Integration of Price Responsive Demand in RPM

1. 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 increased potential~~increasing quantity of~~ for 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, retail customer response to real time energy prices signals can produce a predictable demand curve as a function of price. If Price Responsive Demand is willing to be interrupted during hours of extreme system stress or demand ~~therefore~~ able to reduce the installed capacity required to meet Loss of Load Expectation (LOLE) based reliability standards.

> **Comment [A1]:** The response to price is not the reason that installed capacity needs may be reduced.

PRD is provided by a PJM Member that is a Load Serving Entity that has the capability to reduce load in response to price or that aggregates customers capable of reducing load in response to price.

In RPM, LSEs may voluntarily make a firm commitment of the quantity of Price Responsive Demand that will reduce its consumption in response to price during a Delivery Year. This committed quantity of PRD (i.e., the Nominal PRD Value) reduces the load forecasts used to determine the RTO and LDA Reliability Requirements and impact the development of the RTO and LDA Variable Resource Requirement curves used in the RPM Auctions for such Delivery Year.

In order to commit PRD for a Delivery Year, a LSE must submit a PRD Plan in advance of the Base Residual Auction or Third Incremental Auction, as specified below, for such Delivery Year that demonstrates to PJM's satisfaction that the nominated amount of price responsive demand will be available by the start of the Delivery Year. A LSE with a PJM approved PRD Plan will be required to register price responsive load prior to the start of the Delivery Year to satisfy their PRD commitment. Failure to register enough price responsive loads to meet their PRD commitment prior to the start of the Delivery Year or failure to maintain enough price responsive loads to meet their PRD commitment throughout the Delivery Year will result in a PRD Commitment Compliance Penalty.

A LSE will also be subject to performance compliance ~~during~~ for PJM declared Capacity Curtailment ~~Maximum Emergency~~ Events during the Delivery Year. Failure to ~~comply~~ curtail during ~~Maximum Emergency Events~~periods of Capacity Consumption will result in a PRD ~~Maximum Emergency~~ Event Compliance Penalty.

The LSE will receive a Daily PRD Credit ($/MW-day) during the Delivery Year. This Daily PRD Credit may offset some or all but not more than the Daily Locational Reliability Charges ($/day) that are assessed to the LSE serving such price responsive load during the Delivery Year.

> **Comment [A2]:** Necessarily?

2. Effective Delivery Year

Effective with the 2014/2015 Delivery Year, a LSE may nominate a quantity of Price Responsive Demand prior to the Base Residual Auction or Third Incremental Auction.

3. Transition Period

The Transition Period for the Integration of PRD takes placeplease during the 2014/2015 Delivery Year in RTO through 2018/2019 Delivery Year.

- **Limit on the Participation of PRD**

  The maximum quantity of Price Responsive Demand that can register for a Delivery Year to participate in the PJM Capacity Market is the following:

2014/1015 DY	**2015/1016 DY**	**20161017 DY**	**2017/1018 DY**	**2018/1019 DY**
1,500 MW	2,500 MW	3,500 MW	4,000 MW	No Cap

  The Maximum PRD Registered for each Zone will be determined pro-rata based on preliminary zonal peak load forecasts (less load served under FRR).

  The selection method: registered quantities will be accepted based on lowest to highest price level set to consume on PRD Curve. If this selection method is not feasible, registrations will be selected pro-rata based on preliminary zonal peak load forecasts (less load served under FRR).

  Price Responsive Demand that exceeds the maximum amount during each Delivery Year may participate in the PJM Energy Market.

- **Short-Term Resource Procurement Target**

  Given the limitation on the amount of PRD that can register during the Transition Period, after the committed Price Responsive Demand has been adjusted in the RPM Peak Load

  > **Comment [A3]:** Does PRD affect all forecasts used by PJM including those used for transmission planning and RTEP?

Forecasts, 100% of the PRD quantity, multiplied by the FPR, is subtracted from the Short Term Resource Procurement Target values.

4. Eligibility of Price Responsive Demand

In order for load to be eligible to be considered as Price Responsive Demand, the price responsive load must be:

- served under a dynamic retail price~~rate structure~~ that can and does change on an hourly basis, that is ~~linked~~ greater than or equal to ~~or based upon a and at least~~ 80 percent of the PJM real-time LMP ~~trigger~~when that real-time LMP exceeds $120/MWh, at a substation location within a transmission zone as electrically close ~~as practical~~ to the applicable load as can be determined in accordance with the methods described in PJM Manuals, and that results in predictable response to varying wholesale electricity prices;

  > **Comment [A4]:** Roughly 5 percent of hours in last 4 years

- subject to advanced metering capable of recording electricity consumption at an interval of one hour or less; and

- subject to supervisory control to curtail the demand should PJM declare a Mandatory Capacity Curtailment event~~ an emergency condition~~.

