

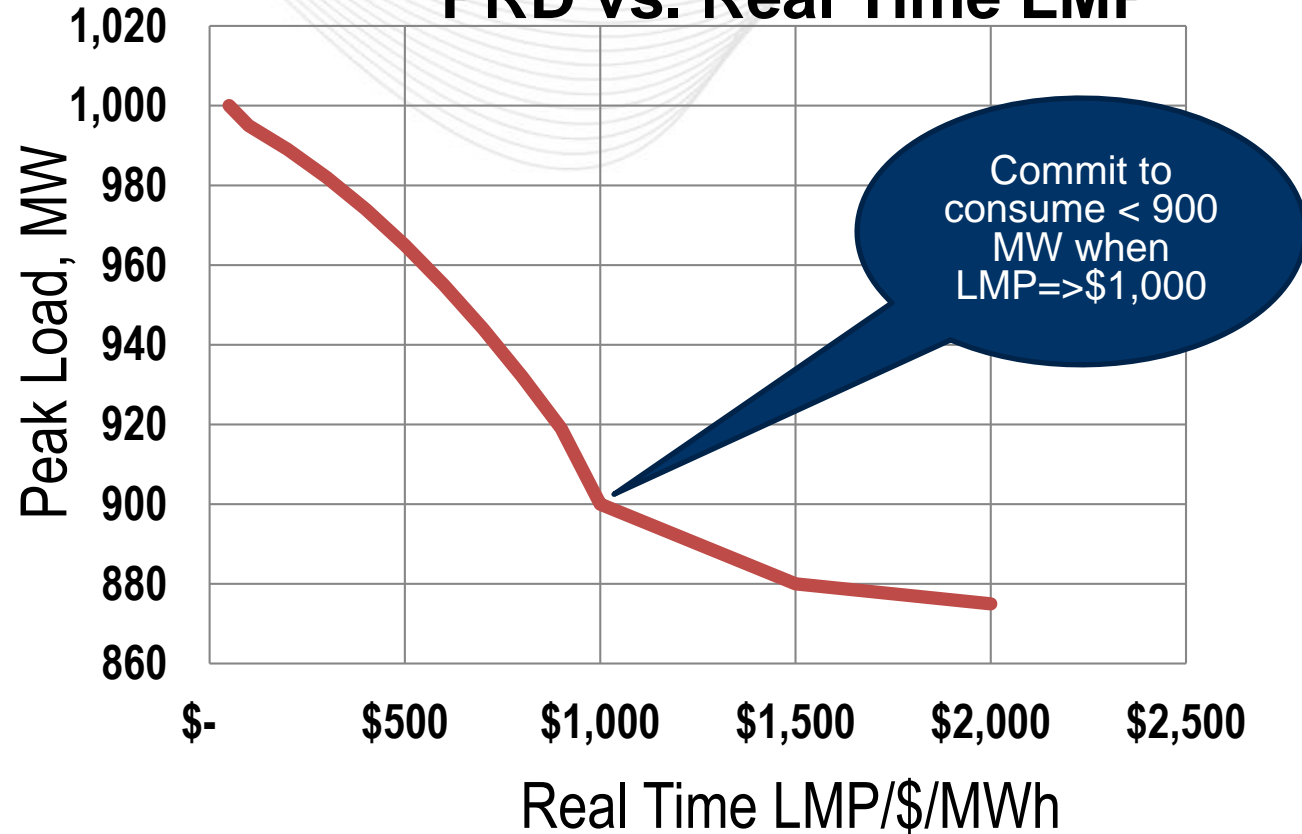


# Price Responsive Demand Overview and DR Hub Implementation

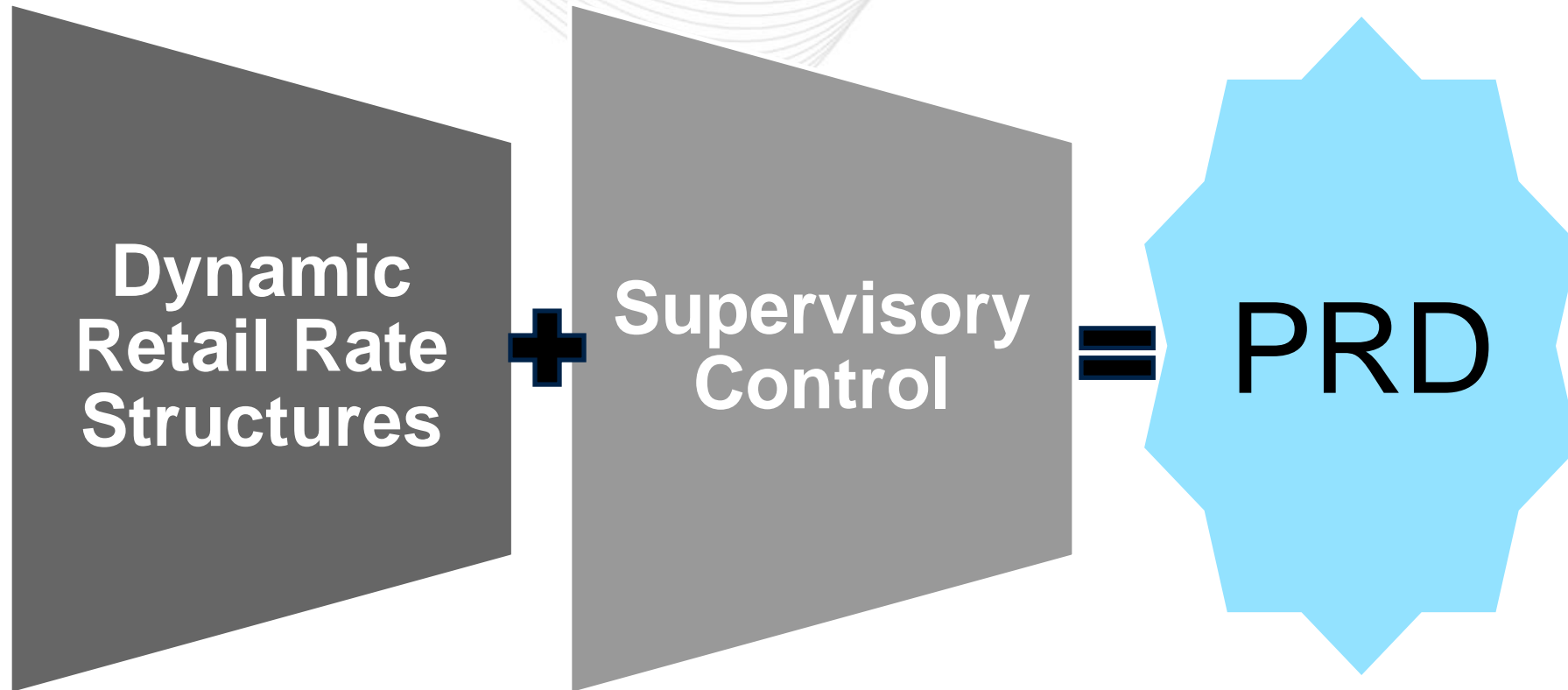
Demand Response Operations  
May 18, 2020

- Training: 5/19/2020
- Production 5/28/2020
  
- Complete PRD Enhancements
  - Interface to Capacity Exchange
  - Interface to Markets Gateway
  - DR Hub PRD Events and Compliance Records

### PRD vs. Real Time LMP



Load that will automatically respond to energy prices and be off the grid during a PJM emergency will receive a lower capacity requirement.



