



Operating Reserve Clarification for Resources Operating as Requested by PJM: Issue Charge and Problem Statement Background

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Problem Statement Summary

1. Clarify the definition of “operating as requested by PJM” in the context of eligibility for Balancing Operating Reserves in both the OATT and PJM manuals.
 - It lacks the type of systematic approach found in the definition of “following dispatch”, which is used in assessing Balancing Operating Reserve deviation charges.
 - The lack of specificity in the definition of “operating as requested by PJM” leaves the definition open to interpretation and has been the subject of disagreement between PJM and the IMM.
 - An algorithmic method to identify units that are not operating as requested by PJM will reduce opportunities for differing interpretations.

2. Strengthen incentives for resources to follow dispatch instructions during real-time operations

- While resources that deviate from PJM's dispatch instructions are assessed Balancing Operating Reserve deviation charges, these resources often simultaneously receive Balancing Operating Reserve Credits.
- In some cases, the credits received far outweigh charges assessed, even when the resource significantly deviates from PJM's real-time instructions.
- The payment of Balancing Operating Reserve Credits to resources deviating from PJM's dispatch instructions, and the MW level to which they are made whole, should be further evaluated.

3. Operating Reserve Rules Applying to Combustion Turbines (CTs).

This piece of the problem statement was addressed with the November 2022 removal of the “CT Rule” as a result of these stakeholder discussions. CTs are now treated the same as other resource types.

- PJM’s rules for calculating Balancing Operating Reserve credits for CTs had not been updated to reflect the flexibility today’s CTs are able to offer.
 - Prior to 2022, CTs received different treatment from other resource types due to outdated assumptions about inflexibility in their dispatchable range.



Issue Charge Key Work Activities

Key Work Activity 1: Education

(Completed in 2022 and will be revisited as needed)

1. Provide education on the following topics

a) Current Tariff, Operating Agreement and Manual requirements regarding calculation of Balancing Operating Reserve Credits, specifically as it relates to eligibility for Balancing Operating Reserve Credits and the MW level to which resources are made whole.

– April 13, 2022 MIC meeting:

- [Item 11A - Operating Reserve Make Whole Credits Education](#)
- [Item 11B - Following Dispatch Education - IMM](#)

b) The incentives and requirements that currently exist in the PJM market for resources to operate as requested by PJM, including the assessment of balancing operating reserve deviation charges and how such charges are calculated.

– May 11, 2022 MIC meeting:

- [Item 09A - Operating Reserve Clarification - Incentives Education](#)

- c) Examples of situations where resources do not follow dispatch and receive uplift under the current rules.
 - May 11, 2022 MIC meeting:
 - [Item 09C - Operating Reserve Clarification - Following Dispatch and Deviation Charges - IMM Education](#)

- d) How other ISOs/RTOs provide incentives for resources to operate at their direction.
 - May 11, 2022 MIC meeting:
 - [Item 09B - Operating Reserve Clarification - Peer ISORTO Policies Education](#)

2. Clarify what it means to “operate as requested by PJM” as it relates to the payment of Operating Reserve Credits. This includes but is not limited to:
 - a) How closely a resource must follow PJM’s real-time dispatch signal or other desired MW in order to be considered operating as requested by PJM. (high priority)
 - b) How the determination of whether resources are coming on line and going offline, consistent with PJM’s operating instructions, is made. (high priority)
 - c) How Combustion Turbines (CTs) that do and do not have a dispatchable range are treated in this definition. (addressed in November 2022)
 - d) How the use of the Fixed Gen flag impacts the determination of whether a resource is considered to be operating as requested by PJM or not. (lower priority)
 - e) Ways in which the definition of “operating as requested by PJM” as it pertains to the calculation of Balancing Operating Reserve Credits may differ from the definition of “following dispatch” that is used for the purpose of calculating Balancing Operating Reserve Deviation Charges. (high priority)

3. Establish alternative rules addressing the MW level to which Balancing Operating Reserve Credits should be paid to resources found not to be closely following PJM's commitment and dispatch instructions (where needed in order to create strong incentives for resources to operate consistent with such instructions). (high priority)
4. Clarify the rules and process to disqualify resources from Balancing Operating Reserve Credits when they operate outside of their unit-specific parameters and such operation was not the result of an actual constraint. (lower priority)

