

Price Responsive Demand education

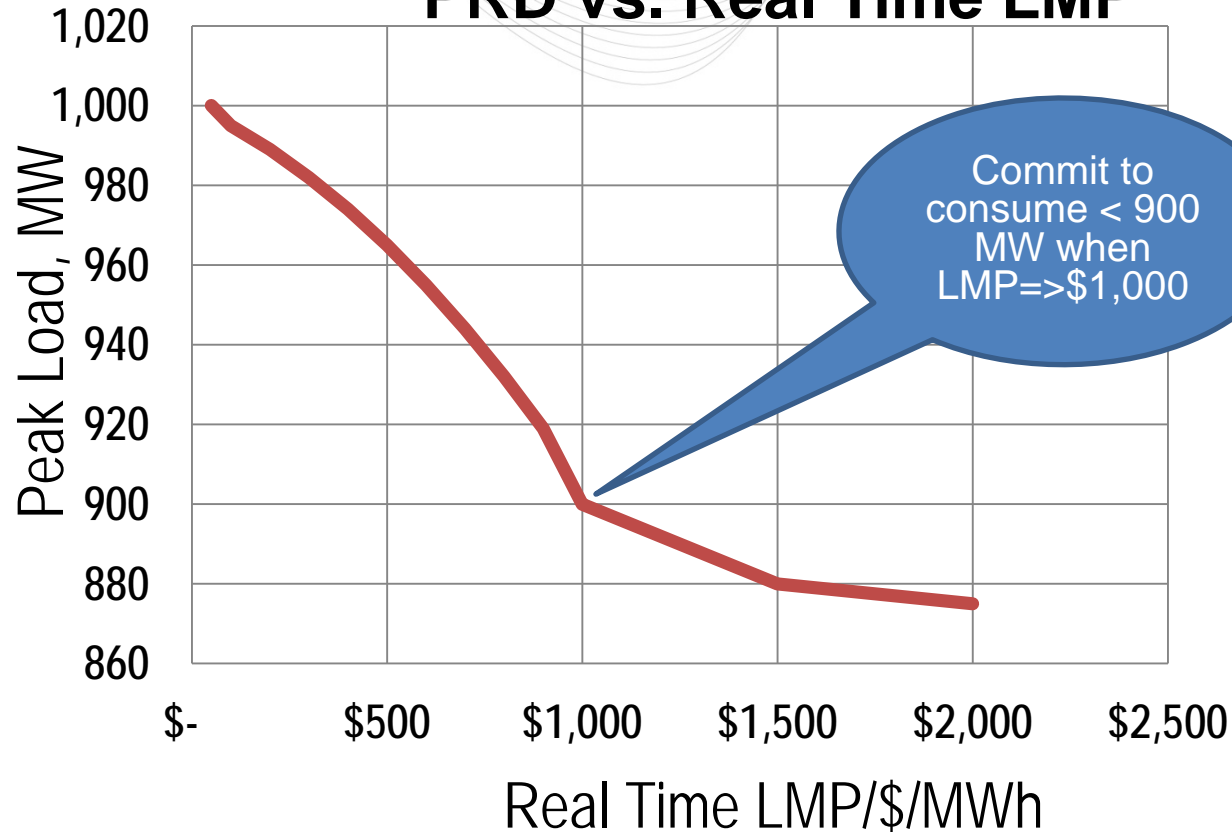
DRS

May 11th, 2017

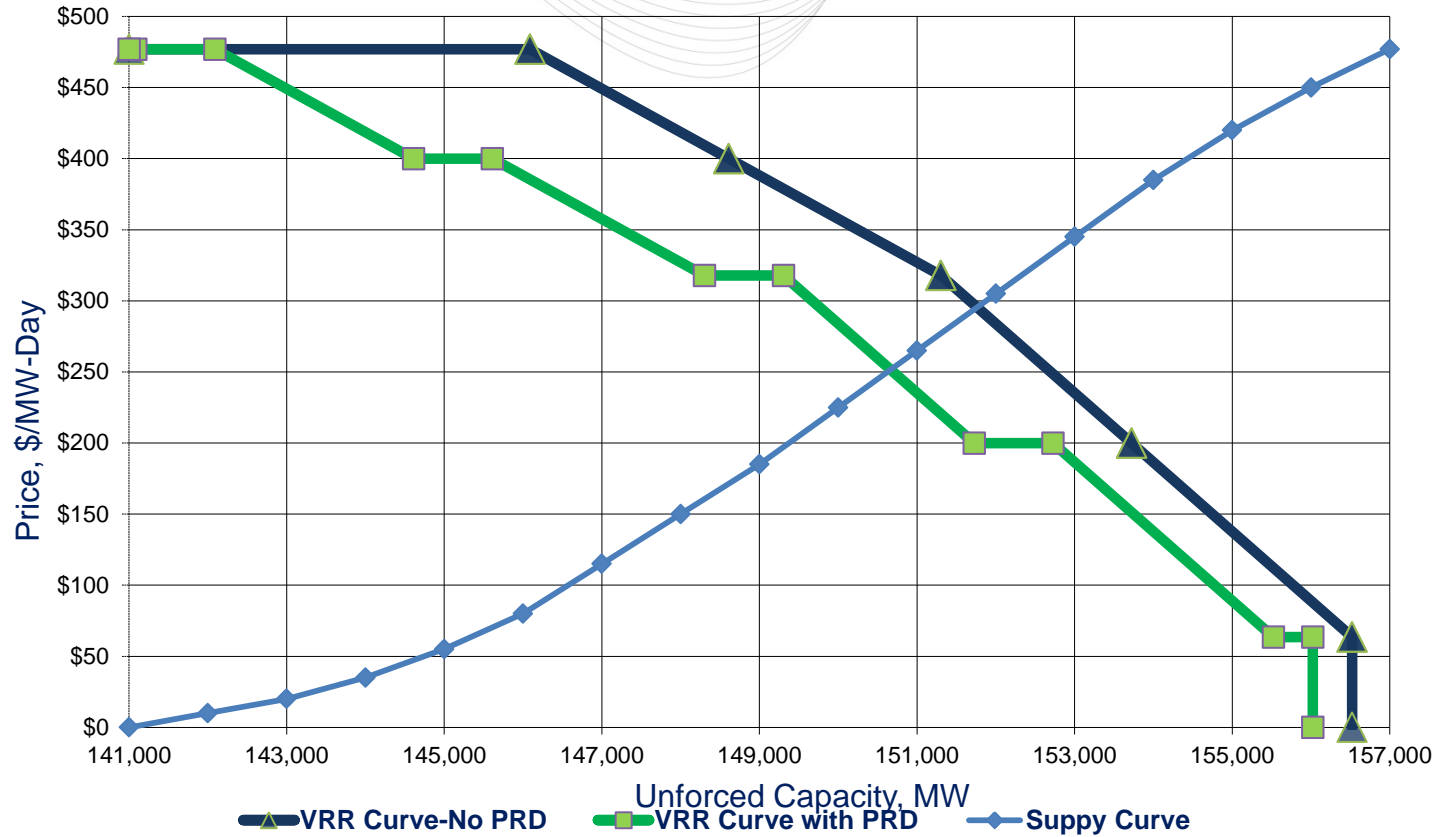


Rules became effective 2012, no participation to date

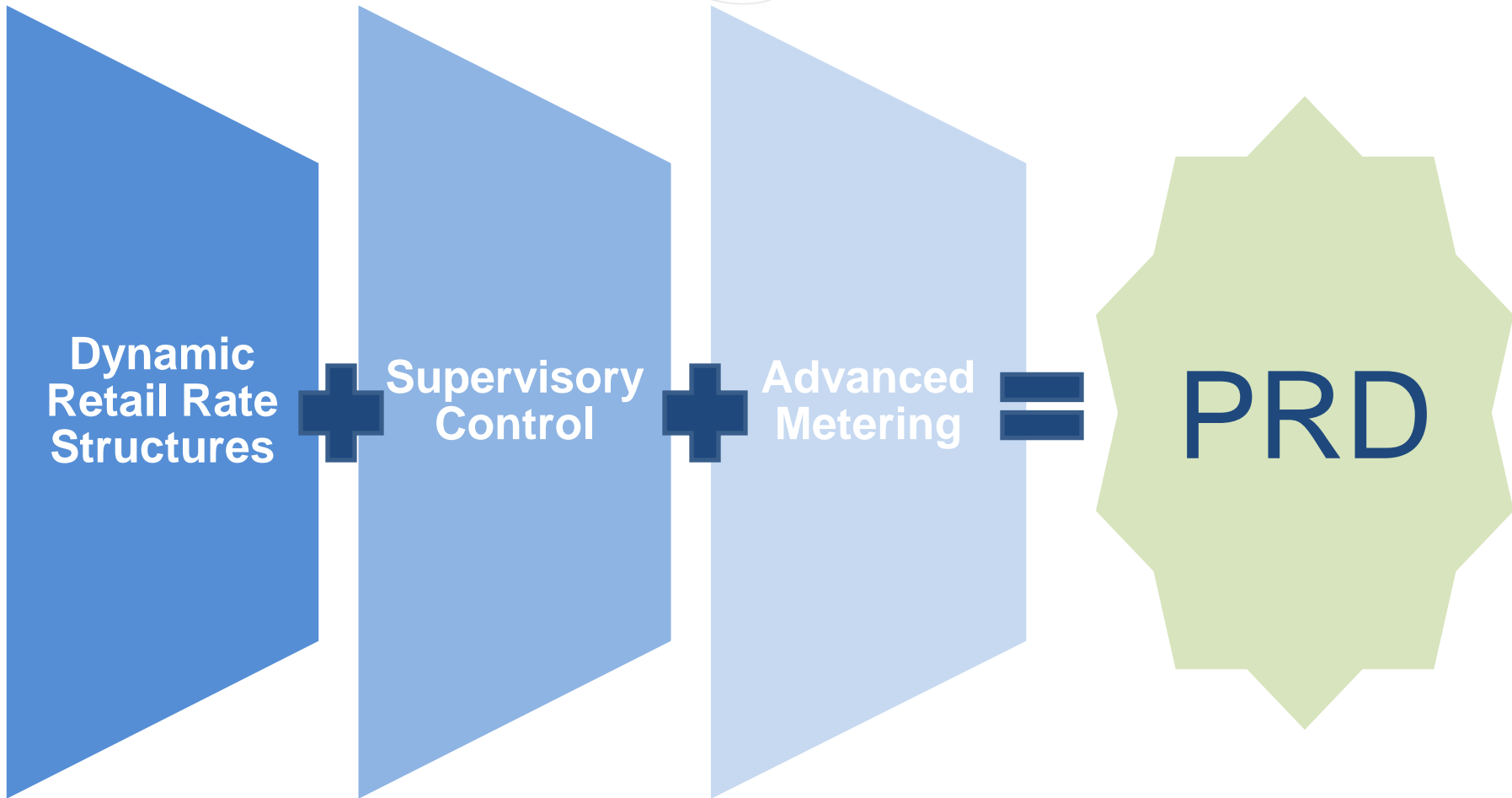
PRD vs. Real Time LMP



Price Responsive Demand (PRD) – load that will automatically respond to energy prices and be off the grid during PJM emergency in exchange for reduction in capacity requirement.



