



Working to Perfect the Flow of Energy

PJM Manual 11:

**Energy & Ancillary Services
Market Operations**

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2.3.4 Minimum Generator Operating Parameters – Parameter Limited Schedules

Below is the list of business rules to require units to submit schedules that meet minimum accepted parameters.

- Pre-determined limits on non-price offer parameters for all generation resources will define limits on generation resources' non-price offer parameters under the following circumstances:
 - If the three pivotal supplier test for the operating reserve market defined by transmission constraint(s) is failed, generation resources will be committed on their Parameter-Limited Schedule, as defined below.
- The Parameter-Limited Schedule that is utilized shall be the less limiting of the defined Parameter-Limited Schedules or the submitted offer parameters.
- In the event that PJM: (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 will be committed on their Parameter-Limited Schedule.
- 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
- 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
- [Turn Down Ratio is defined as the ratio of economic maximum MW to economic minimum MW.](#)

2.3.10 Operating Parameter Definitions

- **Cold/Warm/Hot Notification Time** - The time interval between PJM notification and the beginning of the start sequence for a generating unit that is currently in its cold/warm/hot temperature state. Start sequence may include steps such as any valve operation, starting feed water pumps, startup of auxiliary equipment, etc.
- **Cold/Warm/Hot Start-up Time** - The time interval, measured in hours, from the beginning of the start sequence to the point after generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero for a generating unit in its cold/warm/hot temperature state. For a Combined Cycle unit it is the time interval from the beginning of the start sequence to the point after first combustion turbine generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero. Start sequence may include steps such as any valve operation, starting feed water pumps, startup of auxiliary equipment, etc.

Other more detailed actions that could signal the beginning of the start sequence could include but are not limited to the operation of pumps, condensers, fans, water chemistry evaluations, checklists, valves, fuel systems, combustion turbines, starting engines or systems, maintaining stable fuel/air ratios, and other auxiliary equipment necessary for startup.

- **Minimum Run Time (hour)** - The minimum number of hours a unit must run, in real-time operations, from the time after generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero to the time of generator breaker opening, as measured by PJM's state estimator. For Combined Cycle units this is the time period after the first combustion turbine generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero and the last generator breaker opening as measured by PJM's state estimator.
- **Turn Down Ratio** – The ratio of a unit's economic maximum MW to its economic minimum MW.
- **Minimum Down Time (hour)** - The minimum number of hours under normal operating conditions between unit shutdown and unit startup, calculated as the shortest time difference between the unit's generator breaker opening and after the unit's generator breaker closure, which is typically indicated by telemetered or aggregated state estimator MWs greater than zero. For Combined Cycles units this is the minimum number of hours between the last generator breaker opening and after first combustion



turbine generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero.

- **Maximum Daily Starts** - The maximum number of times that a unit can be started in an operating day under normal operating conditions.
- **Maximum Weekly Starts** - The maximum number of times that a unit can be started in one week under normal operating conditions (168 hour period starting Monday 0001 hour).
- **Maximum Run Time (hour)** - The maximum number of hours a unit can run over the course of an operating day as measured by PJM's state estimator.
- **Cold/Warm/Hot Soak Time** - The minimum number of hours a unit must run, in real-time operations, from the time after generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero to the time the unit is dispatchable. For Combined Cycle units this is the minimum number of hours from the time just after the first combustion turbine generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero and the time the unit is dispatchable.

Soak Time may include items such as the time necessary to alleviate temperature gradients across boiler or turbine components, the startup and stable operation of environmental equipment, water chemistry evaluations and holds, the maintaining of stable fuel/air ratios, the addition of incremental fuel related or other auxiliary equipment, the starting additional combustion turbines in a combined cycle, and the pressure matching of heat recovery steam generators.

2.14 Balancing Operating Reserve Cost Analysis

Accounting for Operating Reserve is performed on a daily basis. A pool-scheduled resource of a PJM Member is eligible to receive credits for providing Operating Reserve in the day-ahead market and, provided that the resource was available for the entire time specified in its offer data, in the balancing market. The total resource offer amount for generation, including startup and no-load costs as applicable, is compared to its total energy market value for specified operating period segments during the day (including any amounts credited for day-ahead scheduling reserve in excess of the day-ahead scheduling reserve offer, any amounts credited for synchronized reserve in excess of the synchronized reserve offer plus opportunity cost, and any amounts credited for resources providing reactive services). If the total value is less than the offer amount, the difference is credited to the PJM Member.

[Fees](#) are also provided for pool-scheduled energy transactions, for generating units operating as synchronous condensers (not for synchronized reserve nor for reactive services) at the direction of PJM, for cancellation of pool-scheduled resources, for units whose output is suspended or reduced due to a transmission constraint or other reliability reason, for units performing an annual black start test, and for units providing reactive services at the direction of PJM.



6.3.5 Credits Fees for Cancellation of Pool Scheduled Resources

At the end of each month, PJM calculates the credits due to each PJM Member for pool-scheduled resources that were selected to run as part of the reliability study, and that PJM canceled before coming on-line. The cancellation ~~credit-fee is defined as equals~~ the actual costs incurred that are typically included in Start-up Costs, when PJM cancels a pool-scheduled generation resource's start and the resource has not yet reached the point after generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero. Cancellation Fees shall be capped at the appropriate Start-up Cost for the resource as specified in its offer data., ~~capped at the appropriate start-up cost as specified in the generating resource's offer data.~~ Requests for such credits must be submitted, in writing, to the PJM Manager of Market Settlement Operations Department, within forty-five days of invoice being received by participant for the month in question.