



Working to Perfect the Flow of Energy

PJM Manual 12: Balancing Operations

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Dispatch

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4.4 Regulation

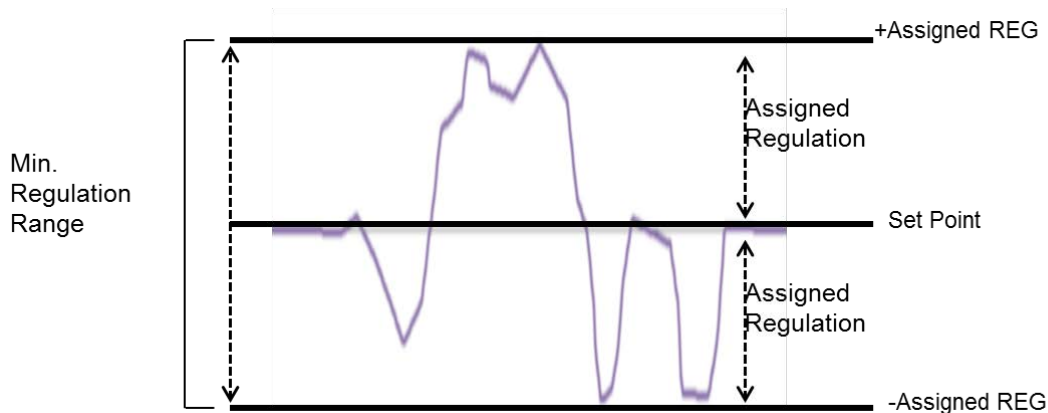
The PJM RTO is a single Balancing Area consisting of multiple Control Zones. Regulation for each Control Zone is supplied from resources that are located within that zone. Resource owners providing Regulation are required to comply with standards and requirements of Regulation capability and dispatch, as described in this section.

PJM requires that all regulating generation resources be equipped with an Automatic Generator Control (AGC) scheme to receive, process and respond to regulation signals. Demand response resources providing regulation must have a similar control system.

4.4.1 PJM RTO Regulation Market Obligations

The Regulation Requirement for the PJM RTO can be found in this manual in Section 4.4.3 Determining Regulation Assignment. The resources assigned to meet this requirement must be capable of responding to the AR signal immediately, achieve their bid capability within five minutes and must increase or decrease their outputs at the ramping rates that are specified in the data that is submitted to PJM.

The PJM RTO requires that the Regulation range of a resource is at least twice the amount of Regulation assigned, and that the resource can symmetrically provide the total amount of Regulation assigned (a full raise and lower of assigned regulation from set-point) as illustrated in Exhibit 12 below.



[Exhibit 12. Assigned Regulation and Regulation Range requirements](#)

Demand Response resources providing Regulation are required to fulfill the regulation range requirements without injecting energy into the Bulk Electric System (BES).

A resource capable of automatic energy dispatch that is also providing Regulation reduces its energy dispatch range by the regulation assigned to the resource. This redefines the energy dispatch range of that resource. (The resource's assigned regulation subtracted from its regulation maximum forms the upper limit of the new dispatch range, while the resource's regulation minimum plus its assigned regulation forms the lower limit of the new dispatch range.) Exhibit 12 illustrates the limit relationship.

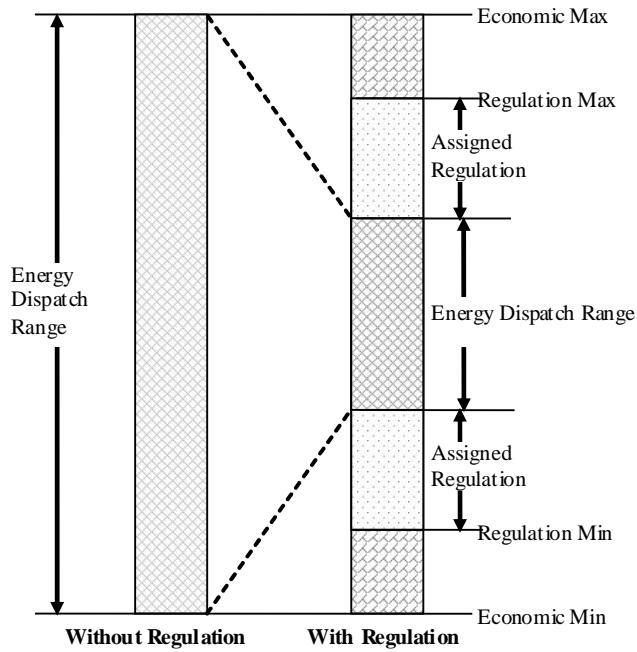


Exhibit 1: Limit Relationship for Regulation

Resource owners wishing to provide Regulation in the PJM balancing area are required to submit the following data via eMKT no later than 6:00 p.m. day-ahead:

- Offer MW – The maximum MW amount of regulation that the resource is willing to provide for the next day. This value is limited by the resource’s qualified capability. Offer MW may be adjusted hourly throughout the operating day giving 60 minutes’ notice before the operating hour.
- Offer Price – The price in at which the owner is willing to provide Regulation from the associated resource. The price should reflect the capability of the resource in \$/MW and the performance of the resource in $\$/\Delta\text{MW}$ of the resource. This value cannot be changed after 6:00pm day-ahead.
- Available Status – Indication of whether the resource is available, unavailable or self-scheduled for Regulation. Available Status may be adjusted hourly throughout the operating day giving 60 minutes’ notice before the operating hour.
- Regulation Max MW – The maximum MW value the resource can attain while providing Regulation. Regulation Max MW may be adjusted hourly throughout the operating day giving 60 minutes’ notice before the operating hour.
- Regulation Min MW – The minimum MW value the resource can attain while providing Regulation. Regulation Min MW may be adjusted hourly throughout the operating day giving 60 minutes’ notice before the operating hour.
- Min MW – The minimum amount of regulation the resource is physically capable of providing for an hour. This number must be less than or equal to the Offer MW. This value cannot be changed after 6:00pm day-ahead.

4.4.2 Regulation Signals

Resource owners will receive from PJM:

- Assigned Regulation (ARegA or ARegD) This is the assigned hourly regulation quantity (MW) that is cleared from the regulation market system. It is assigned for each individual resource that is qualified to regulate in the PJM market. This value, although typically static for the hour, will be sent on a 10 second scan rate. Resources will receive a separate assignment for RegA and RegD if the regulating resource is dual qualified, but the regulating resource will be assigned to follow only one signal for the hour.
- Regulation Control Signals (RegA, RegD) – Real-time instantaneous resource owner fleet regulation signal (+/- MW). This signal is used to move regulating resources in the owner’s fleet within the fleet capability (+/- TReg). This value will be sent on a 2 second scan rate.
 - RegA-is the low filter ACE signal sent to traditional regulating resources
 - RegD-is the high filter ACE signal sent to dynamic regulating resources

Resource owners will send to PJM:

- Total Regulation (TRegA or TRegD)-This is the real-time fleet regulation capability (MW) that represents the active resource owner’s ability to regulate. Ideally the value of this quantity should be the sum of the resource owner’s non-

zero AReg quantities for the majority of the hour, but must reflect any reductions in regulating capability as they occur (resource’s AGC limit restrictions, resource “off control” conditions, etc.). This value shall be calculated every 2 seconds and sent on a 2-second scan rate. A fleet owner must separate the fleet so resources following RegA report TRegA and resources following RegD report TRegD.

- Current Regulation (CRegA or CRegD) - This is the real-time fleet regulation feedback (+/- MW) that represents the active position of the fleet with respect to the +/- TReg capability. Ideally, the value of this quantity will track the RegA signal if the regulating fleet is responding as prescribed. This value shall be calculated every 2 seconds and sent on a 2-second scan rate. A fleet owner must separate the fleet so resources following RegA report CRegA and resources following RegD report CRegD.
- For hydro resources that have no economic offer these resources must submit the resource(s) midpoint.
- [Demand Response resources are expected to provide PJM with their MW-value basepoint they are regulating around.](#)

Resource owners may send the following to PJM if the resource owner will be using a performance group as described in Section 4.5.7-Performance Group of this manual for evaluation:

- Resource Allocation – Individual unit allocation may be sent to evaluate resource response. Allocation should be sent as percent allocation for each individual regulating resource of the resource AReg. When the resource is not assigned it will send either a 0 %. Resources without an associated allocation signal will be scored on a proportional basis.
- Operational Midpoint – the point around which the regulating resource (unit, plant or registration) operates.