PRD will shift or change the demand curve which will reduce the overall capacity requirement



PRD Plan Submittal

Obligation Process –
Calculation of End-Use
Customer Peak
Load Contributions
(PLCs)

PRD Registration

Submittal of PRD
Curves in eMKT

*3 yrs in
advance of DY*

Dec prior to DY

Prior to DY

During DY

PRD Commitment &
Max Emergency
Event Compliance

What is Supervisory Control and why is it required for PRD?

- Supervisory control of customer load committed as Price Responsive Demand is required on the part of the EDC, LSE or CSP acting as PRD Provider
- Supervisory Control shall mean the capability to curtail, in accordance with applicable RERRA requirements, load registered as Price Responsive Demand at each PRD Substation identified in the relevant PRD Plan or PRD registration in response to a Maximum Generation Emergency declared by the Office of the Interconnection
- Since capacity has not been procured for PRD load, supervisory control is necessary to ensure reliability during emergency conditions.

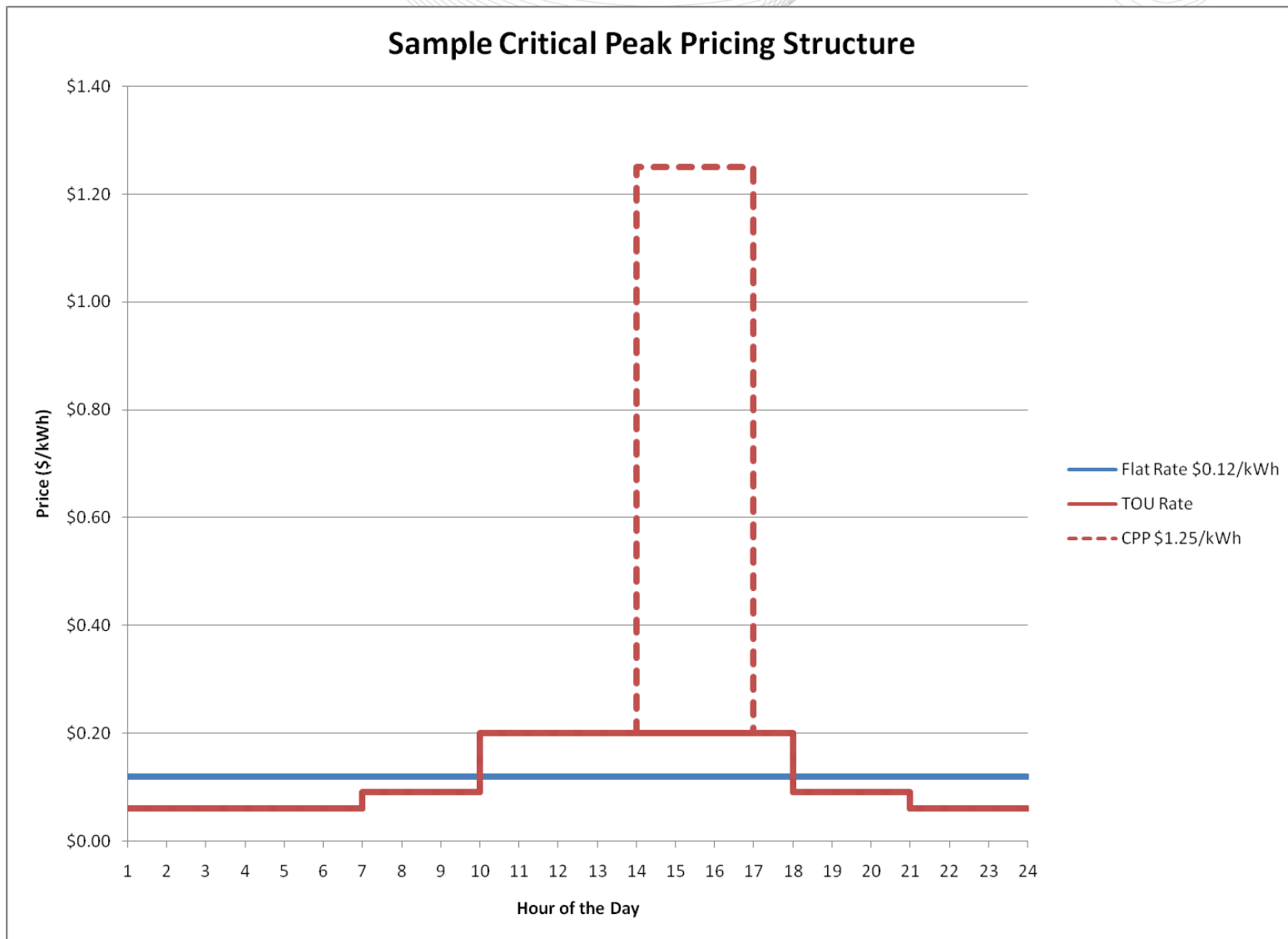
- PRD Providers with committed PRD are required to have automation of PRD that is needed to respond to Real Time LMPs for the PRD Curves that are submitted.
- The PRD Provider (EDC, LSE, or CSP) is required to have the remote capability to decrease the load at each location contained in the PRD Registration to the required service level
 - when a PJM Maximum Emergency event has been declared,
 - and the LMP at the applicable location has exceeded the level at which the load has committed to reduce,
 - to the extent load was not already reduced based on price.