Supervisory control of customer load registered as Price Responsive Demand is required on the part of the LSE consistent with any retail regulatory authority requirements. The LSE is required to have the remote capability to decrease the load at each location contained in the PRD Registration to the required service level during PJM ~~Maximum Emergency~~Mandatory Capacity Curtailment events, to the extent load was not already reduced based on price**.** LSEs 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.

  > **Comment [A5]:** Needs clear definition

The customer load must be on a dynamic retail rate structure ~~that~~ under which real time consumption in ~~high priced~~ hours where the wholesale price exceeds the defined threshold results in ~~retail charges or credits to the end use customer~~prices~~costs~~ that are ~~linked to or~~directly based on the Real Time LMP at or close to the node where the customer is located. Multiple retail rates could qualify for this requirement~~, such as a structure where the retail charge or credit~~is fixed below a preset threshold, but is greater than or equal to the Real-time LMP, or applies only when 80 percent of the Real Time LMP when that LMP exceeds a preset threshold$200/MWh~~. Dynamic retail rate structures, based on PJM nodal Real-time LMP, that qualify as Price Responsive Demand may include:

- Critical Peak Pricing that requires~~allows~~ retail rates to rise when the wholesale market price exceeds ~~a threshold level~~$120/MWh;

- ~~Critical Peak Rebate pricing which provides bill credits to consumers who reduce their usage below a baseline quantity during periods when the wholesale market price exceeds a threshold level; or~~

- Real-Time Pricing ~~based on~~which equals LMP.

5. Submittal of Price Responsive Demand Plan

To properly account for Price Responsive Demand in the Reliability Requirements, Load Forecasts and Load Obligations in RPM, a LSE must submit in a PRD Plan the aggregated amount of eligible Price Responsive Demand (i.e., the Nominal PRD Value) by zone and sub-zone (if committing price responsive demand in any LDA that is smaller than a transmission zone~~PSEG-North or DPL-South~~) for PJM's use in preparing the load forecast applicable to RPM auctions. The aggregated amount of the Price Responsive Demand by Zone/LDA is determined based on the LSE's Zonal Expected Peak Load and Maximum Emergency Service Level values documented for such Zone/LDA in the PRD Plan.
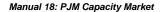
The PRD Plan must detail the price responsive characteristic of the customer load at a zonal or sub-zonal (if load is in any LDA that is smaller than a transmission zone ~~PSEG-North or DPL-South~~) level. If known, the PRD Plan should detail the price responsive characteristics at a substation level. The price responsive characteristic of such customer loads must be provided in terms of the quantity of load that will continue to consume at various levels of price.

The Zonal Expected Peak Load Value of PRD is the expected contribution of such LSE's price responsive load to the Delivery Year's Zonal Peak Load Forecast, or sub zonal forecast if there is any LDA smaller than a zone, if such load were not to be reduced in response to price. The substation/sub-zonal/zonal Zonal Expected Peak Load Value of PRD will be aggregated to determine the Zonal/LDA Zonal Expected Peak Load Value of PRD quantity for the LSE in such Zone/LDA.

The Maximum Emergency Service Level (MESL) is the level to which the price-responsive load will be reduced during the Delivery Year when a Maximum Emergency Event is declared. The quantity of load ~~that will consume at a wholesale real-time locational price equal to $1000/MWh or the energy offer cap applicable to the relevant delivery year represents the MESL~~for which firm capacity must be procured. The locational MESL quantities (at substation/sub-zonal/zonal) will be aggregated to determine the Zone/LDA MESL quantity for the LSE in such Zone/LDA.

The Nominal PRD Value for a Zone/LDA is the difference between the Zonal Expected Peak Load Value of PRD and MESL for such Zone/LDA.

A LSE must submit a PRD Plan to PJM by email via the RPM Hotline at rpm_hotline@pjm.com no later than January 15, prior to the Base Residual Auction or Third Incremental Auction in order to commit PRD for the Base Residual Auction or Third Incremental Auction. Once received by PJM, participant will receive a confirmation that the plan has been received and will be reviewed. PJM will review the content of a PRD Plan to ensure the PRD Plan contains all the necessary detail and information. Once PRD Plan reviews and approvals are completed by PJM, PJM adjusts the Zonal Peak Load Forecasts considering all approved PRD Plans and will post the resulting load forecasts with the planning parameters prior to conducting the relevant Base Residual Auction or relevant Third

Incremental Auction or relevant Third Incremental Auction.   An approved PRD Plan represents a firm commitment by the LSE to provide Price Responsive Demand for the relevant Delivery Year.

Additional PRD may participate in the Third Incremental Auction only if the LDA final peak load forecast for the Delivery Year (as known prior to the approval of PRD Plans submitted in advance of Third Incremental Auction) increases relative to the LDA preliminary peak load forecast used for BRA. If the total additional Nominal PRD Value submitted by LSE's in the LDA exceeds the increase in peak load forecast in such LDA, the nominations from LSEs will be accepted in order of the lowest to highest price level set to implement PRD, up to a Nominal PRD Value in an LDA that equals to the increase in peak load forecast in such LDA.