- Focus first on definition of “Operating as Requested” and level to which resources are made whole when not following dispatch
 - Area of largest disagreement between PJM and IMM
 - Creates most compliance risk
- Move on to other issues afterwards
 - Impact of using Fixed Gen Flag
 - Impact of operating outside PLS parameters

Brief Education:

- Definition of Operating as Requested
- Level to which resources are made whole when not following dispatch

Uplift is a general term that refers to additional credits paid to units to ensure resources operating at PJM’s direction do not operate at a loss. Uplift in the energy market is paid through several sets of credits.



Balancing Operating Reserve make whole credits are the main focus of this issue charge.

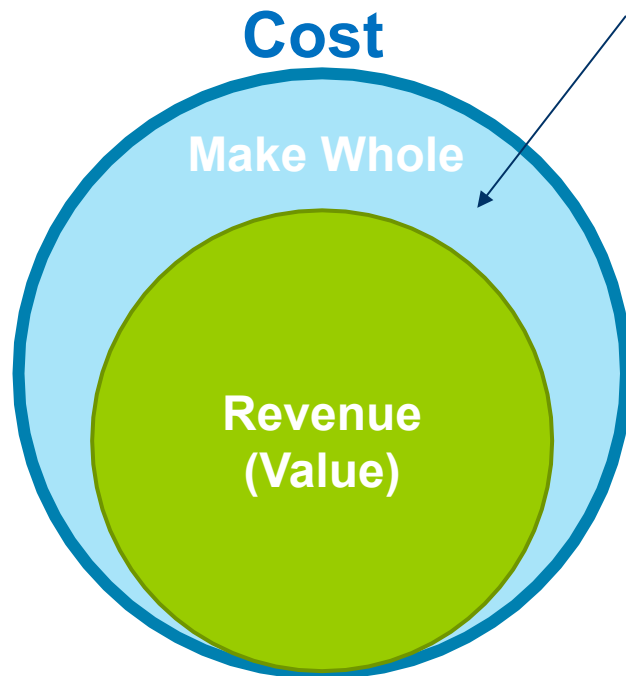
Other types of uplift credits that have parallel logic, such as reactive services credits, may also require revision.

Line Items



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

$$\text{Make Whole Credit} = \text{Cost} \text{ minus } \text{Value} \text{ (floored at zero)}$$



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

- Operating Agreement, Schedule 1, Section 3.2.3(e)

...synchronized pool-scheduled resources...that operate as requested by the Office of the Interconnection...shall be made whole.

(e) At the end of each Operating Day ¹, the following determination shall be made for each synchronized pool-scheduled resource of each Market Seller ¹ that operates as requested by the Office of the Interconnection ¹. For each calendar day, pool-scheduled resources in the Real-time Energy Market ¹ shall be made whole for each of the following Segments ¹: 1) the greater of their day-ahead schedules and minimum run time specified at the time of commitment (minimum down time specified at the time of commitment for Demand Resources ¹); and 2) any block of Real-time Settlement Intervals ¹ the resource operates at PJM's direction in excess of the greater of its day-ahead schedule and minimum run time specified at the time of commitment (minimum down time specified at the time of commitment for Demand Resources). For each calendar day, and for each synchronized start of a generation resource or PJM-dispatched economic load reduction, there will be a maximum of two Segments for each resource. Segment ¹ 1 will be the greater of the day-ahead schedule and minimum run time specified at the time of commitment (minimum down time specified at the time of commitment for Demand Resources) and Segment 2 will include the remainder of the contiguous Real-time Settlement Intervals when the resource is operating at the direction of the Office of the Interconnection, provided that a segment is limited to the Operating Day in which it commenced and cannot include any part of the following Operating Day.

Nuclear resources are generally not eligible for operating reserve credits, unless directed to reduce output by PJM (in which case lost opportunity cost credits apply).