- PRD Providers may request an exception to the automation requirement for end-use customers that are a single site, a single location and a single end-use customer with supervisory control over processes with which load reduction would be accomplished.
- In this case, the end use customer site is eligible for this specific exception from standard automation requirement

What is the definition of “Dynamic Retail Rates”?

- To be eligible to be committed as PRD, the retail rates must be based on wholesale prices (real-time LMPs)
- The retail rate structure must be dependent on the Real-time LMP to ensure that PJM has a way to account for price-sensitivity in real-time operations.
 - “.....served under a dynamic retail rate that varies through time and that is linked to or based upon the PJM real-time LMP at the location applicable to the load, and that results in predictable response to varying wholesale electricity prices”

- Dynamic retail rate structures, based on PJM Real-time LMP, that qualify as Price Responsive Demand may include:
 - **Critical Peak Pricing** that allows retail rates to rise when the wholesale market price exceeds a threshold level;
 - **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 LMP.**
- These types of retail rates provide the necessary exposure to market prices to reduce consumption during high demand periods



- A PRD Provider will be required to register price responsive load in a PJM software application
- End-use customer loads as Price Responsive Demand may not, for such Delivery Year,
 - a) be registered as Economic Load Response or Emergency Load Response;
 - b) be used as the basis of any Demand Resource Sell Offer or Energy Efficiency Resource Sell Offer in any RPM Auction; or
 - c) be identified in a PRD Plan or PRD registration of any other PRD Provider

- What happens if end-use customers switch LSEs?
 - LSE needs to separate end-use customers participating in PRD from other customers
 - If an end-use customer participating in PRD switches to another LSE, the customer PLC value and PRD commitment will be transferred to the new LSE
- An PRD Provider may use a PRD Bilateral to transfer obligation to another LSE
 - LSE may transfer the obligation to provide PRD bilaterally to another LSE during the Delivery Year.
 - As a result of the transfer, the LSE that is assuming the 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.

There are two penalties in RPM for Price Responsive Demand

**PRD
Commitment
Compliance
Penalty**

**PRD
Max Emergency Event
Compliance
Penalty**



(1) Shortfall expressed in terms of a Daily Unforced Capacity Obligation not satisfied (MW)

Shortfall (MW) * Forecast Pool Requirement

(2) RPM PRD Commitment Compliance Penalty rate (\$/MW-Year)

[Weighted Final Zonal Capacity Price in \$/MW-Day + Higher of 0.2 * Weighted Final Zonal Capacity Price or \$20/MW-day].

- 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.

PRD Compliance Penalty for RPM LSE (\$/Year) = (1) * (2)

- Assessed upon Max Emergency Event
- Actual Loads during Emergency Events used to measure and verify compliance.
- A tolerance in MESL value will be applied when the actual load exceeds the forecast in calculating the penalty
 - *Measurement of shortfall is based on MESL increased by the ratio of actual load to forecast load in **zone***



PRD Max Emergency Event Compliance Penalty during the Delivery Year

Maximum Emergency Service Level (MESL)		900 MW
Forecast zonal peak load		10,000 MW
Actual zonal peak load at the Max Emergency condition		10,500 MW
Ratio of actual load to forecast load	10,500/10,000	1.05
Tolerance MESL	900 * 1.05	945 MW
LSE reduces the load to		955 MW
Shortfall (Load in Excess of Tolerance MESL)	955 – 945	10 MW

Penalty Equation

$$\begin{aligned} & \text{MW shortfall} \\ & * \\ & \text{[Forecast Pool Requirement]} \\ & * \\ & \text{[Weighted Final Zonal Capacity Price in \$/MW-Day + Higher of} \\ & \text{0.2 * Final Zonal Capacity Price or \$20/MW-day]} * 365 \text{ days.} \end{aligned}$$

- Because PRD is demand, not a supply resource, Forecasted Pool Requirement (FPR) should be included in penalty equation.

- 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 .

