

Segmented Make-Whole Payments

Below is a suggested list of business rules to segment Make-Whole Payments as a function of the greater of the Day-Ahead Schedule, or Minimum Run Time. *Revision is expected to be required to OATT sections 1.10.1A (d), 1.10.2 (b) and 3.2.3 (b) and PJM M-28, PJM Operating Agreement Accounting*

1. For an entire calendar day, a resource will be made whole for the duration of the greater of the Day-Ahead Schedule or Minimum Run Time (Minimum Down Time for demand resources) and made whole separately for the block of hours it is operated at PJM's direction in excess of the greater of the Day-Ahead Schedule or Minimum Run Time (Minimum Down Time for demand resources).
2. During an entire calendar day, and for each synchronized start or PJM-dispatched economic load reduction, there will be a maximum of two segments per day, per unit. Segment 1 will be the greater of the Day-Ahead schedule and Minimum Run Time (Minimum Down Time for demand resources) and Segment 2 will include the remainder of the calendar day when the unit is running.
3. A segment cannot be "carried over" into the next calendar day. Any individual segment will have an end hour at midnight.
4. Startup costs (shut down costs for demand resources) and no-load costs as applicable will be included in the segment represented by the longer of the Day-Ahead Schedule or Minimum Run Time (Minimum Down Time for demand resources).
5. Regulation Market and Synchronized Reserve Market (with the exception of Condensing CTs) revenue will be applied against balancing credits along the segments that correspond to the appropriate hour that the revenue was earned. For Condensing CTs, Synchronized Reserve Market revenue will be applied against balancing credits earned during a single period of operation, where a period of operation is defined as contiguous hours of condensing and generation operation.

Minimum Generator Operating Parameters – Parameter Limited Schedules

Below is the suggested list of business rules to require units to submit schedules that meet minimum accepted parameters. *Revision is expected to be required to OATT section 6.4 and PJM Manuals M-11, Scheduling Operations; M-15, Cost Development Task Force Guidelines; and M-28, PJM Operating Agreement Accounting*

6. Pre-determined limits on non-price offer parameters for all generation resources, both exempt and non-exempt, will define limits on generation resources' non-price offer parameters under the following circumstances:
 - i. If the three pivotal supplier test for the operating reserve market defined by transmission constraint(s) is failed, generation resources, both exempt and non-exempt, will be committed on their Parameter-Limited Schedule.

- For exempt units, the Parameter-Limited Schedule will be used with the existing price offer for the day such that the price components of the offer may not change as a result;
 - For exempt and non-exempt units, the Parameter-Limited Schedule shall be the less limiting of the defined Parameter-Limited Schedules or the submitted offer parameters.
- ii. In the event that the Office of the Interconnection: (i) declares a Maximum Generation Emergency; (ii) issues an alert that a Maximum Generation Emergency may be declared (“Maximum Generation Emergency Alert”); or (iii) schedules units based on the anticipation of a Maximum Generation Emergency or a Maximum Generation Emergency Alert for all or any part of such Operating Day, generation resources, both exempt and non-exempt, will be committed on their Parameter-Limited Schedule.
7. On an annual basis, PJM will define a list of minimum acceptable operating parameters, based on an analysis of historically submitted offers, for each unit class for the following parameters¹:
- Turn Down Ratio
 - Minimum Down Time
 - Minimum Run Time
 - Maximum Daily Starts
 - Maximum Weekly Starts
8. The following parameters² will be reviewed on an ongoing basis, via a stakeholder process, and may, at some future date, define limitations for:
- Hot Start Notification Time
 - Warm Start Notification Time
 - Cold Start Notification Time
9. The operating parameters for each unit class must meet the historically based criteria listed in the rules below. The operating parameter limits will remain in place unless an exception is filed and approved (see rules 10 through 20 below).
10. Turn Down Ratio is defined as the ratio of economic maximum MW to economic minimum MW.
11. The minimum acceptable Turn Down Ratio applicable to an individual unit will be the greater of:
- a) the difference between the minimum of the economic minima and the maximum of the economic maxima submitted over the prior 24 months, or
 - b) 90 percent of the PJM-defined unit class Turn Down Ratio.
12. If the resulting unit Turn Down Ratio is less than 90 percent of the PJM-defined unit class Turn Down Ratio, then the unit’s Turn Down Ratio will be set equal to 90 percent of PJM-defined unit class Turn Down Ratio.

¹ As defined in the PJM Manuals and Markets Database Dictionary.

² As defined in the PJM Manuals and Markets Database Dictionary.