If the above signals are not sent, then PJM will use proportional allocation and economic setpoint.

4.4.3 Determining Regulation Assignment

The PJM RTO’s Regulating Requirement is 525 effective MW during off-peak hours (0000 to 0459) and 700 effective MW during on-peak hours (0500 – 2359). PJM dispatch may increase or decrease the regulation requirements as needed to accommodate system conditions.

Each LSE is required to provide a share of the PJM Regulating Requirement. An LSE’s actual hourly Regulation obligation is determined for the hour, after-the-fact, based on the LSE’s total load in the PJM RTO, as follows:

$$\text{LSEs Regulation Obligation} = \left(\frac{\text{LSEs Load Allocation \%} \times}{\text{PJM Assigned Regulation}} \right)$$

An LSE may satisfy its Regulation obligation by any of the following methods:

- Self-Scheduled Resources — An LSE can satisfy its Regulation obligation by self-scheduling Regulation.

- Bilateral Transaction — An LSE can make contractual arrangements with other PJM Members that are able to provide Regulation service.
- PJM Regulation Market Purchases — An LSE can purchase its Regulation obligation from the PJM Regulation Market, i.e., from the excess Regulation capability provided to PJM by Resource owners.

All Regulation offers reported to PJM must provide Regulation that has a quality standard of 75% or greater, as established by verification testing.

PJM Actions:

PJM will notify the Transmission Owners and Generation Owners via the PJM ALL-CALL of changes to the regulation requirement and the expected duration of such change.

PJM Members Actions:

- Each LSE determines its estimated Regulation Obligation for the operating day based on its own forecast load and the information received via the PJM ALL-CALL.
- Resource owners view the hourly regulation market results via eMKT (available at least a half an hour before the operating hour) as to those resources to which regulation has been assigned. Resource owners that have self-scheduled Regulation on any of their resources inform the PJM dispatcher when those resources are on line and able to provide the self-scheduled Regulation.
- Once regulation on a resource is self-scheduled by a resource owner, it is no longer eligible to participate as a pool assigned regulating resource for the current operating day.
- If purchasing Regulation from another entity, the buyer and seller negotiate the transaction and the buyer submits the transaction through the Regulation Bilateral page of eMKT. The seller must then confirm the transaction via eMKT by 4:00pm the day after the operating day. The rules for these transactions are described in more detail later in this section of the manual.

4.4.4 Dispatching Regulation

PJM obtains the most cost efficient Regulation Ancillary Service available, as needed, to meet the PJM RTO's Regulation Requirement. PJM assigns Regulation in economic order based on the total cost of each available resource to provide Regulation, including real time opportunity cost and the resource's Regulation offer price. The AR signals are then automatically sent to the Resource Owners via Automatic Generator Control (AGC). Resource Owners are responsible for maintaining unit regulating capability. Exhibit 13 shows how the Regulation is assigned to the resources.

