

Fast Start Pricing – Market Settlement Update

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Market Settlements Subcommittee

- FERC issued an order on PJM's compliance filing (ER19-2722) on December 17, 2020
- Specific to Market Settlements, the Commission found that PJM had submitted Tariff language that complied with this directive.
- However, the Commission also found that PJM had submitted additional, unnecessary Tariff provisions that would provide additional uplift payments.

- Dispatch Differential Lost Opportunity Cost Credits
- Double Counting of Commitment Costs

- Day-ahead Scheduling Reserve (DASR) Lost Opportunity Cost Credits
- Day-ahead Transaction Make Whole Payments
- Real-Time Make Whole Credit

- PJM will submit its compliance filing on or before **February 15, 2021**.
- The Commission directed PJM to include a specific proposed effective date for its fast-start Tariff changes in its further compliance filing (due in 60 days) that reflects “PJM’s estimate of when development, testing, and implementation of the software system changes will be complete.”

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**Please send feedback on compliance
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Appendix – Market Settlement Details

- The FERC order accepted PJM's proposal to use lost opportunity cost (LOC) credits to offset the incentive for over-generation or price chasing
 - Incentive can exist when a resource is dispatched down to maintain power balance due to the need to accommodate the inflexibility of fast-start resources as well as the inclusion of commitment costs into the LMP
 - Pool-scheduled and dispatchable self-scheduled resources are eligible to receive this LOC credit

- Objective
 - Minimize incentive for a resource to deviate from dispatch instructions by chasing LMP
- Approach
 - Calculate a Dispatch Differential LOC (DD LOC) that is the difference between additional revenue above cost that a resource would have received if it operated at the Pricing Run MW and the actual revenue above cost the resource earned

- Resources will continue to receive eligible LOC credits if scheduled for:
 - Regulation
 - Synchronized Reserve
 - Reactive Services
 - Reduced or suspended due to a transmission constraint or for other reliability reasons
- For these resources, existing LOC credits cover the differences between the pricing run and the dispatch run and as a result these resources will not be eligible for DD LOC
- Eliminates the potential for duplicate LOC credits for the same MWs

- Dispatch Differential LOC will only be calculated for the Real-time Market
- Dispatch deviations can only occur in the real-time energy market, so this LOC does not apply to the Day-ahead market

- Five-minute interval based calculation
- Dispatch Differential LOC will equal the positive difference between the revenue above cost that a resource would have received if it operated at the Pricing Run MW and the actual revenue above cost the resource earned
- Dispatch Differential LOC credits will be allocated to real-time load plus exports on an hourly basis

- Pricing Run Revenue Above Cost
 (Expected MW Output * LMP_p) – Incremental Energy Offer for
 Expected MW Output
 Expected MW Output is the MW value of the resource based on the
 Final Offer at the five minute real-time LMP at the resource bus
- Dispatch Run Revenue Above Cost
 Greater of (Dispatch MW, Actual MW) * LMP_p –
 Lesser of (Cost of Dispatch MW, Cost of Actual MW)
- Dispatch Differential LOC = Max(Pricing Run Revenue Above Cost –
 Dispatch Run Revenue Above Cost, 0)



Dispatch Differential LOC Calculation

Segment	MW	Price	Cost
1	85	\$20	\$1700
2	95	\$27	\$235
3	100	\$30	\$142.50
Total Cost			\$2077.50

