



Working to Perfect the Flow of Energy

PJM Manual 11:

***Energy & Ancillary Services Market
Operations***

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Revisions for Price Responsive Demand

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Section 12: Overview of the Price Responsive Demand

Welcome to the Overview of the Day-ahead Scheduling Reserve Market section of the **PJM Manual for Energy & Ancillary Services Market Operations**. In this section you will find the following information:

- An overview description of the Price Responsive Demand (see "Overview of PJM Price Responsive Demand").
- A list of the Price Responsive Demand Business Rules (see "PJM Price Responsive Demand Business Rules").

12.0 Overview of Price Responsive Demand

The development and implementation of dynamic and time-differentiated retail rates, together with utility investment in Advanced Metering Infrastructure (AMI) has lead an increasing quantity of load in PJM to be responsive to changing wholesale prices. Through enabling technology and behavioral changes, consumers modify their demand as prices change without being centrally dispatched by PJM or bidding demand reductions into the PJM markets. Given the linkage between dynamic retail rate structures and wholesale prices, this price responsiveness is predictable and needs to be accounted for in the wholesale market design and operations. This predictable reduction in consumption in response to changing wholesale prices is known as Price Responsive Demand (PRD). The continued development of Price Responsive Demand requires coordination between the wholesale market and the retail rate design to maximize its benefit to consumers. The deployment of AMI for small commercial and residential customers enables dynamic and time-differentiated retail rate structures linked to wholesale prices. AMI supports dynamic retail rate structures and these types of retail rates provide the exposure to market prices necessary to provide the incentive for retail customers to reduce or shift consumption in response to price.

Although Price Responsive Demand is not directly dispatchable by PJM, automated retail customer response to real time energy prices signals can produce a predictable demand curve as a function of price. Prices typically increase during capacity emergencies and as a consequence demand drops. Price Responsive Demand will therefore be able to reduce the installed capacity required to meet Loss of Load Expectation (LOLE) based reliability standards.

PRD is provided by a PJM Member that represents retail customers that have the capability to reduce load in response to price. PJM Member acting on behalf of such retail customers for the purpose of providing PRD is referred to as the PRD Provider. A PRD Provider for a given retail customer may be the customer's retail Load Serving Entity (LSE). However, PRD may also be provided in the PJM markets by an entity such as an Electric Distribution Company (EDC), or Curtailment Service Provider (CSP) that does not have direct responsibility for serving the retail load but meets all of the eligibility requirements for providing PRD.

12.1 Price Responsive Demand Business Rules

12.1.1 Price-Demand Curves in the Energy Market

Price Responsive Demand that is committed in RPM for a Delivery Year will bid in the PJM Energy Market per the business rules below. For details about PRD participation in the PJM Capacity Market, refer to *PJM Manual M18: PJM Capacity Market*.

Price Responsive Demand that is not committed in RPM for a Delivery Year has the option to bid in the Energy Market as an "Energy Only" bid. If PRD is bid into the market as "Energy Only", the Maximum Emergency segments that are not committed MW of capacity may submit a bid price up to the energy market offer cap for the respective delivery year.

End-use customer loads identified as Price Responsive Demand may not, (i) be registered as Economic Load Response or Emergency Load Response; (ii) be used as the basis of any Demand Resource Sell Offer or Energy Efficiency Resource Sell Offer in any RPM Auction; or (iii) be identified in a PRD Plan or PRD registration of any other PRD Provider

12.1.2 Characteristics of Price-Demand Curves in PJM Energy Market

The Price-Demand Curves (PRD Curves) for Price Responsive Demand committed in RPM for a Delivery Year will have the following characteristics and can be submitted in the PJM Energy Market on a daily basis:

- PRD Curves accepted at the time of PRD registration, will be used as default Price Responsive Demand bids in the Day Ahead Market clearing process. Updates to the default curves may be submitted into the Day Ahead Market on a daily basis by 1200 at the closing of the Day-ahead bid period
- PRD Curves in the Energy Market will be modeled in the real-time dispatch algorithms and can set Real-Time LMP. Price Responsive Demand will set Real-Time LMP based on offer price on the PRD curve, as described in next section. If a PRD Curve is marked as "unavailable", the PRD curve is ineligible to set Real-Time LMP. PRD Curves in the Energy Market must be submitted locationally; identified at the substation location within a transmission zone as electrically close as practical to the applicable load (i.e., PNODE). PJM will provide assistance to EDCs to post mapping files that map PNODES to geographic locations such as zip codes.
- PRD curves will include the following parameters:
 - a) Availability flag
 - b) Response rate
 - c) Minimum quantity of PRD
 - d) Maximum quantity of PRD

- PRD Curves in the Energy Market must be non-increasing and can have up to 10 price-quantity segments for each hour.
- PRD Providers with committed PRD are required to have automation of PRD that is needed to respond to Real Time LMPs for the PRD Curves that are submitted.
- The maximum bid price of the PRD Curve is the applicable energy market offer cap

12.1.3 Business Rule Changes to Price Sensitive Demand Bids

- Participants may indicate in Price Sensitive Demand Bids if the bids are available to be used in the Real Time Market.

12.1.4 Price-Demand Curves in Real-time Energy Market Operations

During normal Economic conditions:

- PRD Curves will be included in Security Constrained Energy Dispatch (SCED)
- Price Responsive Demand can set Real-time LMP up to the energy market offer cap

During Emergency conditions:

- Price Responsive Demand must be curtailed once PJM has:
 - a) declared and loaded Max Emergency Generation; or
 - b) loaded emergency purchases; or
 - c) initiated a voltage reduction;

and the real-time LMP at the applicable location meets or exceeds the price on the submitted PRD curve at which the load has committed to curtail.

- PJM will issue an emergency procedures notification to clearly indicate when PRD must be reduced to its committed value based on the MESL, as follows: "At this time, PRD Providers are required to take all actions, including use of supervisory control if necessary, to reduce Price Response Demand (PRD) down to the Maximum Emergency Service Level (MESL)"
- During Emergency conditions, PJM will use real-time data submitted by PRD Providers to determine the availability and actual response of PRD, per the rules for *Load Management Operational Reporting*.

12.1.5 Balancing Operating Reserves Deviations

While PJM will not send dispatch signals to PRD load, PRD load that reduces consumption in real time in response to price will be viewed as having “followed dispatch instructions” and therefore not accrue Balancing Operating Reserve (BOR) deviations for the reduced demand.

- PJM will sum an LSE’s total fixed and price sensitive demand cleared in the Day-Ahead market in each zone.
- PJM will sum the LSE’s total real time load in each zone.
- If the LSE has PRD load in a given zone, the Real- Time LMP at the PNODEs where such PRD was modeled for a given hour is higher than the Day-ahead LMP at those PNODEs for that hour and the LSEs real time load minus its Day-Ahead fixed demand was less than the LSE’s Day-Ahead cleared price sensitive demand in that zone, then the LSE will not accrue BOR deviations for the amount by which the Day-Ahead cleared price sensitive demand exceeded the real time load minus the Day-Ahead fixed demand.

12.1.6 PRD Curves Submitted by Curtailment Service Providers (CSPs)

- PRD Curves may be submitted by PRD Providers without direct load responsibility in the PJM energy market by 1200 at the closing of the Day-ahead bid period.
- PRD Curves submitted by PRD Providers without direct load responsibility will be identified as CSP-PRD bids in the Day-ahead Market software and user interface.
- CSP-PRD bids will be modeled in the Real-time Energy market only, and will be modeled in the real-time dispatch algorithms. CSP-PRD bids will not be modeled in the Day-ahead Market Clearing process.
- CSP-PRD bids will not result in any energy market charges or credits to the CSP. Any energy market settlements associated with the load represented by CSP-PRD bids will accrue to the LSE responsible for serving the load.