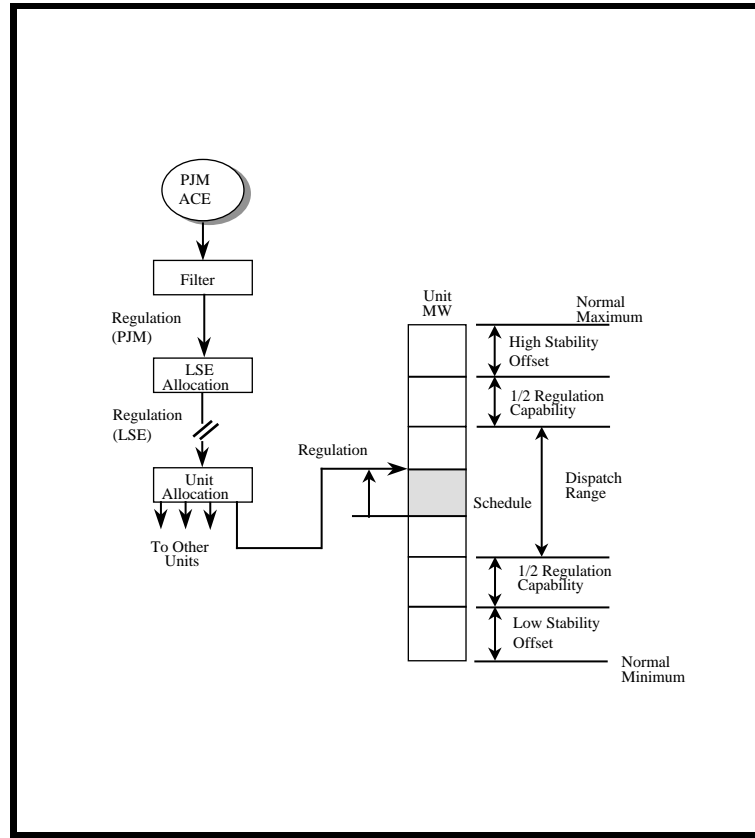


Exhibit 2: Area Regulation Assignment

PJM dispatcher re-assigns regulating capability as necessary to meet the PJM Balancing area's Regulating Requirement. Market Sellers must comply with Regulation dispatch signals that are transmitted by PJM. Market Sellers must operate their regulating resources as close to desired output levels, as practical, consistent with Good Utility Practices.

Regulation Deficiency

After the initial Regulation assignments are made, and throughout the operating hour, PJM Members report changes to their resource's regulating capabilities either by a phone call to PJM or by virtue of the TReg signal(s) each company sends to PJM. If a resource becomes unable to supply its assigned amount of Regulation, the PJM dispatcher must de-assign deficient resources and assign replacement Regulation to ensure that the total Regulation requirement is met. Such assignments are made economically based on each available resource's total cost to provide regulation, including real time opportunity cost and the resource's regulation offer price.

If, after assigning all available Regulation, the PJM Regulating Requirement is still not met, PJM dispatcher operates the system without the required amount of Regulation, logging such events.

In the event there is a loss of EMS communication between PJM and a resource owner, Current Regulation Assignments must be reassigned to another Resource Owner until EMS communication is reestablished.

Regulation Excess

If during the period an excess in assigned Regulation occurs and the total PJM RTO Regulation value exceeds the objectives by 15 MW or more, PJM dispatcher de-assigns Regulation economically based on each resource's total cost to provide regulation, including real time opportunity cost and the resource's regulation offer price.

PJM Actions:

- PJM dispatcher continuously monitors the Regulation deviation to assess Resource Owner fleet capability and reassigns Regulation as required.
- PJM's accounting staff determines the billing for the regulating service, according to the procedures in the **PJM Manual for Operating Agreement Accounting (M-28)**.

PJM Member Actions:

- When initial assignments and reassignments are made, each affected Resource Owner dispatcher then updates the entity's regulating capability as defined by the Resource Owner TReg value.
- Participants report to the PJM dispatcher changes (of at least +/- 1 MW for duration greater than 15 minutes) to assigned Regulation capability.

Bilateral Transactions

One PJM Member may sell Regulation Ancillary Service to another PJM Member. The two members must agree on the MW amount of capability being sold, schedule Regulation accordingly, and submit the two-PJM Member Regulation transaction to PJM via eMKT.

PJM Actions:

None

PJM Member Actions:

- All two-PJM Member transfers of regulating capability must be submitted as MW amounts via eMKT.
- The two members agree on the amount and duration of the Regulation transaction prior to the sale.
- The "buying" member submits the MW amount of the two-PJM Member transaction, the selling member, and the start and end time of the transaction via eMKT.
- The "selling" member confirms the transaction via eMKT by 4:00pm the day after the operating day.

4.5 Qualifying Regulating Resources

In order to ensure the quality of Regulation supplied to control the PJM RTO, a quality standard is developed. A resource must meet the quality standard to be permitted to regulate.

In general, there are two phases to qualifying a regulating resource:

- Certifying the resource
- Verifying regulating capability

An Area Regulation (AR) test is used for both certifying and verifying regulating capability for a resource.

Note: It must be emphasized that the Regulation test is not intended to test a resource's governor response to power system frequency changes.