6. PRD Plan Timeline

Nomination of PRD load for a Base Residual Auction must be made by January 15, 3 years prior to the Delivery Year for relevant Base Residual Auction. Nomination of additional PRD load for a Third Incremental Auction when LDA peak load forecast increases may be made by January 15, 4 months prior to the Delivery Year. Approved PRD will be used to adjust the planning parameters to be posted by February 1 prior to relevant Base Residual Auction and by Third Week of January prior to relevant Third Incremental Auction.

To help a LSE plan for PRD and submit a PRD Plan by January 15, the following information will be made available:

- Prior year summer weather normalized Zonal peak loads by October 31. The summer weather normalized Zonal peak loads include any add backs due to PRD for hours that load is reduced in response to price.

- Customer PLCs developed by EDCs based on prior year summer weather normalized Zonal peak loads by December 31.

- Zonal Scaling Factors (Ratio of Delivery Year Zonal Peak Load Forecast to prior year summer weather normalized Zonal peak load) by January first week.

A LSE with a PJM approved PRD Plan will be required to register price responsive load in a PJM software application prior to the start of the Delivery Year and maintain the registration of enough price responsive load throughout the Delivery Year to satisfy their PRD commitment.

7. Price Responsive Demand (PRD) Plan

The PRD Plan is a document submitted by the LSE that defines and provides data to support a LSE's Nominal PRD Value in a Zone/LDA. The PRD plan must identify any methods and techniques that will be used to determine and verify the quantity of load consumed at varying wholesale price levels. A single PRD Plan may be submitted to cover multiple Zone/LDA locations, provided that the price-demand curves are submitted on a Zone/LDA level. All of the assumptions, procedures, and data for the PRD Plan should be clearly documented. The data included should be sufficient for a third party to audit the procedures and verify the Nominal PRD Value in a Zone/LDA.

7.1 Requirements of Price Responsive Demand (PRD) Plan

A Price Responsive Demand (PRD) Plan submitted to PJM must include:

(1)   Company name

(2)   Submission date

(3)   Company address and contact information

(4)   Location of Price Responsive Demand by applicable electrical location within a transmission zone, if available at the time of submittal of PRD Plan (ie PNODE,) or by Zone/LDA.. At the time of the submittal of PRD Plan, the LSE may provide a point at the smallest LDA level, but the LSE is required to provide final locational detail prior to Delivery Year

(5)   Zonal Expected Peak Load Value of PRD by applicable electrical location, if available or by Zone/LDA

(6)   Maximum Emergency Service Level (MESL) of Price Responsive Demand by applicable electrical location, if available or by Zone/LDA

(7)   Nominal PRD Value by applicable electrical location, (if available) or by Zone/LDA

(8)   Price-Demand curves at the applicable electrical location, (PNODE)/zone/LDA level that detail the base consumption level as well as the decreasing consumption levels at increasing prices.

(9)   A description of the methodologies, analysis, or pilot programs used to determine the Zonal Expected Peak Load Value of PRD, Maximum Emergency Service Level (MESL) value, and Price-Demand Curves

(10)   Specifications of the equipment used to meet the advanced metering and supervisory control requirements, including a project plan and timeline with the milestones that demonstrates that the AMI and supervisory control will be available and operational for the start of the Delivery Year.

(11)   Verification that it has received Relevant Electric Retail Regulatory Authority ("RERRA") approval of its time-varying retail rate structure.

A LSE must submit a PRD Plan to PJM by email via the RPM Hotline at rpm_hotline@pjm.com no later than January 15, prior to the Base Residual Auction or Third Incremental Auction in order to commit PRD for the Base Residual Auction or Third Incremental Auction.   Once received by PJM, the LSE will receive a confirmation that their plan has been received and will be reviewed by PJM. PJM will review the content of the PRD Plan and will notify the LSE within 10 days of receipt of the PRD Plan whether or not the PRD Plan is approved or rejected.

PJM may reject a PRD Plan if the submitted PRD Plan is incomplete and falls short of the meeting the requirements. If a PRD Plan is rejected, PJM will provide to the LSE a list of the areas in the PRD Plan that were not adequate.   PRD Plans that are denied by PJM may be corrected and resubmitted no later than February 1 prior to the Base Residual Auction or Third Incremental Auction.

Alternately, PJM may approve a lower Nominal PRD Value supported by the PRD Plan.

