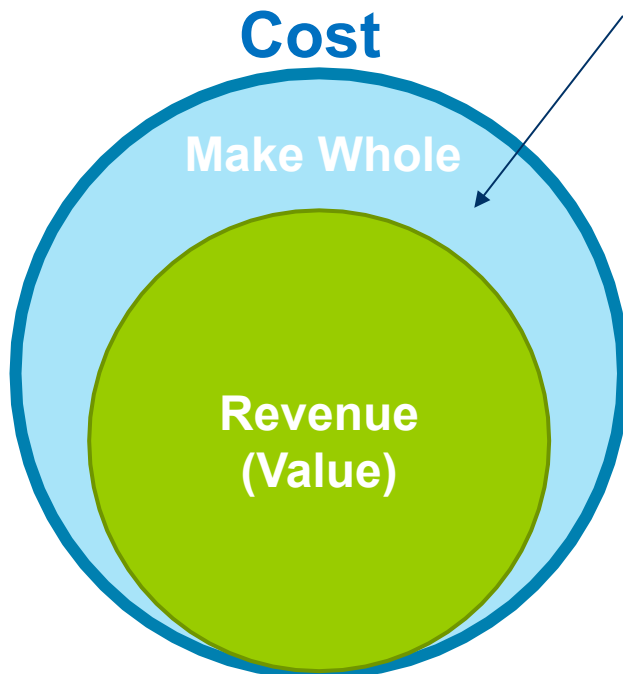
Cost = Total resource offer amount for generation, including startup and no-load costs as applicable

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

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.

- 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.

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.

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

- 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

- 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 revenues received in the PJM market.

- 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

The tariff states that a resource that <u>operates outside of its unit-specific parameters</u> 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 which parameter violations impact the calculation of BOR credits and how.

- A unit running on a price schedule will not be made whole for losses 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 a unit will not be made whole for based on which PLS parameter was violated (less subjective, more prescriptive rules)

4. Conforming Changes to Generator Deviations

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.

- 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.

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

- Overall, the proposal will <u>reduce</u> 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

Operating Reserve Clarifications

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Credit Reform:
PJM / IMM Proposal Overview

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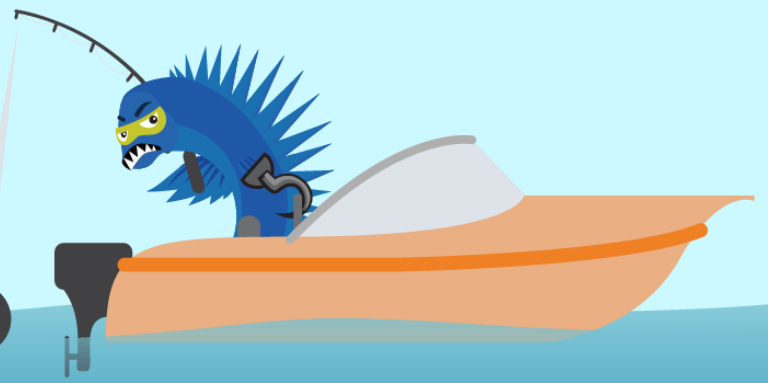custsvc@pjm.com

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