Nuclear generation resources shall not be eligible for Operating Reserve ¹ payments unless: 1) the Office of the Interconnection ¹ directs such resources to reduce output, in which case, such units shall be compensated in accordance with Tariff, Attachment K-Appendix, section 3.2.3(f) and the parallel provision of Operating Agreement, Schedule 1, section 3.2.3(f); or 2) the resource submits a request for a risk premium to the Market Monitoring Unit ¹ under the procedures specified in Tariff, Attachment M - Appendix, section II.B. A nuclear generation resource (i) must submit a risk premium consistent with its agreement under such process, or, (ii) if it has not agreed with the Market Monitoring Unit on an appropriate risk premium, may submit its own determination of an appropriate risk premium to the Office of the Interconnection, subject to acceptance by the Office of the Interconnection, with or without prior approval from the Commission ¹.

The term “operating as requested by PJM” is not well defined in the Tariff. Clarifying this definition is critical.

PJM INTERPRETATION

- The Tariff references payment of balancing operating reserve credits to units “operating as requested by PJM.”
 - Operating as requested by PJM has been historically interpreted as coming online and offline consistent with PJM’s request
 - Manual 28, Section 5.2.1 provides guidance on this interpretation (see next slide)
- The Tariff does not use the term “following dispatch” in reference to operating reserve eligibility. Instead, the term “following dispatch” is only referenced in the assessment of balancing operating reserve **charges** to units that deviate from PJM’s dispatch instructions.
 - However, PJM acknowledges that some may interpret following dispatch as a pre-requisite for being eligible for balancing operating reserve credits due to the lack of specificity in the tariff language. This should be explicitly contemplated and clarified through the work of this committee.
- The concept of following dispatch is embedded throughout the Balancing Operating Reserve Make Whole Credit calculations though, as cost recovery is maximized when a resource is following dispatch

PJM determines eligibility for Balancing Operating Reserve credits for each generating resource from dispatcher logs. The following operating guidelines are used in the determination of Operating Reserve credits:

- Resource **must operate according to the on and off times requested by PJM**, and units tripping during pool-scheduled periods of operation will retain their eligibility up through the five minute interval in which the unit trips.
- Resources that trip or fail to start are required to notify PJM per the Synchronization and Disconnection procedures in PJM Manual 14D: Generator Operational Requirements.
- Resources that trip, are requested to restart by PJM, and return to operate as requested, **are eligible to receive credits for the latter period of operation**. Resources that trip or failed to start, are requested to restart by PJM for reliability, and operate as requested, are eligible for additional startup costs.”

- PJM's commitment tools and dispatchers log the time when units are called on and off as well as the reason for committing or releasing the unit
- The status of pool-scheduled or self-scheduled is derived from the log reason.
 - Log reasons therefore feed the determination of eligibility for operating reserve credits.
- PJM Settlements provides secondary review of dispatcher logs and recordings for consistency and verification of operating reserve eligibility as needed.

Incentives within the structure of the make whole credit calculation

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

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.