7.2 Determination of the Nominal PRD Value

The following steps may be followed by a LSE to estimate the Nominal PRD Value in their PRD Plan:

Step A: LSE may analyze the PLC data available for existing and potential customers and the Zonal Scaling Factors provided by PJM for the Delivery Year to determine the anticipated load growth to the Delivery Year. The growth may also be based on discussions with specific end-use customers. The LSE should aggregate the end-use customer forecasted demands to determine the Zonal Expected Peak Load Value of PRD for the Delivery Year. The Zonal Expected Peak Load Value of PRD is the expected contribution of such LSE's price responsive load to the Delivery Year's Zonal Peak Load Forecast if such load were not to be reduced in response to price.

The Zonal Expected Peak Load Value for PRD should be determined consistent with the 50/50 load forecast that is the input to the RPM auctions and weather-sensitive loads should consider the Zonal Weighted Temperature Humidity Index Standard for each Zone as posted by PJM on its web site.

> **Comment [A6]:** What is the expected price level at the 50/50 forecast?
> It is possible that the load at $1000 will exceed the load at the 50/50 level.

The substation/sub-zonal/zonal Zonal Expected Peak Load Value of PRD will be aggregated to determine the Zonal/LDA Zonal Expected Peak Load Value of PRD quantity for the LSE in such Zone/LDA.

Step B: The LSE estimates the demand reduction as a function of price based on a pilot study conducted by the LSE or based on data from other pilot studies for classes of customers. Demand reduction as a function of price for specific large customers may be based on discussions and agreements with those customers.   The LSE must include the Zonal Expected Peak Load Value and the MESL Value in a Price-Demand curve at the locational level (sub-station/sub-zonal/zonal/LDA) . The Price-Demand curve must detail the base consumption level (Zonal Expected Peak Load Value) as well as the decreasing consumption levels at increasing prices. A Price-Demand Curve must be monotonically decreasing.

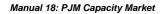> **Comment [A7]:** Data and analysis should be required.

The MESL will be the value at the last, highest price point on the Price-Demand Curve. The highest price on the price-consumption curve must be less than or equal to the $1,000 MWh, or the energy offer cap applicable to the relevant delivery year.

If one or more of the variables that will be measured or monitored and/or assumptions that will be used in the determination of the MESL are not known at the time the PRD Provider submits its PRD Plan to PJM for review and approval, the Load Serving Entity may provide alternative information

and/or forecasts and indicate the portion of the MESL associated with such measurement and monitoring variables and/or assumptions and explain the basis for such forecasts.

The Price-Demand curves for all PRD customers are aggregated to determine the LSE's aggregate Price-Demand curve at a locational level (at substation/sub-zonal/zonal). The locational Price-Demand curves (at substation/sub-zonal/zonal) are aggregated to determine the Zonal/LDA Price-Demand curves in such Zone/LDA. The aggregated quantity of demand that will consume at a price equal to the energy offer cap represents the MESL in such Zone/LDA.

Step C: A LSE's Nominal PRD Value in Zone/LDA is calculated as

Nominal PRD Value in Zone/LDA = Zonal Expected Peak Load Value in Zone/LDA – MESL in Zone/LDA

7.3 Verification of Retail Rate Structure

Before PJM will approve a LSE's PRD Plan, PJM will require that the LSE verify that it has received Relevant Electric Retail Regulatory Authority ("RERRA") approval of its time-varying retail rate structure for the referenced load. A LSE that seeks to assert that the RERRA approves or conditionally approves (which condition the LSE asserts has been met) its time varying retail rate structure for the referenced load, shall provide to PJM at the time of the request for a PRD Plan, within ten (10) business days of PJM's request, either: (a) an order, resolution or ordinance of the RERRA, approving or conditionally approving (which condition the LSE asserts has been met) the LSE's time varying retail rate structure for the referenced load, or (b) an opinion of the Relevant Electric Retail Regulatory Authority's legal counsel attesting to existence of a RERRA order, resolution or ordinance approving or conditionally approving (which condition the RERRA legal counsel or the LSE asserts has been met) the LSE's time varying retail rate structure for the referenced load. In the absence of such provisiona response by the LSE within the referenced ten business days, PJM shall reject the LSE's PRD Plan.

In RERRA jurisdictions where a LSE is not required by the RERRA to seek approval from the RERRA for its time varying retail rate structure for the referenced load, the LSE shall provide to PJM, at the time of the request for a PRD Planwithin ten (10) business days of PJM's request, an opinion of either the LSE's legal counsel or the RERRA's legal counsel attesting that the LSE does not need to obtain approval from the RERRA for the LSE's time varying retail rate structure for the referenced load, and that the LSE's time-varying retail rate structure for the referenced load adheres to any guidelines established by the RERRA. In the absence of such provisiona response by the LSE within the referenced ten business days, PJM shall reject the LSE's PRD Plan.

8. Registration of Price Responsive Demand

A LSE will be required to register price responsive load in a PJM software application prior to the start of the Delivery Year and maintain the registration of enough price responsive load throughout the Delivery Year to satisfy their PRD commitment within the smaller of which is applicable: zone or subzone LDA.