PJM Actions:

- PJM Performance Compliance will [evaluate test results against the PJM RTO Regulation Market Obligations as described in Section 4.4.1 &](#) score the test using the performance score calculation as described in Section - 4.5.6 Performance Score Calculation of this manual within three business days of the test.
- PJM Performance Compliance will send results of test to the resource owner within three business days.
- PJM maintains a historical database of individual resource Regulation test results and calculates all appropriate compliance information. Individual test results are provided via email to the participant within three business days to facilitate a review and validation of results at the participant level.
- PJM Dispatcher determines if a self-scheduled test or PJM administered test can be performed based on system conditions.

4.5.1 Regulation Qualification Test

Traditional Resource Test

The AR test is run during a continuous 40-minute period when, in the judgment of PJM test administrator, economic or other conditions do not otherwise change the base loading of the resources that are being tested. [All resources performing a regulation test must set and hold for the test duration the MW-value basepoint that the resource is regulating around.](#)

Changes in base loading for a resource during the test period invalidate the test for that resource. A separate set of tests are required for qualification for the traditional signal (RegA) and the dynamic signal (RegD). The test follows a simulated [RegA-regulation](#) signal. The test will last for 40 minutes.

Once an AR test is announced, a Resource Owner is not permitted to change any resource's Regulation assignment.

Following the testing period an initial evaluation will be performed to ensure all underlying regulation obligations and testing requirements have been met. This will include verifying the resource (1) was providing regulation for the duration (40 minutes) of the test, (2) can achieve its full regulation testing range (+/- TREG), (3) has held its regulation base loading for the full duration of the test and (4) that no other resources within the testing fleet were in the regulation market during the testing period.

Scoring the AR test is based on compliance to the Performance Score Calculation as described in Section 4.5.6 - Performance Score Calculation of this manual. The score is evaluated on the entire 40 minute test period.

Dynamic Resources

The qualification test procedures described above for resources that will follow the dynamic regulation signal (RegD) are the same as the qualification test for RegA. For each test, resources will follow a signal for 40 minutes and be scored using the performance score calculation. Resources must complete a separate set of tests to qualify for the traditional signal (RegA) or the dynamic signal (RegD).

Changes to the Signal Path Re-Test – New Resource Owner

For previously qualified resources that are either purchased by a new resource owner which would constitute a change in the regulation signal path, resource owners must conduct a single, successful re-test to verify that each unit is able to respond to the regulation signal under the new resource owner. This test will be PJM administered and must meet threshold for certification as described in Sections 4.5.2-4.5.3. During the transition resources will not be qualified to offer regulation. After the retest, the resource performance score will be set to the re-test qualification score.

Changes to the Signal Path Re-Test – Existing Owner

For previously qualified resources where an existing resource owner who makes changes to the Energy Management System (EMS) or Generation Management System (GMS) or other changes, which would constitute a change in the regulation signal path, resource owners must conduct testing based on mutual agreement with PJM. This includes but is not limited to EMS/GMS database, Inter-Control Center Communication Protocol (ICCP) server, and Communication Front End (CFE) replacements and/or upgrades. After system verification, the resources' historic performance score will be maintained. This test must be administered by PJM.

PJM Actions:

- PJM Performance Compliance will certify a resource after three consecutive successful tests of 75% or better. After this requirement has been met, the change will be made to enable regulation offers to reflect the new certification within 1 business day.

PJM Member Actions:

- Contact PJM Performance Compliance at least a day prior to testing stating a regulation test will occur and include the following information: the resource

name and identification number, the time of the test, the amount of MWs being tested, basepoint, and what signal type the resource will test on.

- Contacts the PJM Dispatch at least 60 minutes in advance of a PJM administered test for test scheduling and approval. Contacts PJM Performance Compliance at least 24 hours before the start of the test to ensure that test can be scored by the Performance Score Calculation Engine (PSCE).
- For a new resource owner, schedules a re-test by contacting RegulationTesting@pjm.com for each unit in a manner similar to the guidelines above when a new owner takes control of an already qualified regulation.
- For an existing resource owner, schedules system verification by contacting RegulationTesting@pjm.com based on mutual agreement with PJM Staff when an existing resource owner changes the control signal path (e.g. EMS or GMS is changed or upgraded).