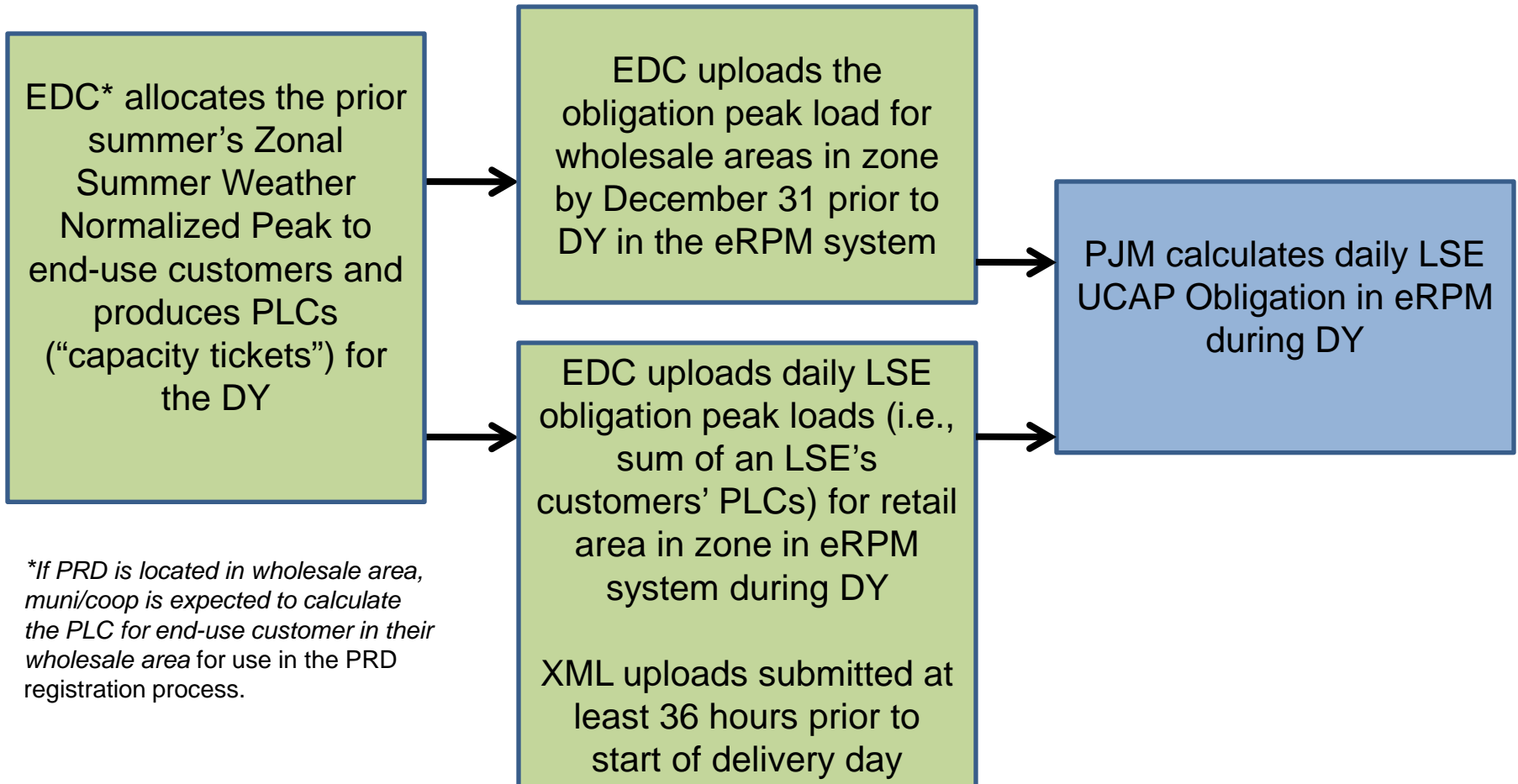
LSE Charges for Capacity Obligation

Provider	Expected Peak Load Value (MW)	UCAP Obligation (MW) (see Note 1)	Final Zonal Capacity Price (\$/MW-Day) (see Note 2)	Locational Reliability Charge (\$/Day) (see Note 3)	PRD Credit Quantity (MW) (see Note 4)	PRD Credit (\$/Day) (see Note 5)	Net Load Charge (\$/Day) (see Note 6)
A	20,000.0	21,695.7	\$253.38	\$5,497,232.03	502.2	\$127,250.74	\$5,369,981.29
B	35,000.0	37,967.5	\$253.38	\$9,620,156.05	502.2	\$127,250.74	\$9,492,905.31
C	28,000.0	30,374.0	\$253.38	\$7,696,124.84	1,004.4	\$254,501.48	\$7,441,623.36
D	30,000.0	32,543.6	\$253.38	\$8,245,848.04	0.0	\$0.00	\$8,245,848.04
E	25,889.0	28,084.1	\$253.38	\$7,115,892.00	0.0	\$0.00	\$7,115,892.00
	138,889.0	150,665.0		\$38,175,252.97	2,008.9	\$509,002.97	\$37,666,250.00