Only load that meets all the eligibility requirements of PRD can be registered as PRD. The final registration of price responsive load must be identified on a locational basis at the substation location within a transmission zone as electrically close as can be identified to the applicable load (ie PNODE) in accordance with the methods described in PJM Manuals. This level of detail is necessary for Day-Ahead & Real-Time Market operation processes to ensure that the PJM dispatch software recognizes the price-consumption characteristic of the PRD on a locational basis. This recognition by electrical location is necessary such that the dispatch algorithms recognize that at pre-defined price levels the demand required to be served at specific locations on the system will decrease. Failure to recognize this characteristic on a locational basis would result in the software's inability to maintain power balance while correctly solving for transmission constraints.

If during the Delivery Year, the load no longer meets all the eligibility requirements of PRD, the LSE must terminate the initial registration on the date the load no longer meets the eligibility requirements. A LSE may also register new customers throughout the Delivery Year to cover loss of PRD load when customers, particularly those who switch to another LSE, drop out of the program.

The portion of any customer load that is registered and committed as Price Responsive Demand cannot be included in any other PJM demand side program and thus, for example, cannot also be registered as Interruptible Load for Reliability (ILR),offered as Energy Efficiency or DR in RPM Auctions, or registered as Economic Load Response applicable to the Delivery Year for which it is committed as PRD.

The PJM software applications will be used to verify registrations in order to monitor and track the level of Price Responsive Demand registered at the zonal level to allow adjustments to the zonal unrestricted load forecasts. The application will also be used to verify registrations to monitor and verify the level of eligible Price Responsive Demand at the LSE level to ensure that load charges to the LSE will be based on adjustment for Price Responsive Demand.

PJM will receive data to validate the PLC calculation of any EDC who is also an LSE that has registered PRD for a given year.
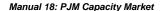
Any PRD that is registered at the time of PRD Plan submittal may be considered as Existing PRD and not be subject RPM Credit Requirement.

9. Adjustments to RPM Peak Load Forecasts

PJM produces ***annual peak load forecasts*** for the RTO and individual transmission zones for use in the RPM auction clearing processes and for planning purposes. In RPM, the load forecasts are used to determine the RTO and LDA Reliability Requirements.

PJM determines the Zonal Peak Load Forecasts considering Price Responsive Demand that is committed by LSEs in each Zone prior to conduct of RPM Auctions.

The Preliminary RTO Peak Load Forecast and the Preliminary Zonal Peak Load Forecasts for the Delivery Year are determined by PJM and adjusted for Price Responsive Demand that is nominated and approved in advance of the Base Residual Auction in accordance with *the Load Data Systems Manual (M-19).*

The Final RTO Peak Load Forecast and the Final Zonal Forecasts for the Delivery Year are determined by PJM and adjusted for Price Responsive Demand that is nominated and approved in advance of the Base Residual Auction and any additional Price Responsive Demand that is nominated and approved in advance of the Third Incremental Auction in accordance with *the Load Data Systems Manual (M-19).*

In order to allow PJM to determine an unrestricted load forecast, PRD load that is reduced in response to price is added back similar to adding back load reduced due to load management (DR, ILR) as defined in PJM Manuals. As a result, the load charges to LSEs will be based on PLCs adjusted for Price Responsive Demand.

10. Adjustments to Short-Term Resource Procurement Target (STRPT)

The Short-Term Resource Procurement Target is 2.5% of the RTO Reliability Requirement for the BRA. The Short-Term Resource Procurement Target in MW is allocated to Zones pro rata based on preliminary zonal peak load forecasts reduced by the load served under FRR alternative. LDA Short-Term Resource Procurement Target is the sum of Short-Term Resource Procurement Targets of the Zones in the LDA**.**

After the committed Price Responsive Demand has been adjusted in the RPM Peak Load Forecasts, the PRD quantity, multiplied by the FPR, is subtracted from the Short Term Resource Procurement Target values. The adjusted Short Term Resource Procurement Target is used in the determination of each point on Variable Resource Requirement curve**.** The value of the Short-Term Resource Procurement Target less the committed PRD cannot be a negative value.

11. Performance Requirements of Price Responsive Demand

Once a PRDRPD Provider commits PRD for the Delivery Year, the LSE will be subject to both commitment compliance and performance compliance during Maximum EmergencyMandatory Capacity Curtailment Events during the Delivery Year.

A LSE must register enough PRD prior to the start of the Delivery Year and maintain enough Price Responsive Demand registrations throughout the Delivery Year to satisfy their PRD commitment. PJM will determine the actual Daily Nominal PRD Value of the LSE based on the information provided in the registration system. If a LSE's actual Daily Nominal PRD Value is less than their committed Nominal PRD Value, the LSE will be subject to a Daily PRD Commitment Compliance Penalty.