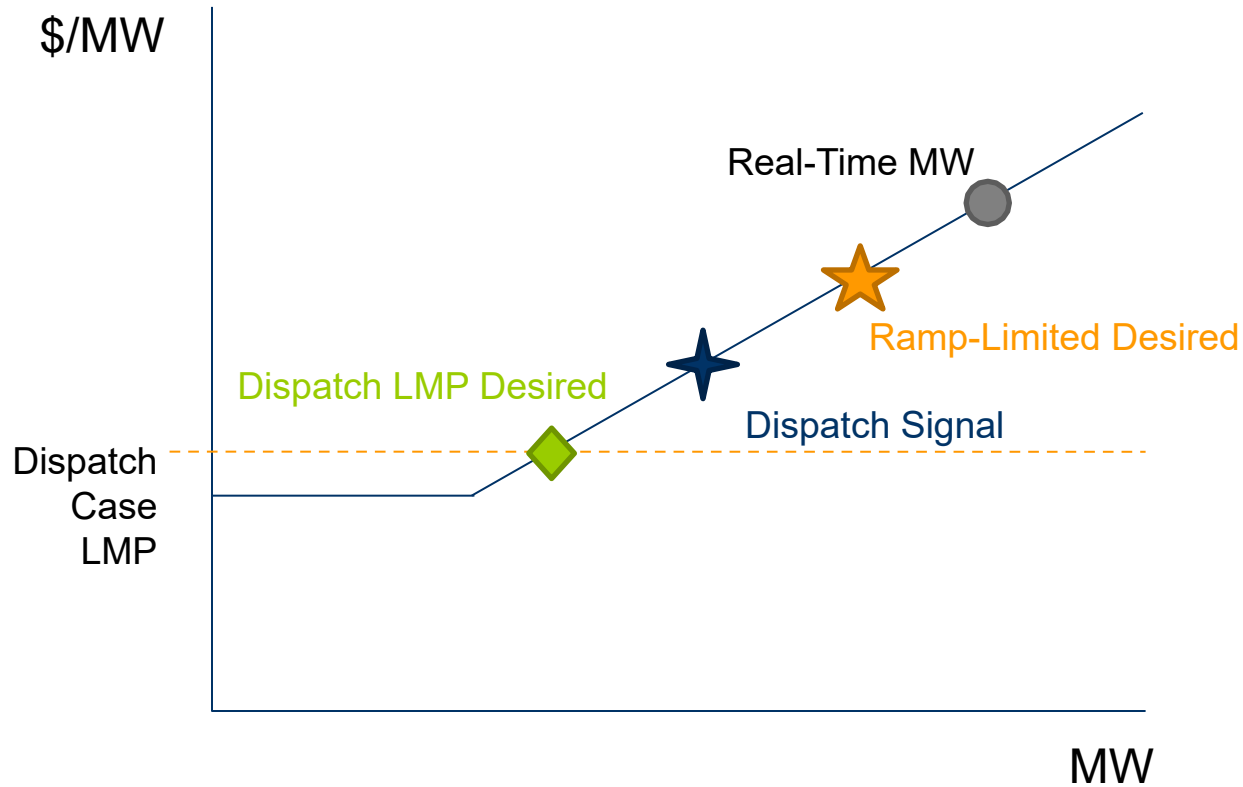
Opportunity for cost recovery is maximized when a resource follows dispatch

There are several variations of the Desired MW value that can be used in the operating reserve calculations. This Desired MW impacts the level to which resources will be made whole when they are not following dispatch.

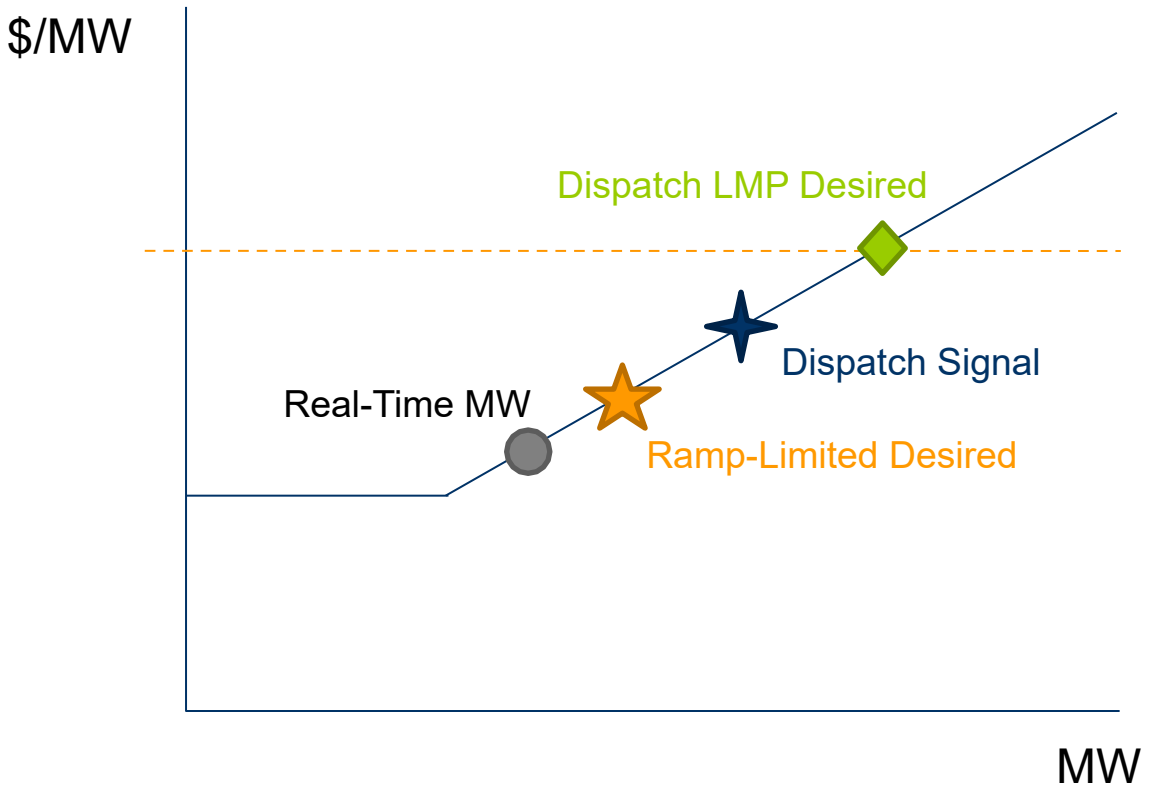
Desired MW Type	Explanation
Ramp-limited Desired (RLD)	Output level that a resource should have achieved between dispatch signals.
Dispatch signal MW or Basepoint MW	Output level requested via the dispatch basepoint issued by PJM's real-time dispatch tools
Dispatch LMP Desired	Output level based on the dispatch run LMP and the incremental offer curve. This value is not ramp limited.
Real-time MW	Revenue Meter Value as defined in M28 section 1A.1 Business Rules for Revenue Data for Settlements.