4.5.2 Certifying Regulating Resource

A resource may be certified only after it achieves three consecutive scores of 75% or above. Resources providing dispatchable energy and regulation service needs to provide testing at the low economic and high economic regulation limits.

The first of these tests may be performed internally by the member following the PJM Regulation test procedure. To perform a self-test the member must use the PJM test shape posted on the Markets and Operations> Ancillary Services>Market Based Regulation page fed into the resource owner's EMS. Additionally, the member must notify the PJM Performance Compliance at least 24 hours before the test. The Resource owner should also notify PJM Dispatch who will make a determination whether the test can be run. The resource should be set to unavailable during the test, though the other units may continue to regulate. Up to three self-administered tests may be performed on a resource each day.

The remaining tests should be administered by PJM Dispatch. The resource owner should contact PJM Dispatch and PJM Performance Compliance at least 24 hours before the test. For a PJM administered test, all resource(s) will be taken out of the regulation market for the specific signal. PJM Dispatcher makes the final determination about whether a PJM administered test can be performed. Only one PJM administered test may be performed on a resource each day.

PJM Actions:

- PJM Performance Compliance will certify a resource after three consecutive successful tests of 75% or better. After this requirement has been met, the change will be made to enable regulation offers to reflect the new certification within 1 business day.

PJM Member Actions:

- Before a self – administered test, resource owner notifies PJM Performance Compliance and PJM Dispatch. Before a PJM administered test, the resource owner notifies PJM Performance Compliance and PJM Dispatch 24 hours prior to testing.

- For any tests performed by the members for the purpose of certification, the member will supply the resource, the time of the test amount of MW being tested, [the MW-value](#) basepoint [the unit will be regulating around](#), and the signal type the resource is following to RegulationTesting@pjm.com.
- Resource owner uses posted test shape on Markets & Operations>Ancillary Services>Market Based Regulation <http://www.pjm.com/markets-and-operations/ancillary-services/mkt-based-regulation.aspx> for self administered test.
- Resource owner will set the resources specific operation setpoints for each resource to test around.

4.5.3 Certifying Multiple Combustion Turbines or Hydro Units at a Single Site

Combustion Turbines and Hydro-generators operating under a single plant control system must have a minimum of three tests of the control system. In addition, the performance of the each of the units being certified must be demonstrated in at least one of these tests. The test format must follow PJM Regulation test procedure. High and low band requirements do not apply for CTs and Hydro units being certified. The resource will be evaluated based on the Operational Midpoint of the grouped resources and the Resources Allocation as described in Section 4.4.2-Regulation Signals of this manual.

4.5.4 Increasing Regulation Capability on a Resource

One Regulation Certification Test is required for each market resource to increase the Regulating Capability on the resource. This test must be administered by PJM. Additionally, the member must notify the PJM Performance Compliance and PJM Dispatch at least 24 hours before the test. The resource should be set to unavailable during the test, though the other units may continue to regulate.

PJM Actions:

- PJM will update the regulation bidding availability to reflect the new certification within 1 business day after one successful test of 75% or better.

PJM Member Actions:

- The resource owner notifies PJM Performance Compliance and PJM Dispatch before a PJM administered test.
- For any tests performed by the members for the purpose of increasing certification, the member will supply the resource, the time of the test, amount of MW being tested, [the MW-value](#) basepoint [the unit will be regulating around](#), and the signal type the resource is following to RegulationTesting@pjm.com.
- Resource owner will set the resources specific operation setpoints for each resource to test around.

4.5.5 Disqualification and Re-Qualification of a Regulation Resource

Regulating resources that have not met performance thresholds over a specified time period will be disqualified and must re-qualify to offer into the regulating market for applicable signal type (RegA or RegD). The disqualification threshold is based on the historic

performance score. The historic performance score is a rolling average actual hourly performance score for the last 100 hours a resource has operated or a weighted average of the average of the three initial or requalification scores that are then averaged with available actual hourly performance scores. The hourly performance score calculation is described in section 4.5.6 Performance Score Calculation of this manual.

When the historic performance score falls below 40% by signal type, PJM will notify the resource owner and the resource will no longer be eligible to offer into the regulation market for the applicable signal type.