13. For CTs, the Turn Down Ratio will assumed to be 1.0.
14. The submitted Minimum Run Time may not exceed the defined Minimum Run Time for the PJM-defined unit class.
15. The initial Minimum Down Time for each unit is based on the minimum of the Minimum Down Times submitted over the prior 24 months, if the resultant minimum down time is less than or equal to 110 percent of the PJM-defined unit class Minimum Down Time.
16. If Minimum Down Time submitted for a unit is more than 110 percent of the PJM-defined unit class Minimum Down Time, then the unit's Minimum Down Time will be set equal to 110 percent of the PJM-defined unit class Minimum Down Time.
17. The initial Maximum Starts per Week for a unit will be based on the posted level for the PJM-defined unit class.
18. If the Maximum Starts Per Week submitted for a unit is less than the PJM-defined unit class maximum starts per week, then the unit's Maximum Starts per Week will be set equal to the PJM-defined unit class posted Maximum Starts per Week.
19. The Maximum Starts Per day will be based on the PJM-defined unit class for non-CT units. For CT units, the minimum value of maximum starts per day will be 2.
20. If the number of Maximum Daily Starts submitted by a unit is less than the PJM-defined unit class Starts per Day for a non-CT unit, or less than 2 for a CT, then the unit's Maximum Starts per Day will be set equal to the PJM-defined unit class Maximum Starts per Day for a non-CT unit and 2 for a CT.
21. Non-exempt generation resources will be required to submit an additional price schedule specifying the unit's predefined non-price parameter limits. This schedule will be identified as the unit's "parameter limited" schedule. The unit's cost-based schedule(s) to be used when the unit is offer-capped for transmission will also need to include the same parameters as the Parameter-Limited Schedule.
22. Exempt generation resources will be required to submit an additional schedule specifying the unit's predefined non-price parameter limits. This schedule will be identified as the unit's Parameter-Limited Schedule.
23. The MMU will post unit class specific parameter limits thirty (30) business days prior to the bi-annual enrollment periods for the submission of start-up and no-load costs. Period 1 is defined as the period of time beginning April 1 and ending September 30. Period 2 will be defined as the period of time beginning October 1 and ending March 31. Twenty (20) business days prior to each period, all generation suppliers that wish to submit a Parameter-Limited Schedule for units with physical operational limitations that prevent the units from meeting the minimum parameters may submit a request for a new exception to ParametersExceptions@pjm.com for evaluation. Each generation supplier must supply the required historical unit operating data in support of the exception.

24. Physical operational limitations may include, but are not limited to, metallurgical restrictions due to age and long term degradation, physical design modifications performed as part of a life extension program, or environmental permit limitations under non-emergency conditions.
25. Each requested exception will indicate the expected duration of the requested exception including the date on which the requested exception period will end. If physical conditions at the unit change such that the exception is no longer required, the generation supplier is obligated to inform PJM and the exception will be reviewed to determine if the exception continues to be appropriate.
26. PJM and the MMU will review the exception and provide the generation supplier with a decision within ten (10) business days. Should PJM require additional technical expertise in order to evaluate the exception request, PJM will engage the services of a consultant with the required expertise.] All Parameter-Limited Schedules must be submitted in eMKT seven days prior to the beginning of period 1 and period 2, defined as April 1 and October 1, respectively.
27. On a daily basis, each generation supplier may submit notification to PJM that changed physical operational limitations at the unit require a temporary exception to the unit's parameters. Each generation supplier must supply the required unit operating data in support of the exception.
28. Physical operational limitations may include, but are not limited to, short term equipment failures, short term fuel quality problems such as excessive moisture in coal fired units, or environmental permit limitations under non-emergency conditions.
29. For steam units, regardless of fuel type, the average historical values for any of the parameters as offered by the owners for the calendar year 2006 may be used in place of the values in the matrix.
30. For steam units, regardless of fuel type, the historical average is calculated from the market based offers for market based units and from cost-based offers for units which made only cost-based offers.
31. For combined cycle units,
 - i. If the 2006 average historical market-based offer parameters are within the limits in the parameter matrix, the unit be limited to that 2006 historical average. If not then ii) applies;
 - ii. If the unit was offered with market-based offer parameters for 10% or more of the days (36 days minimum) at a level at or more flexible than parameters in matrix, the unit will be limited at that level. If not the iii) applies
 - iii. If the 2006 average historical market based offer parameters exceed the limits in the matrix (less flexible than the parameters in the matrix) then the unit will be limited to the level at which the market-based parameter was bid to the most flexible level for 10% or more of the days (36 days minimum) at that level.
32. Each generation supplier will provide a date on which the exception period will end. Exceptions granted pursuant to Business Rule #27 may not continue past the beginning of the next period. Such exceptions will be accepted, but will be subject to after-the-fact review by PJM and the MMU provided that the after-the-fact review shall be limited to the continuation of the exception. If physical conditions at the unit change such that the exception is no longer required, the generation supplier is obligated to inform PJM and the exception will be terminated.