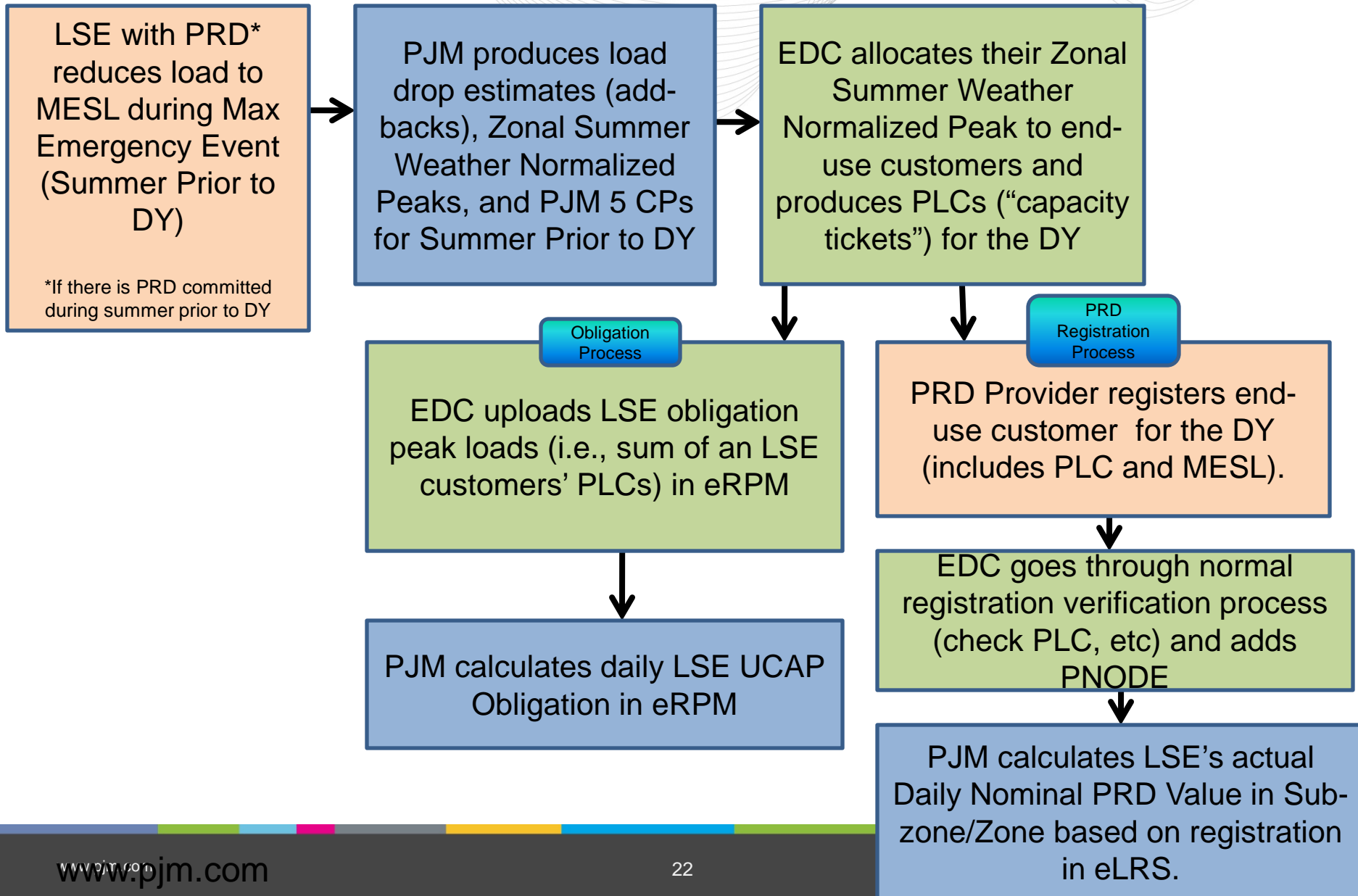
Notes

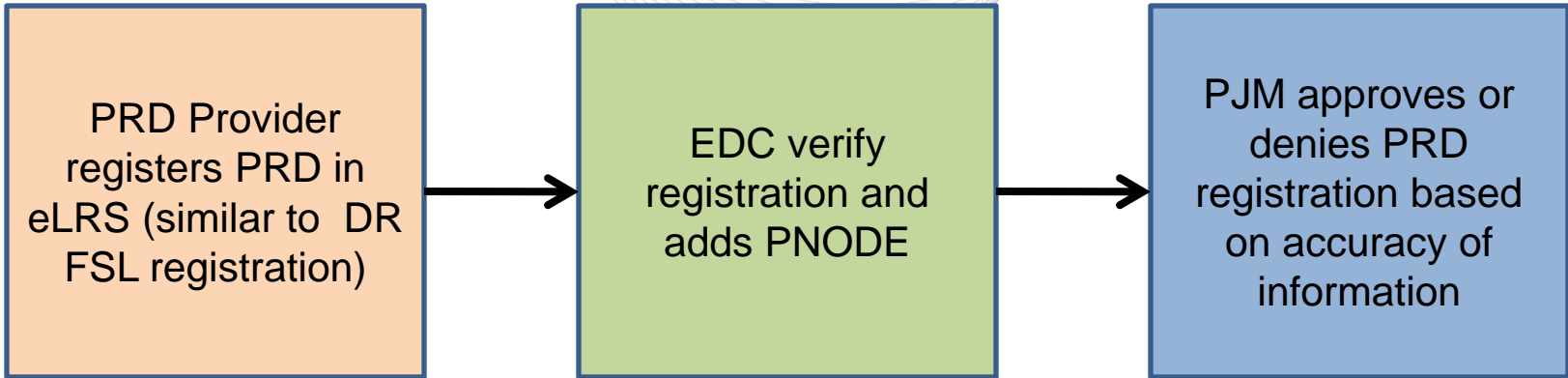
- (1) Total cleared resource quantity (150,665 MW) is allocated to each LSE in proportion to the LSE share of total Expected Peak Load Value.
- (2) The Final Zonal Capacity Price is the RPM Auction clearing price adjusted upward in order to compensate PRD credits.
- (3) Locational Reliability Charge is equal to LSE UCAP Obligation multiplied by Final Zonal Capacity Price.
- (4) PRD Credit Quantity is equal to cleared Nominal PRD Value times (Total UCAP Obligation / Expected Peak Load).
- (5) PRD Credit is equal to PRD Credit Quantity multiplied by Final Zonal Capacity Price.
- (6) Net Load Charge is equal to Locational Reliability Charge minus PRD Credit.