Committed PRD is required to reduce to a level based on the MESL in the registration system upon PJM declaration of a ~~Maximum Emergency~~Mandatory Capacity Curtailment Event during that Delivery Year. During the Delivery Year, LSEs for which committed Price Responsive Demand does not respond consistent with the commitment during emergency conditions will be subject to a PRD ~~Maximum Emergency~~Mandatory Capacity Curtailment Event Compliance Penalty.

Once committed by virtue of being included in the load forecast for an RPM auction, Price Responsive Demand may not be uncommitted or replaced by available capacity resources or Excess Commitment Credits.

11.1 PRD Bilaterals

A LSE may transfer the obligation to provide PRD bilaterally to another LSE during the Delivery Year. As a result of the transfer, the LSE the transferee that is assuming the transferor LSE's obligation will receive the Daily PRD Credit and be subject to performance requirements and any penalties (PRD Commitment Compliance and PRD Maximum Emergency Event Compliance Penalty) during the term of the transfer.

Comment [A9]: Serving load in the zone or LDA?

12. Measurement & Verification of Performance of Price Responsive Demand

Measurement and Verification of PRD is based on the committed load's actual consumption under specific conditions during the Delivery Year. Verification of Price Responsive Demand is conducted whenever PJM declares a Mandatory Curtailment~~Maximum Emergency~~ Event. LSEs are responsible for the submittal to PJM of all information required to complete this verification for each PJM ~~Maximum Emergency~~ Capacity Curtailment Event during the Delivery Year. PJM will establish and communicate reasonable deadlines for the timely submittal of data to expedite reviews. Reviews are completed as soon after a ~~Maximum Emergency Event~~ Capacity Curtailment Event as possible, with the expectation that reviews of each event will be completed within two months of the end of the month in which the event took place.

For Price Responsive Demand, compliance is assessed upon ~~declaration~~ PJM initiation of a ~~PJM Maximum Emergency~~Capacity Curtailment Event, by comparing actual load to ~~an adjusted~~the MESL value. ~~In order to account for the fact that actual load can be greater than the PJM 50/50 load forecast during emergency events, the MESL is adjusted by a ratio equal to the amount by which the actual zonal load during the event exceeded the PJM load forecast for the Delivery Year.~~ LSEs must submit actual customer load levels for all hours during the PJM Emergency Event.   No additional credit is provided for any load reduction below the MESL.

13. Penalties for Non-Performance of Price Responsive Demand

13.1 PRD Commitment Compliance Penalty

Given that nomination of PRD prior to an RPM auction could occur three years ahead of the actual Delivery Year for which the PRD is being committed, a LSE may not actually have the AMI or supervisory control in place or know the exact customers that will be price responsive at the time of

PRD Plan submittal. When the installation of Advanced Metering and Supervisory Controls are delayed beyond the start of the Delivery Year, or when a LSE has not demonstrated that is has subscribed enough load to be Price Responsive Demand throughout the Delivery Year, the LSE will be subject to a PRD Commitment Compliance Penalty.

PRD commitment compliance will be evaluated on a daily basis throughout the Delivery Year. PJM will determine the actual Daily Nominal PRD Value of the LSE in a Sub-Zone/Zone based on the information provided in the registration system. If a LSE's actual Daily Nominal PRD Value in a Sub-Zone/Zone is less than their committed Nominal PRD Value in Sub-Zone/Zone, the LSE will be subject to a Daily PRD Commitment Compliance Penalty in the Sub-zone/Zone.

The Daily PRD Commitment Compliance Penalty is equal to the MW shortfall in the Sub-zone/Zone * [Forecast Pool Requirement] * [Weighted Final Zonal Capacity Price in $/MW-Day + Higher of 0.2 * Weighted Final Zonal Capacity Price or $20/MW-day].

A LSE's Weighted Final Zonal Capacity Price is the average of the Final Zonal Capacity Price and the price component of the Final Zonal Capacity Price due to the Third Incremental Auction, weighted by the Nominal PRD Values committed in Base Residual Auction and Third Incremental Auction.

> **Comment [A10]:** Consistent with load obligation?

The MW Shortfall in Sub-zone/Zone is the Daily Nominal PRD Value committed in BRA and/or Third IA minus the Daily Nominal PRD Value determined as a result of registration process.

13.2 PRD ~~Maximum Emergency~~Mandatory Capacity Curtailment Event Compliance Penalty

PRD event compliance is assessed for periods during which PRD is needed to avoid or relie~~ve~~f emergency conditions, and, for which ~~upon declaration of a~~PJM will initiate a ~~PJM Maximum Emergency~~Mandatory Capacity Curtailment event. The PRD compliance event hours are those hours for which ~~a~~ PJM calls for mandatory curtailment to avoid or relieve Maximum Emergency ~~Conditions~~~~Event was in place~~. ~~During this period, consumption is considered capacity~~This period, during which unrestricted consumption would result in emergency conditions, shall be referred to as the capacity consumption period. PRD is required to reduce consumption to the MESL for the duration of the capacity consumption period and each period is considered a Mandatory Capacity Curtailment Event.