33. If an exception request is denied by PJM in part or in full, the generation supplier may choose to dispute the decision via the Dispute Resolution Process as defined in the PJM Operating Agreement. While under dispute, the generation supplier will be required to submit parameter-limited schedules for the period as determined during the exception process.
34. Generation suppliers may indicate to PJM those units with the ability to operate on multiple fuels. Multiple-fuel units may submit a parameter-limited schedule associated with each fuel type. All Parameter-Limited Schedules must be submitted via eMKT seven days prior to the beginning of each period. The generation supplier will be required to indicate to PJM which of the parameter-limited schedules are available each day. Any exceptions required for any of the parameter-limited schedules submitted for multiple-fuel units will be required to be submitted and approved via the exception process.
35. Nuclear Units are excluded from eligibility for Operating Reserve payments except in cases where PJM requests that nuclear units reduces output at PJM's direction or where a physical problem at a nuclear unit requires a risk premium and that risk premium is submitted to and accepted by the MMU. Other specific circumstances will be evaluated on a case-by-case basis by PJM and the MMU.

Ramp-limited RT Desired MW to determine deviations

Below is a suggested list of business rules to calculate a Ramp-limited Desired MW value. *Revision is expected to be required to OATT 3.2.3 (f) and PJM Manuals M-11, Scheduling Operations and M-28, PJM Operating Agreement Accounting.*

36. PJM will determine a unit's Ramp-Limited Desired MW according to the following calculation:

$$\text{Ramp_Request}_t = \frac{(\text{UDStarget}_{t-1} - \text{AOutput}_{t-1})}{(\text{UDSLAtime}_{t-1})}$$

$$\text{RL_Desired}_t = \text{AOutput}_{t-1} + \left(\text{Ramp_Request}_t * \text{Case_Eff_time}_{t-1} \right)$$

where the variables are:

- UDStarget = UDS basepoint for the previous UDS case
- AOutput = Unit's output at case solution time
- UDSLAtime = UDS look ahead time
- Case_Eff_time = Time between base point changes
- RL_Desired = Ramp limited desired MW

37. PJM will determine the unit's MW off dispatch and % off dispatch by using the lesser of the difference between the actual output and the UDS Basepoint or the actual output and Ramp-Limited Desired MW.

38. % off dispatch and MW off dispatch will be a time-weighted average over the course of an hour.
39. A pool-scheduled or dispatchable self-scheduled generator is considered to be “following dispatch” if its actual output is between its Ramp Limited Desired MW and UDS Basepoint, or its % off dispatch is ≤ 10 or its hourly integrated Real-time MWh is within 5% or 5 MW (whichever is greater) of the hourly integrated Ramp Limited Desired MW. A self-scheduled generator must also be dispatched above economic minimum.
40. A dispatchable self-scheduled resource that is not dispatched above economic minimum will be assessed deviations using $|\text{hourly integrated Real-time MWh} - \text{Day-Ahead MWh}|$.
41. A unit that is dispatchable Day-Ahead but is Fixed Gen in real-time will have deviations assessed using $|\text{hourly integrated Real-time MWh} - \text{UDS LMP Desired MW}|$.
42. Pool-schedule generators deemed to be “following dispatch” will not be assessed balancing operating reserve deviations.
43. Pool-scheduled generators that are deemed to be “not following dispatch” will be assessed operating reserve deviations based on $|\text{hourly integrated Real-time MWh} - \text{hourly integrated Ramp Limited Desired MW}|$.
44. As a result of this revised calculation, PJM will not consider the “Eligible to set LMP” Flag when determining Balancing Operating Reserve eligibility.
45. PJM will calculate a Ramp Limited Desired MW value for units where the economic minimum and economic maximum are at least as far apart in real-time as they are in Day-Ahead.
 - Real Time Economic Minimum $\leq 105\%$ of Day-Ahead Economic Minimum or Day-Ahead Economic Minimum plus 5MW, whichever is greater.
 - Real Time Economic Maximum $\geq 95\%$ Day-Ahead Economic Maximum or Day-Ahead Economic Maximum minus 5MW, whichever is lower.
46. If a unit’s real-time economic minimum is greater than its Day Ahead economic minimum by 5% or 5MW, whichever is greater, or its real-time economic maximum is less than its Day Ahead economic maximum by 5% or 5MW, whichever is lower, and UDS LMP Desired MWh for the hour is either below the real time economic minimum or above the real time economic maximum, then deviations for the unit will be calculated as $|\text{hourly integrated Real time MWh} - \text{UDS LMP Desired MWh}|$.
47. UDS LMP Desired MWh is calculated by comparing the hourly integrated UDS LMP to the unit’s bid curve to determine a corresponding MW value. This value is not ramp-limited.
48. If the unit is deemed “not following dispatch” and its % Off Dispatch is $\leq 20\%$, the deviation will be calculated as the $|\text{hourly integrated Real-time MWh} - \text{hourly integrated Ramp Limited Des MW}|$. If deviation value is within 5% or 5 MW (whichever is greater) of Ramp Limited Desired MW, no deviations will be calculated.
49. If the unit is deemed to be “not following dispatch” and its % off Dispatch is $> 20\%$, the unit’s deviations will be calculated as $|\text{hourly integrated Real time MWh} - \text{UDS LMP Desired MWh}|$.
50. If a unit is deemed to be “not following dispatch” and has tripped, the deviation MW for the hour it tripped and the hours it remains offline throughout its DA Schedule will be calculated as $|\text{hourly integrated Real time MWh} - \text{Day-Ahead MWh}|$.