The resource owner may schedule a re-test as soon as practicable. When a regulating resource re-tests it will follow the testing procedure described in Sections 4.5.1-4.5.3 of this manual. Upon successful completion of requalification, the regulating resource performance score starts a new rolling average without any hours from the previous period counting towards the current period's rolling average.

When a regulating resource has no historic performance available, either because it is a new resource or a resource that has re-qualified, the average of the qualification test scores will be used as proxy for the historic performance rolling average as follows:

$$\text{Hour} = \frac{X * \text{Qualification Performance Score} + Y * \text{Actual Performance Score}}{100}$$

Where $100 - X = Y$ and Y is the number of hours after qualification. After 100 hours of actual performance scores $X \rightarrow 0$.

PJM Actions:

- Tracks rolling average of a regulating resource's performance score by signal type.
- Alerts the regulating resource's owner when performance by signal type falls below threshold of 40%.
- Blocks the disqualified resource from offering into the market.
- Monitors re-testing of the regulating resource
- Re-qualifies regulating resource,
- Notifies LSEs of a resource's certification for Regulation within three business days.

Member Actions:

- Schedules re-test to re-qualify as regulating resource status, if desired, while adhering to regulation testing guidelines.

4.5.6 Performance Score Calculation

PJM will calculate an hourly performance score which reflects a regulation resource's accuracy in increasing or decreasing its output to provide frequency regulation service in response to PJM's dispatch signal. With the Performance Score Calculation Engine (PSCE), PJM will collect regulation signal data every 10 seconds and resource operating parameters

that will be inputs into the performance score. The performance score calculation (PSC) evaluates each resource's accuracy in following the AGC signal.

PSCE Assumptions

Unless a resource owner elects to send additional data to detail operational decisions, it is assumed that resources are allocating the regulation control signal(s) proportionally and operating around the PJM Individual Generator Dispatch (IGD) setpoint. If a resource elects to use other than proportional dispatch the resource must send Operation Midpoint and Resource allocation described in Section 4.4.2 Regulation Signals of this manual.

Delay and Correlation Score

For each 10 second interval starting from Time 0 +10, PJM will calculate a Delay Score to quantify the delay in response between the regulation signal (RegA) and the resource change in output. To calculate the match, use the statistical correlation function (r), which measures the degree of relationship between the two signals. By shifting the time periods to compare the signals, delay (δ) is defined at the point in time of the maximum correlation between the two signals. This generates both a Correlation and Delay Score as:

$$\text{Correlation Score}_{\delta=0 \text{ to } 5 \text{ Min}} = r_{\text{Signal,Response}}(\delta, \delta+5\text{Min})$$

$$\text{Delay Score} = \text{Abs} \left| \frac{\delta - 5 \text{ Minutes}}{5 \text{ Minutes}} \right|$$

where the Delay score allows a 10 second latency for signal propagation delay for regulating resources.

Correlation and Delay are determined together by finding the 10 second interval with the highest coincident Correlation and Delay score. The 10 second interval that will determine Correlation and Delay for each scoring period is:

$$\max_{\delta=0 \text{ to } 5 \text{ Min}} (\text{Delay Score} + \text{Correlation Score})$$

Correlation during Periods of Zero Slope

If the standard deviation of the regulation signal is less than a threshold value, then the Correlation shall be calculated as the 1 - absolute difference between the slope of the regulation signal and the slope of the response. The performance score for Correlation and Delay will be calculated by using linear regression to find the slopes of the regulation signal and the resource response.

Precision Score

For each 10 second interval starting from Time 0 +10, PJM will calculate a Precision Score as a function of the difference in the energy provided versus the energy requested by the regulation signal while scaling for the number of samples. For each 10 second sample averaged over an hourly basis, PJM calculates the Precision Score as the absolute error (ϵ) as a function of the resource's regulation capacity, as:

$$Error = Avg\ of\ Abs\ \left| \frac{Response - Regulation\ Signal}{Hourly\ Average\ Regulation\ Signal} \right|$$

$$Precision\ Score = 1 - \frac{1}{n} \sum Abs(Error)$$

Where n is the number of samples in the hour and the precision allows a 10 second latency for signal propagation delay for regulating resources.