The penalty applicable to a LSE for which load committed as Price Responsive Demand and the load does not respond consistent with its daily commitment at the first ME event is
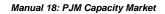
MW shortfall * [Forecast Pool Requirement] * [Weighted Final Zonal Capacity Price in $/MW-Day + Higher of 0.2 * Final Zonal Capacity Price or $20/MW-day] * 365 days.

A LSE's Weighted Final Zonal Capacity Price is the average of the Final Zonal Capacity Price and the price component of the Final Zonal Capacity Price due to the Third Incremental Auction, weighted by the Nominal PRD Values committed in BRA and Third IA.

> **Comment [A11]:** Consistent with load obligation?

The same penalty rate will be applied to the subsequent ~~Maximum Emergency~~Mandatory Capacity Curtailment Events based on MW shortfall exceeding the total shortfalls in the prior ~~Maximum Emergency~~Mandatory Capacity Curtailment Events.

The MW shortfall will be based on MESL identified at the time of the PRD registration.~~, except that the MESL will be increased by the ratio of actual PJM peak load at the time of the Maximum Emergency Event to the final PJM load forecast for the Zone.~~ That is:

MW shortfall = [highest hourly integrated aggregate metered load for LSE's PRD load in the Sub-zone/Zone] – [(aggregate MESL for Sub-zone/Zone~~)*(Actual non-PRD zonal load/Final Zonal non-PRD Peak Load Forecast)~~]

To avoid double-counting of penalties, the MW shortfall for PRD event compliance may be adjusted downward if the LSE was also assessed a Daily PRD Commitment Compliance Penalty.

 A LSE cannot use Replacement Capacity to reduce a PRD MW shortfall for commitment compliance or for failure to perform during a Ma~~ximum Emergency ~~ndatory Capacity Curtailment Event. However, a LSE can use Replacement Demand by registering additional PRD throughout the Delivery Year to cure a daily commitment compliance shortfall or avoid additional event compliance shortfalls.

Penalty funds are allocated to all RPM Resource Providers with commitments for the Delivery Year in proportion to their net RPM Revenues (i.e. – Resource Clearing Price revenue net of any penalties accrued) for the delivery year.

LSEs that do not meet their PRD commitments in a given year with the amount of load reduction for which they are committed as PRD, need to provide additional justification for~~justify~~ their Nominal PRD Value or revise the Nominal PRD Value estimate for the purposes of the next Delivery Year for which an RPM auction has not yet occurred.

14. Credit Requirements

LSEs that nominate Price Responsive Demand that has satisfied the eligibility requirements (i.e., already installed the required AMI and supervisory control and have customers that are being served under a retail rate structure that changes on an hourly basis in response to PJM real-time LMP at the substation location applicable to the load), are not required to establish credit for the RPM Auctions.

. [Reason for deletion: A duplicate sentence that is currently in section 8]

LSEs that nominate Price responsive Demand that are in the process of installing the required equipment and subscribing customers to become eligible, must establish an RPM Credit Limit prior to an RPM Auction on the same basis as Planned Demand Resources as defined in ***Section 4 of PJM Manual M18: PJM Capacity Market***.

15. Testing of Advanced Metering and Supervisory Controls

Testing requirements for PRD will be comparable to testing requirements and penalties for Load Management resources as defined in *Section 8 of PJM Manual 18: PJM Capacity Markets*

Testing is required to ensure that the LSE has the ability to achieve the committed Maximum Emergency Service Level (MESL) via ~~both~~either:

- Responding to the Real-time LMP signal; ~~or~~and

- Reducing load in response to a supervisory control signal

> **Comment [A12]:** Mandatory requirement

Tests must be executed simultaneously for all Price Responsive Demand in a given transmission zone/sub-zone.

During testing PRD is required to demonstrate compliance for a one hour period.

16. Fixed Resource Requirement (FRR) Alternative

The above rules for Price Responsive Demand are also applicable to participants in the FRR alternative of PJM Capacity Markets. In this case, the Preliminary Daily Unforced Capacity Obligation of an FRR Entity is calculated based on the FRR Entity's preliminary zonal peak load forecast reduced by the approved Nominal PRD Value submitted in advance of a Base Residual Auction. The Final Daily Unforced Capacity Obligation of an FRR Entity is calculated based on the FRR Entity's final zonal peak load forecast reduced by the approved Nominal PRD Values submitted in advance of a Base Residual Auction and Third Incremental Auction.

In the case of FRR Entities, penalties for non-performance will be based on the Final Zonal Capacity Price for the Zone encompassing the FRR Entities Zone .