PRD must be managed by pricing point/substation (“pnode”)

- Customer response if based on a dynamic retail rate.
  - “..... and a retail rate structure, or equivalent contractual arrangement, capable of changing retail rates as frequently as an hourly basis, that is linked to or based upon changes in real-time Locational Marginal Prices at a PRD Substation level and that results in a predictable automated response to varying wholesale electricity prices”.
- Examples:
  - **Critical Peak** that allows retail rates to rise when the wholesale market price exceeds a threshold level;
  - **Critical Peak Rebate** 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
  - **Index based on Real-Time LMP.**

# Eligibility Requirement - Supervisory Control (automated load reduction)

- Customer load at each substation automatically reduced based on PRD price curve
  - “load shall be reduced automatically in response to control signals sent by the PRD Provider directly to the control equipment where the load is located without the requirement for any action by the end-use customer.”
  - Exception: individual site with supervisory control
- PRD provider can reduce customer’s load remotely



Load must be reduced – capacity was not procured for the customer



# PRD changes filed at FERC (22/23 DY)

Design Components	Status Quo	Original Filing (FERC rejected)	New Filing
Auction/FRR Plan credit requirement	Credit based on Base Capacity Rate	Credit based on new CP rates (which are higher than base rates)	same
Auction/FRR Plan Nominated capacity amount (PRD plan)	Existing based on prior registered capacity nomination, Planned based on estimated nominated capacity amount	Existing based on prior registered capacity nomination, Planned based on estimated nominated capacity amount	same
Nominated capacity amount (PRD registration)	Expected Peak Load (PLC times Zonal Forecast Peak / Zonal W/N Peak) minus MESL	Lesser of: PLC - Summer FSL (adjusted for losses), WPL - Winter FSL (adjusted for WWAF and losses)	PLC - FSL (adjusted for losses)
Event Compliance Penalty Rate	Provider's Weighted Final Zonal Capacity Price + Higher of [0.2 Provider's Weighted Final Zonal Capacity Price, \$20/MW-day]*number of days in DY. The penalty is applied on event basis	Subject to CP non-performance assessment. Higher of (Net Cone * 365/30 and Daily Commitment Penalty), up to the stop loss provision. Penalty applied on hourly basis	same
load reduction measurement add back (PJM unrestricted load for forecast and customer PLC input)	Expected Peak Load minus load plus MESL adjustment amount	Summer = PLC minus Summer load, Winter = adjusted WPL minus Winter load. Performance measured for each hour	PLC - load. Performance measured for each hour.
Trigger to assess CP Penalty	LMP at or above PRD curve and max emergency generation action	Based on when PRD required to reduce load from PRD energy curve (add back amount based on capacity compliance amount)	same
Overperformance/bonus payments	not applicable	PAH and LMP greater than PRD curve triggers penalty overperformance will be eligible for bonus payment (similar to Load Management event), update balancing ratio calculation to include PRD bonus performance (similar to DR bonus performance).	same

Slides are based on the PRD changes which will become effective for X if approved by FERC

- PRD provider
  - PJM member
  - Typically the Load Serving Entity (LSE) for the retail customer
  - Responsible for all PRD obligations and associated penalties
- LSE
  - receives reduced capacity charges (PJM bill credit)
  - Registration review – ensure it is there customer if they are not the PRD Provider
- EDC
  - Registration review - data validation for account number, PLC, line losses, etc.

PRD customer may not participate as Economic or Emergency (Load Management) DR



Submit PRD plan  
~3.5 years in  
advance (Jan 15  
prior to BRA)

PRD may participate  
in 3<sup>rd</sup> IA if Load  
Forecast goes up

DY  
Submit PRD  
curves by pnode

Register locations  
by pnode  
Jan – May prior to  
DY

Update  
Registrations,  
Performance  
compliance



# Key PRD processes when there is a PRD commitment



- **LSE PRD Credit = [PRD Icap commitment \* Final Zonal RPM Scaling Factor \* FPR \* Final Zonal Capacity Price]**
  - Very similar to DR BRA credit.