No change in the LSE UCAP Obligation Process

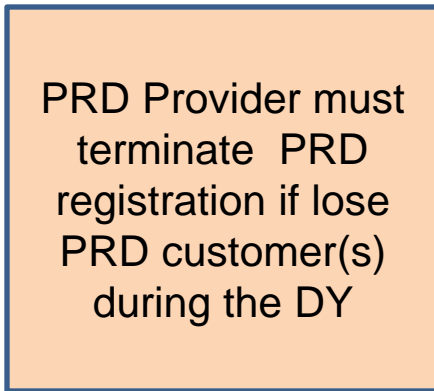


**If PRD is located in wholesale area, muni/coop is expected to calculate the PLC for end-use customer in their wholesale area for use in the PRD registration process.*





Initial Registration



Updated Registration

PJM calculates Daily Nominal PRD Value for each LSE PRD Registration.

Nominal PRD Value = Expected Peak Load – MESL

*Expected Peak Load = PLC * Zonal Peak Load Forecast Scaling Factor*

Zonal Peak Load Forecast Scaling Factor = DY Final Zonal Peak Load Forecast / Zonal Summer Weather Normalized Peak for summer prior to DY



PJM aggregates the Daily Nominal PRD values for all PRD Provider PRD registrations in a Sub-zone/Zone to calculate LSE's Daily Nominal PRD Value in Sub-zone/Zone.



PJM compares PRD Provider's Daily Nominal PRD Value in Sub-zone/Zone to PRD Provider's Committed Nominal PRD Value in Sub-zone/Zone

If LSE's Daily Nominal PRD Value < Daily Committed PRD Value, LSE will be assessed a Daily PRD Commitment Penalty

- PJM declares Max Emergency
- PRD required to curtail load down to MESL
- LSE provides PJM hourly load data in DR Hub for end use customers to verify compliance
- EDC reviews hourly load data for accuracy
- PJM calculates compliance
- PJM assesses penalties as necessary

What are the Testing Requirements for Price Responsive Demand

- Testing Requirements for PRD will be comparable to testing requirements for Load Management resources, as defined in **Section 8 of PJM Manual 18: PJM Capacity Markets**.
- Testing is required to ensure that the committed load LSE has the ability to achieve the committed Maximum Emergency Service Level (MESL) via either:
 - Respond to the Real-time LMP signal; or
 - Reducing load in response to a supervisory control signal
- Tests may be executed for all resources in a given transmission zone.
- Testing is required to demonstrate compliance for a one hour period

1

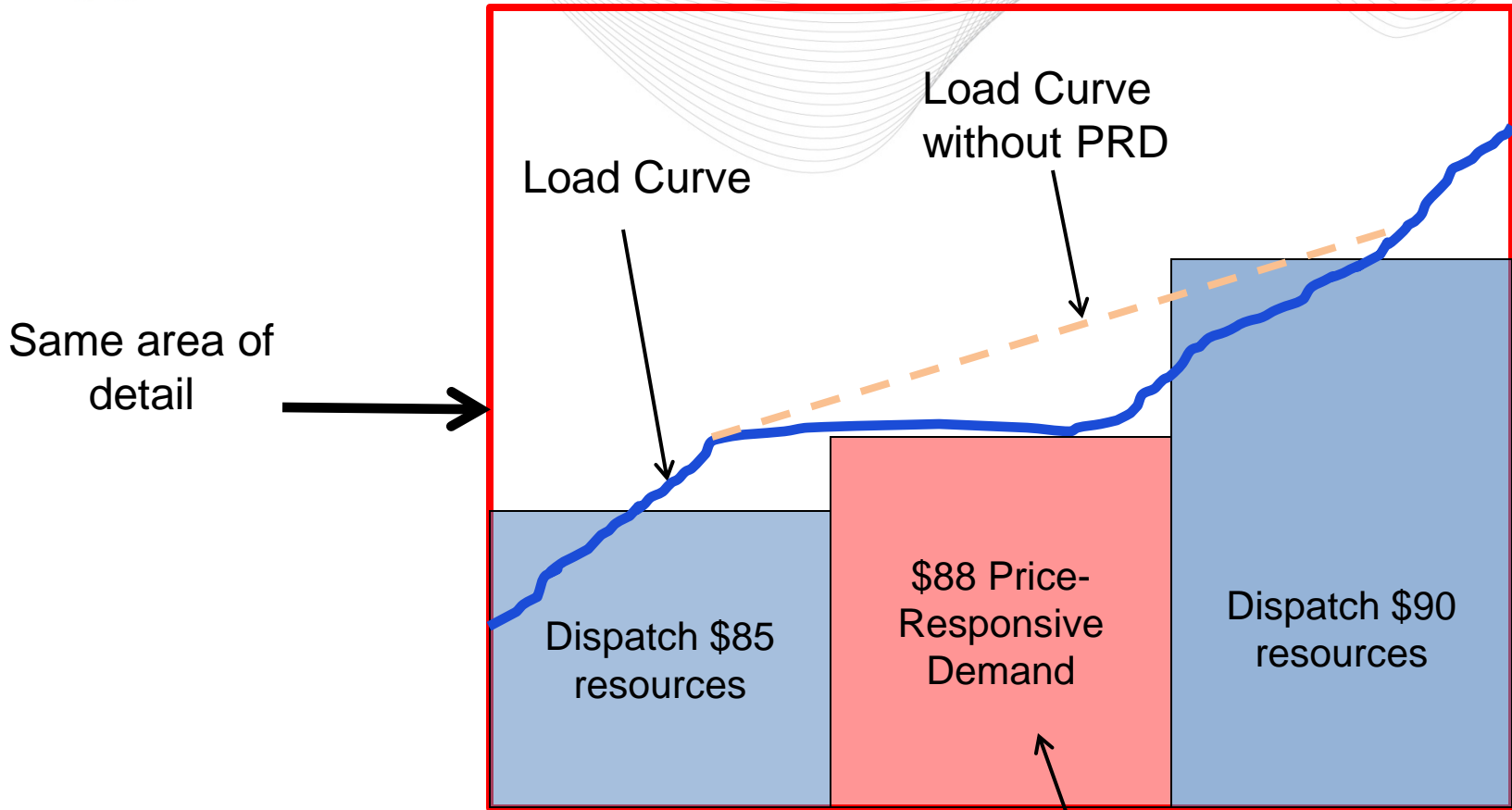
Close coordination with
LSEs on quantities and prices