17. RPM Settlement

Use of Nominal PRD Value to modify the VRR Curve used in RPM auctions reduces the resources to be procured and as a result reduces the clearing price in RPM Auctions. Other LSEs may benefit from this reduction in RPM Auction clearing prices.

The settlement steps are summarized below:

- Determine the Final RTO Unforced Capacity Obligation for the Delivery Year as net of the unforced capacity obligations satisfied through BRA and all Incremental Auctions. Unforced capacity satisfied may be negative if capacity is de-committed in an Incremental Auction.

- Allocate the Final RTO Unforced Capacity Obligation for the Delivery Year to zones based on Final Zonal Peak Load Forecasts made one month prior to Third Incremental Auction to
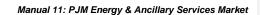
determine Final Zonal Unforced Capacity Obligations. The Final Zonal Peak Load Forecasts used in the allocation are not adjusted for the approved Nominal PRD in the zone.

- Final Zonal Unforced Capacity Obligations are allocated to LSEs daily based on the LSE daily Obligation Peak Loads. The same method is used for LSEs that are serving price responsive demand and LSE's daily unforced capacity obligations are based on PLCs that are not reduced by Nominal PRD Values.

- LSE's PRD Credit = [(Nominal PRD Value in BRA * (FZWNSP/FZPLDY) * Final Zonal RPM Scaling Factor * FPR * Final Zonal Capacity Price) + (Nominal PRD Value in Third IA * (FZWNSP/FZPLDY) * Final Zonal RPM Scaling Factor * FPR * Final Zonal Capacity Price * Third Incremental Auction Component of Final Zonal Capacity Price stated as a Percentage)] .

Comment [A13]: Discuss why this is correct

- Where, FZPLDY = Final Zonal Peak Load Forecast for Delivery Year; and

- FZWNSP = Zonal Weather-Normalized Peak Load for the summer concluding prior to the commencement of such Delivery Year.

The PRD Credit may provide different options to the LSE or EDC that installed the Advanced Metering and Supervisory Control infrastructure.

Integration of Price Responsive Demand in PJM Energy Market

18. Price-Demand Curves in Energy Market

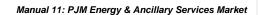#### 18.1 Characteristics of Price-Demand Curves in PJM Energy Market

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 ~~submi~~submit tted into the DA market on a daily basis.

- 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.

- 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 (ie PNODE) as can be identified in accordance with methods described in PJM Manuals

- PRD Curves in the Energy Market must be monotonically decreasing and can have up to 10 price-quantity segments.

- LSEs 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.

18.2 Price-Demand Curves in 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, if the Price Responsive Demand displaces the next available supply resource.

- Price Responsive Demand can set Real-time LMP up to the energy market offer cap

~~During Emergency~~ Capacity Consumption conditions:

- Price Responsive Demand ~~must~~will be ~~curtailed once~~called on for mandatory curtailment in a distinct ~~emergency action~~ capacity consumption announcement, which, parallel to load management products, will occur prior to the following PJM ~~has~~Emergency Actions;

  - a) ~~declared~~declaring and ~~loaded~~loading Max Emergency Generation; or

  - b) ~~loaded~~loading emergency purchases; or

  - c) ~~initiated~~initiating a voltage reduction

- PJM will issue a~~n~~ capacity consumption~~emergency~~ procedures notification to clearly indicate when PRD must be reduced to its committed value based on the MESL.

- ~~Price will be determined based on the interaction of the PRD Curves with the Operating Reserve Demand Curve (ORDC) used for Shortage Pricing (SP)~~

- All PRD will be modeled as price taking customers up to their MESL for as long as PJM determines PRD is needed to avoid capacity reserve shortages.

18.3 Balancing Operating Reserves Deviations

In general, 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. ~~While details will need to be determined and Operating Agreement changes approved through the stakeholder process, the basic evaluation method will be as follows~~PJM will calculate an estimate of actual response to price based on information available and use it to offset LSE BOR deviations:

- PJM will sum an LSE's total fixed and price sensitive demand cleared in the DA 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 was higher than the DA LMP at those PNODEs for that hour and the LSEs real time load minus its DA fixed demand was less than the LSE's DA cleared price sensitive demand in that zone, then the LSE will be eligible for exemption ~~not~~

~~accrue~~from BOR deviations for the amount by which ~~the DA cleared price sensitive demand exceeded the real time load minus the DA fixed demand~~PJM determines real time PRD caused deviations from Day-Ahead Scheduling. PJM will estimate PRD associated deviations for each node where PRD is modeled for each hour by interpolating Real-Time and Day-Ahead LMP on the submitted PRD schedules. If the Real-Time LMP is high enough to cause a change in consumption compared to Day-Ahead Scheduling, the change in PRD consumption triggered by Real-Time LMP according to the submitted schedules will be exempt from deviation charges.