Performance Score Calculation

For each 10 second set of calculations the performance score will be averaged over a five minute period for PJM will determine a composite Performance Score per resource as a unit-less scalar ranging from 0 to 1. The Performance Score will be a weighted average of the performance score components, as:

$$Performance\ Score(t) = \max_{i=0\ to\ 5min} \left[A * \frac{Delay(t+i)}{Score} + B * \frac{Correlation(t+i)}{Score} \right] + C * \frac{Precision(t)}{Score}$$

The component scalars will be weighted equally with each at one-third (1/3). For periods when assigned regulation is 0, no score will be calculated. Correlation, Delay and Precision will be calculated with all applicable samples. Null scores will not be included in the hourly average performance score.

PJM Actions:

- PJM will calculate the Performance Score for each regulating resource after the operational hour and report the score to resource owners.

Member Actions:

- None

4.5.7 Use of Performance Groups in the Performance Score

Resources may elect to use a performance group for performance score evaluation. Performance groups can only be created for resources that satisfy one of the following criteria:

- Resources not eligible for LOC and total to less than or equal to 10 MWs across Transmission Owner boundaries.
- A performance group can be any number of resources not eligible for LOC inside a transmission owner's boundary.
- Resources within a fleet with equivalent applicable offers and point of interconnection.

Resources that are part of a performance group will send the Operational Midpoints and Resource Allocation of the group TReg for the grouped resources by signal type as

described in Section 4.4.2 - Regulation Signals. Each resource will be metered independently.

PJM Actions:

- PJM will receive additional control data to be used in the Performance Score Calculation to be reflected resource owner's dispatch.

Member Actions:

- Resource owners will notify PJM via RegulationTesting@pjm.com that they satisfy one of the Performance Group criteria.
- Resource owners will add required information to their data transfer link to PJM.

4.5.8 Performance Scores for Regulation Resources during a Synchronized Reserve Event

Regulation Resources choosing to respond to a Synchronized Reserve event will receive synchronized reserve compensation based on Manual 11, Section 4.2.11.

Resources that choose to respond to a reserve event for their reserve zone in an hour when they are cleared or assigned regulation are expected to return to their regulating band within 10 minutes of the end of the Synchronized Reserve event. From the start of the event, through the event, and for the 10 minutes after the end of the event, the performance scores for all regulating resources in the reserve zone where the Synchronized Reserve Event takes place will be null.

PJM Actions:

- PJM logs the time of the start and end of a Synchronized Reserve event.
- PJM will score performance for all regulating resources as null for the period during the Synchronized Reserve event and 10 minutes after the end of the event for those resources in that reserve zone.

PJM Member Actions:

- If the resource owner chooses to respond to an event the resource will return to the regulating band as soon as possible after the end of the reserve event.

4.5.9 Performance Scores during Periods with Insufficient Data

In rare cases of data disruption, circumstances may arise when PJM does not have sufficient data to calculate performance scores. During these disruptions, PJM will calculate performance scores for all intervals with at least fifteen contiguous minutes of sufficient data. All intervals with performance scores, and only those intervals, will contribute equally to the hourly performance score. In the event that an operating hour does not contain fifteen contiguous minutes of sufficient data, the historical score will be used as the hourly performance score for that operating hour.

PJM will also use the historical score as the hourly performance score for an operating hour when a partial-hour regulation assignment does not result in fifteen contiguous minutes of sufficient data.

PJM Actions:

- PJM uses current operating day historical performance score for an operating hour where input data for performance scores calculations lasts for greater than 15 minutes.
- PJM will use operating day historical performance score when partial hour regulation assignment results in less than 15 minutes of data.

4.5.10 Performance Scores for Regulation Assignments with Limited Notification

Performance Scoring will begin ten minutes after PJM Dispatch logs a resource to provide regulation service. This will not impact the length of time a resource is considered to be providing regulation service for settlement calculations. For purposes of scoring under section 4.5.9, the fifteen contiguous minutes condition will begin ten minutes after PJM Dispatch logs a resource to provide regulation service.

PJM Actions:

- PJM Dispatch logs the time of the start for the regulation assignment.
- PJM will score performance starting ten minutes after PJM Dispatch log indicates resource start time.