Zone	Nominated PRD Value [MW]	PRD Credit [\$/day]	PRD credit effective price	BRA prices
BGE	330.0	\$34,223.35	\$103.71	\$86.04
PEPCO	170.0	\$17,630.21	\$103.71	\$86.04

**Commitment  
Penalty (do not have  
enough customers to cover  
commitment)**

**Max Emergency Event  
Penalty (don't reduce  
enough load when  
required)**

**Test  
Penalty (don't reduce  
enough load when  
required)**



# PRD vs DR/CP comparison in capacity market

Process	PRD	DR/CP
RPM	BRA or 3 <sup>rd</sup> IA if forecast goes increases, No replacement, Submit PRD plan, PRD provider only. Credit based on the CP rates	BRA and IAs, replacement allowed, Submit DR plan, CSPs provide. Credit based on new CP rates
Revenue	No revenue – bill credit to LSE based on FZCP if cleared in BRA. No energy market revenue. If PRD provider different from LSE then they must work out arrangements for any transfer for money	Revenue to CSP based on auction clearing price. Energy market revenue based on full LMP
Registration	LSE required and nnode required (and limits aggregation), Dynamic retail rates (linked to nodal LMP). Not allowed to participate as economic DR	No LSE required. Registration not permitted after start of DYs.
Reporting	PRD hourly curve (load and LMP) by nnode	Expected reductions by dispatch group
Dispatch & Notification	PRD provider dispatches from price curve and supervisory control during Max Emergency. Eligible to set LMP. May have price curve of 1 point at energy offer cap	PJM dispatch/release by zone/subzone by type by lead time. Eligible to set LMP. PJM dispatches based on system needs when short on reserves
Verification	FSL (compared to PLC, hourly basis	Summer FSL (compared to PLC) and Winter FSL (compared to WPL). Hourly basis
Penalty	Daily deficiency charge (FZCP * > of 1.2 or \$20/mwday Event – same as DR	Daily deficiency charge (RPM price * > of 1.2 or \$20/mwday Event – Net Cone * 365/30
Testing	Same	same
Add Back	Based on emergency event and 5 CPs	Based on emergency and economic events

- **PRD Registrations**
- **PRD Events**
  - **Compliance and Non-Compliance Events**
- **PRD Test and Re-Test Events and Compliance**

- One location per registration
  - Same CSP/EDC/LSE/Zone/Pricing Point (Pnode)
- Locations < 10 kW that are part of a utility program may be on one location with a pseudo-EDC Account Number
  - Must maintain accurate list of same information throughout the DY and provide to PJM upon request
- Locations > 10 kW must have their own location
- EDC and LSE reviews registrations

- **Non-compliance event:** Pnode load must reduce load within 15 minutes whenever a 5-minute LMP is above or equal to the Offer Price for that pnode.
  - There may be multiple times during a day that the 5-minute LMP is above or equal to the Offer Price for a pnode
- **Compliance event:** If Maximum Generation Emergency event is declared by PJM **AND** 5 min LMP is above or equal to offer Price then PRD provider must do same as non-compliance event, but ALSO get down to MESL (Maximum Emergency Service Level)
  - A PRD compliance event is created if  $LMP \geq \text{offer price}$  for at least 4 contiguous intervals. Compliance will be measured starting with the 4th interval until the last interval.



- Same as Load Management Tests for Capacity Performance (Annual):
  - Must test if no PRD Compliance Event during the delivery year
  - PRD Providers acknowledge start and end of test by registration using Electronic Notification
  - Compliance records are created when PRD Provider confirms test

- PRD Offers are the expected load if LMP is higher than the offer price of the DR Hub registrations assigned to a Pricing Point
- PRD Response Curve and PRD Hourly Offers must be entered for each day and each hour in Markets Gateway for every Pricing Point with an effective registration in DR Hub
  - **Response Curves** are hourly offers (MW and Price) by Pricing Point and can be up to 10 segments per hour. MW represents expected load when  $LMP = Price$ )
  - **Hourly Offers** represent the hourly MinMW ( $LMP > Price$ ) and MaxMW ( $LMP < Price$ ) and up and down response or ramp rates (measured in MW per hour)

More information about the DR Hub Implementation can be found on [pjm.com](http://pjm.com) => Training => Training Material => Demand Response => Price Responsive Demand, or directly here:

<https://www.pjm.com/-/media/training/core-curriculum/ip-dsr/in-dr-hub-and-markets-gateway.ashx?la=en>