Ramp-Limited Desired vs. Dispatch Signal vs. Dispatch LMP Desired

Over Generating



Under Generating



Operating Reserve Desired MW is the umbrella term used for the desired MW value used in the Operating Reserve make whole credit calculation (as well as in the deviation charge calculation).

It is equal to one of Desired MW types referenced on the prior slide and is determined as follows:

- If any of the following are true, then it equals Dispatch LMP Desired;
 - Ramp-limited desired MW and Dispatch Signal are not available
 - This means they are unavailable due to technical reasons or Economic minimum and Economic maximum are not at least as far apart in real-time as they are in day-ahead as determined by:
 - $RT\ eco\ min > 105\% DA\ eco\ min$ or $DA\ eco\ min + 5\ MW$, whichever is greater
 - $RT\ eco\ max < 95\% DA\ eco\ max$ or $DA\ eco\ max - 5\ MW$, which ever is lower
 - Percent off dispatch is greater than 20%
 - Resource's Fixed Gen Flag is set in Real-time but not Day-ahead

Continued on next page

- Otherwise, if any of the following are true, then it equals Dispatch Signal MW
 - Dispatch Signal MW is less than or equal to the ramp-limited desired MW
 - Dispatch Signal MW is greater than the ramp-limited desired MW and the resource's Real-time MW is greater than the ramp-limited desired MW
- Otherwise it equals Ramp-Limited Desired MW
 - That is, all of the above conditions must be false for Ramp-Limited Desired MW to be used as Operating Reserve Desired MW
 - In general, if a resource is “following dispatch” within 20%, the Ramp-Limited Desired MW will be used.

- PJM recognizes the opportunity to improve the operating reserve make whole credit rules to provide stronger incentives for resources to follow PJM's dispatch signal
- Possible areas of improvement include the use of Ramp Limited Desired MW.
 - An important component in determining make-whole credits
 - The degree to which a unit follows PJM's signals can influence the Ramp Limited Desired MW
 - The unit's SE MW can limit the degree to which the dispatch software can move the unit
 - If a unit does not follow dispatch consistently, the Ramp Limited Desired value will not be reflective of where the unit would have been desired had it been following dispatch. This creates a limit on the desired MW that can be factored into the make whole credit calculation, and the amount of deviations that can be assessed.
 - Is there a more appropriate MW value to use in the determination of Operating Reserve Desired MW, or a better way to determine if the unit is following dispatch?

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Operating as Requested by PJM Education**



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