51. Units that are not dispatchable in both the Day-Ahead and Real-time Market will have operating reserve deviations based on the current comparison between [hourly integrated Real-time MWh and Day-Ahead MWh].

Supplier Netting

Below is a suggested list of business rules to allow **Supplier Netting at the Bus** to offset deviations. *Revision is expected to be required to OATT 3.2.3 (e) and PJM Manuals M-11, Scheduling Operations and M-28, PJM Operating Agreement Accounting.*

52. Generator deviations for units deemed to be “not following dispatch” that occur at a single bus will be able to offset one another.
53. A “single bus” will be any unit located at the same site and that has the identical electrical impacts on the transmission system.
54. Unit parameters do not have to be identical for the units’ deviation MW to offset one another.
55. If multiple units are deemed to be “not following dispatch” at a single bus, the deviation MW and direction of each unit at that bus will be summed to determine the deviation MW at that bus.
56. Units at a “single bus” must be owned or marketed by single PJM Market Participant.

Netting Deviation Calculations

Below is a suggested list of business rules for **Netting Deviation Calculations**. *Revision is expected to be required to PJM OATT 3.2.3 (h) and M-28, PJM Operating Agreement Accounting.*

57. Demand deviations will be assessed by comparing all Day-Ahead demand transactions at a single transmission zone, hub, or interface against the Real Time demand transactions at that same transmission zone, hub, or interface.
58. Supply deviations will be assessed by comparing all Day-Ahead transactions at a single transmission zone, hub, or interface against the Real Time transactions at that same transmission zone, hub, or interface.
59. Generator deviations will be assessed on an individual unit basis, except as provided in Business Rules 49 - 53.
60. Deviations that occur within a single zone will be associated with a particular Region, and will be subject to the Regional Balancing Operating Reserve rate.
61. Deviations at interfaces and hubs can be associated with a particular region, if all the busses that define all interfaces or all hubs are located completed in the region and will be subject to the Regional Balancing Operating Reserve rate.
62. Demand and supply deviations will be based on total activity in a zone, including all aggregates within the same zone.

Balancing Operating Reserve Cost Allocation

Below is a suggested list of business rules for **Balancing Operating Reserve Cost Allocation**. *Revision is expected to be required to PJM OATT 3.2.3 (h) and M-28, PJM Operating Agreement Accounting.*