2

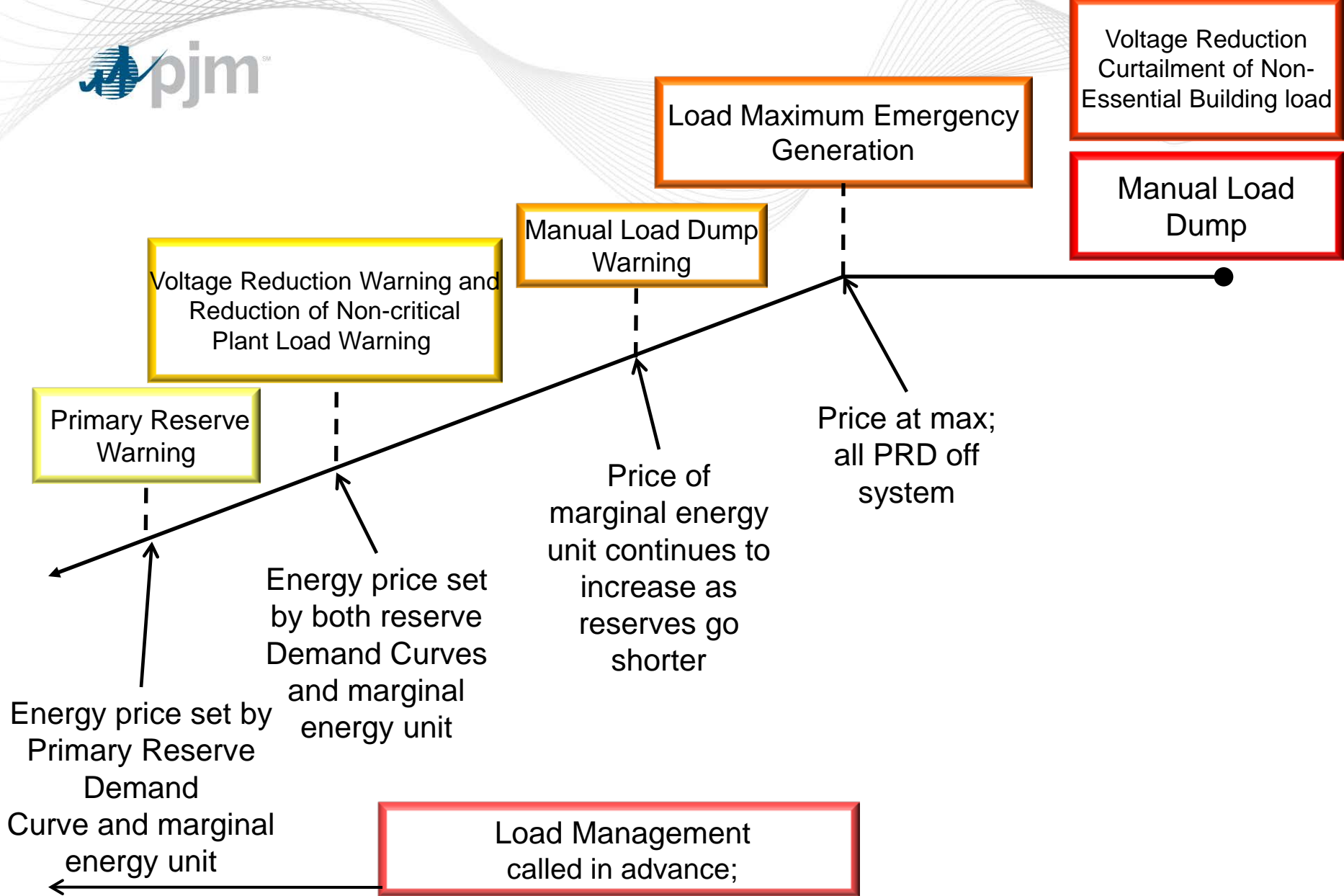
Locational detail of
PRD quantities

3

Recognition in dispatch
and pricing software



No dispatch of additional resources due to demand response at indicated price level



Process	PRD	DR/CP
RPM	BRA or 3 rd IA if forecast goes increases, No replacement, Submit PRD plan, PRD provider only. Credit based on the Base Capacity rates	BRA and IAs, replacement allowed, Submit DR plan, CSPs provide. Credit based on new CP rates (higher than base 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 our arrangements	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	Adjusted MESL (compared to PLC) – max hour of event	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 daily deficiency charge * 365	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