63. For the purposes of allocation of Balancing Operating Reserve charges, PJM will determine and identify the reasons for which operating reserve credits are earned. This determination will be conducted by PJM in two stages: 1) those resources called on during the Reliability Analysis and 2) those resources called on to operate during the operating day. The results of this determination will identify the resources for which Balancing Operating Reserve credits will be allocated to Real-time deviations from Day-Ahead schedules and identify the resources for which Balancing Operating Reserve credits will should be allocated to real-time load share plus exports.
64. For units called on during Reliability Analysis (i.e. – called on by PJM between 1800 and 2400 hours the day preceding the operating day to operate the next day or to “run through” the midnight period) Balancing Operating Reserve credits will be allocated based on the reason for which the PJM operator logs the decision.
65. During the Reliability Analysis, if the PJM operator determines, through the commitment and dispatch algorithms utilized to complete the Reliability Analysis, that such units were committed to operate in real time in order to augment the physical units committed in the Day-Ahead Market to meet the forecasted real time load plus the operating reserve requirement, then any balancing operating reserve credits earned by those units would be allocated to deviations. Balancing Operating Reserve credits for such units will be identified as “RA Credits for Deviations”. PJM will the post the aggregate amount of MWs committed that meet this criteria
66. During the Reliability Analysis, if the PJM operator determines that such units are being committed due to extenuating conditions that warrant conservative actions to ensure the maintenance of system reliability (i.e. – to provide reserves over and above the quantity determined by the real time load forecast), then any Balancing Operating Reserve credits earned by those units would be allocated according to ratio share of real time load plus export transactions. Balancing Operating Reserve credits for such units will be identified as “RA Credits for Reliability”. PJM will the post the aggregate amount of MWs committed that meet this criteria
67. Units with Day-Ahead schedules that are identified in the Reliability Analysis and either required to start earlier in the operating day than the DA schedule or run longer in RT than their DA schedule will need to have the reason for such extension identified in the same manner as units committed in the RA. The Balancing Operating Reserve credits will be segmented and calculated separately.
68. During the Operating Day, Balancing Operating Reserve credits earned by units called on by PJM to operate during the operating day for which the LMP at the unit’s bus does not meet or exceed the unit’s applicable offer (cost or price) for at least four, 5-minute intervals of at least one clock hour during which the unit was running at PJM’s direction will be allocated according to ratio share of load plus exports. . Balancing Operating Reserve credits for such units will be identified as “RT Credits for Reliability”. PJM will the post the aggregate amount of MWs committed that meet this criteria
69. During the Operating Day, Balancing Operating Reserve credits earned by all other units operated at PJM’s direction in real time will be allocated according to deviations between Day-Ahead schedules and Real-Time quantities. Balancing Operating Reserve credits for such units will be identified as “RT Credits for Deviations”. PJM will the post the aggregate amount of MWs committed that meet this criteria
70. Units called on to run in real time (i.e. – during the operating day) will be treated identically regardless of unit type. That is, regardless of whether a unit is identified as a “CT” or “Steam” unit, the same test regarding

whether the LMP exceeded the unit's applicable offer for the minimum number of intervals in at least one of its run hours will be conducted and any BOR credits earned by the unit allocated accordingly.

71. Three months after the implementation of the Balancing Operating Reserve Cost Allocation, the Reserve Markets Working Group will reconvene to conduct a review of the impact on market and system operations..

Regional Balancing Operating Reserve Charge Allocation

Below is a suggested list of business rules for calculating the **Regional Balancing Operating Reserve Charge Allocation**. *Revision is expected to be required to PJM OATT 3.2.3 (h) and M-28, PJM Operating Agreement Accounting.*

72. PJM will determine Regional Balancing Operating Reserve Rates for the following Operating Reserve Regions:
 - Western Region defined as transmission zones AEP, APS, COMED, DUQ, DAYTON
 - Eastern Region defined as transmission zones BGE, DOM, PENELEC, PEPCO, METED, PPL, , JCPL, PECO, DPL, PSEG, RECO
73. In each Region, PJM will collect the credits paid to generators for all identified transmission constraints that are less than or equal to 345kv. The total credits that are collected for each local transmission constraint will be allocated to all real-time deviations and real time load within that Region, to determine a Regional Adder rate for Reliability and a Regional Adder rate for Deviations. As determined in the Balancing Operating Reserve Cost Allocation, Balancing Credits will be identified for either Reliability or Deviations and will be collected by Region.
74. The total balancing operating reserve credits that accrue in excess of the Regional Adder rates will be allocated to all real-time deviations and real-time load across the RTO to determine an RTO Balancing Operating Reserve Rate for Reliability and a RTO Balancing Operating Reserve Rate for Deviations. As determined in the Balancing Operating Reserve Cost Allocation, Balancing Credits will be identified for either Reliability or Deviations and will be collected for the RTO.
75. Each Regional Balancing Operating Reserve Rate for Deviations and/or Reliability will be determined by summing the RTO Balancing Operating Reserve rate for Deviations and/or Reliability and the associated Regional Adder rate.
76. For regions that do not have Regional Adders, the Regional Balancing Operating Reserve Rate for Deviations and/or Reliability will equal the RTO Balancing Operating Reserve Rate for Deviations and/or Reliability.