	Dispatch Run	Pricing Run
Energy	85 MW	95 MW
Reserves	0 MW	5 MW

	Value
Dispatch MW	85 MW
Actual MW	85 MW

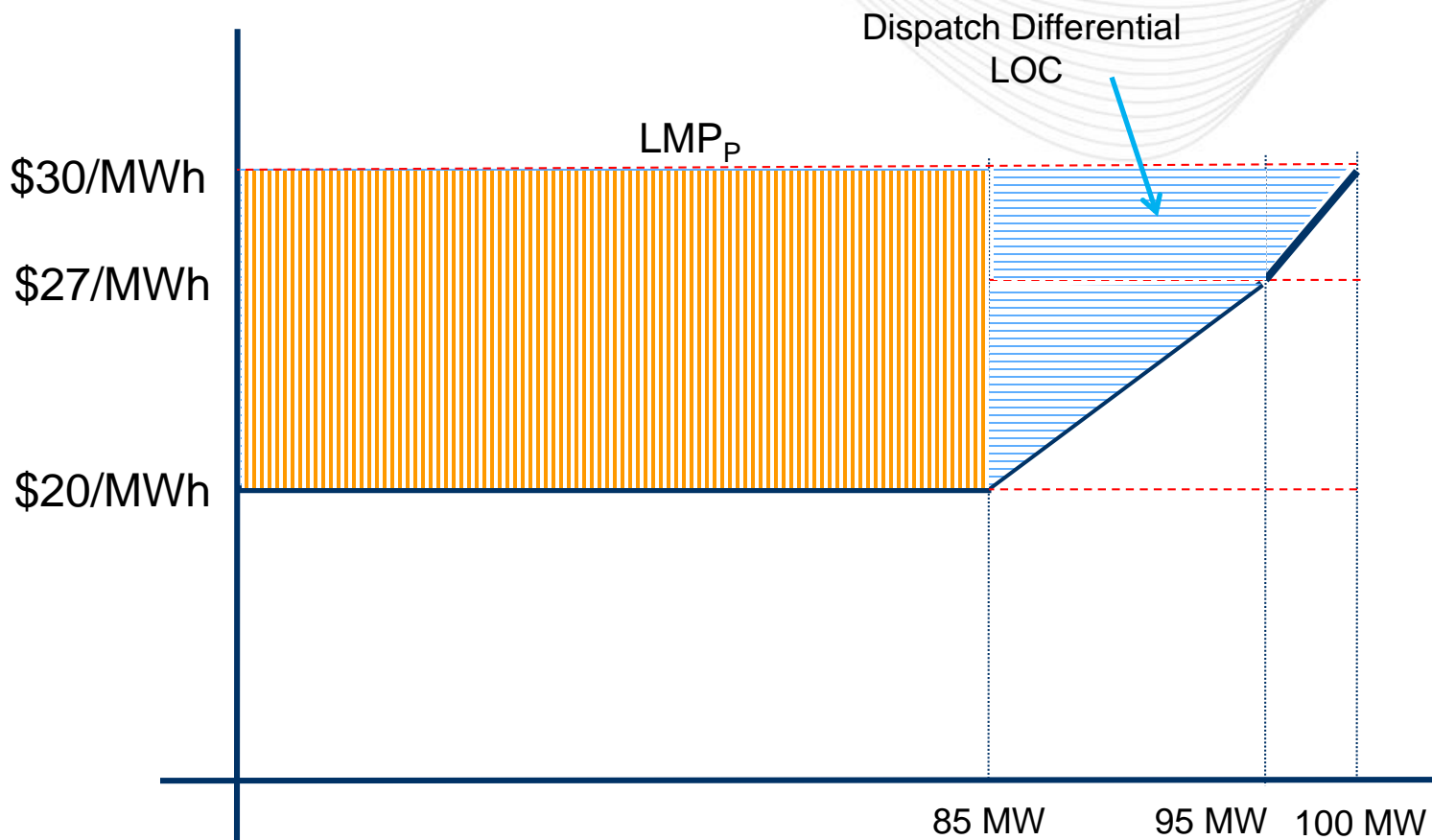
$$\begin{aligned}
 \text{Pricing Run Revenue Above Cost} &= (\text{Expected MW Output} * \text{LMP}_p) - \text{Incremental Energy Offer for Expected MW Output} \\
 &= (100 \text{ MW} * \$30/\text{MW}) - \$2077.50 \\
 &= \$3000 - \$2077.50 \\
 &= \$922.50
 \end{aligned}$$

$$\begin{aligned}
 \text{Dispatch Run Revenue Above Cost} &= \text{Max} (\text{Dispatch MW}, \text{Actual MW} * \text{LMP}_p) - \text{Min} (\text{Cost of Dispatch MW}, \text{Cost of Actual MW}) \\
 &= (85 \text{ MW} * \$30/\text{MW}) - (85 \text{ MW} * \$20/\text{MW}) \\
 &= \$2550 - \$1700 \\
 &= \$850
 \end{aligned}$$

$$\begin{aligned}
 \text{Dispatch Differential LOC} &= \text{Pricing Run Revenue Above Cost} - \text{Dispatch Run Revenue Above Cost} \\
 &= \$922.50 - \$850 \\
 &= \$72.50
 \end{aligned}$$



Dispatch Differential LOC Calculation



Pricing Run Revenue Above Cost \$922.50

Dispatch Run Revenue Above Cost \$850

Dispatch Differential LOC \$72.50

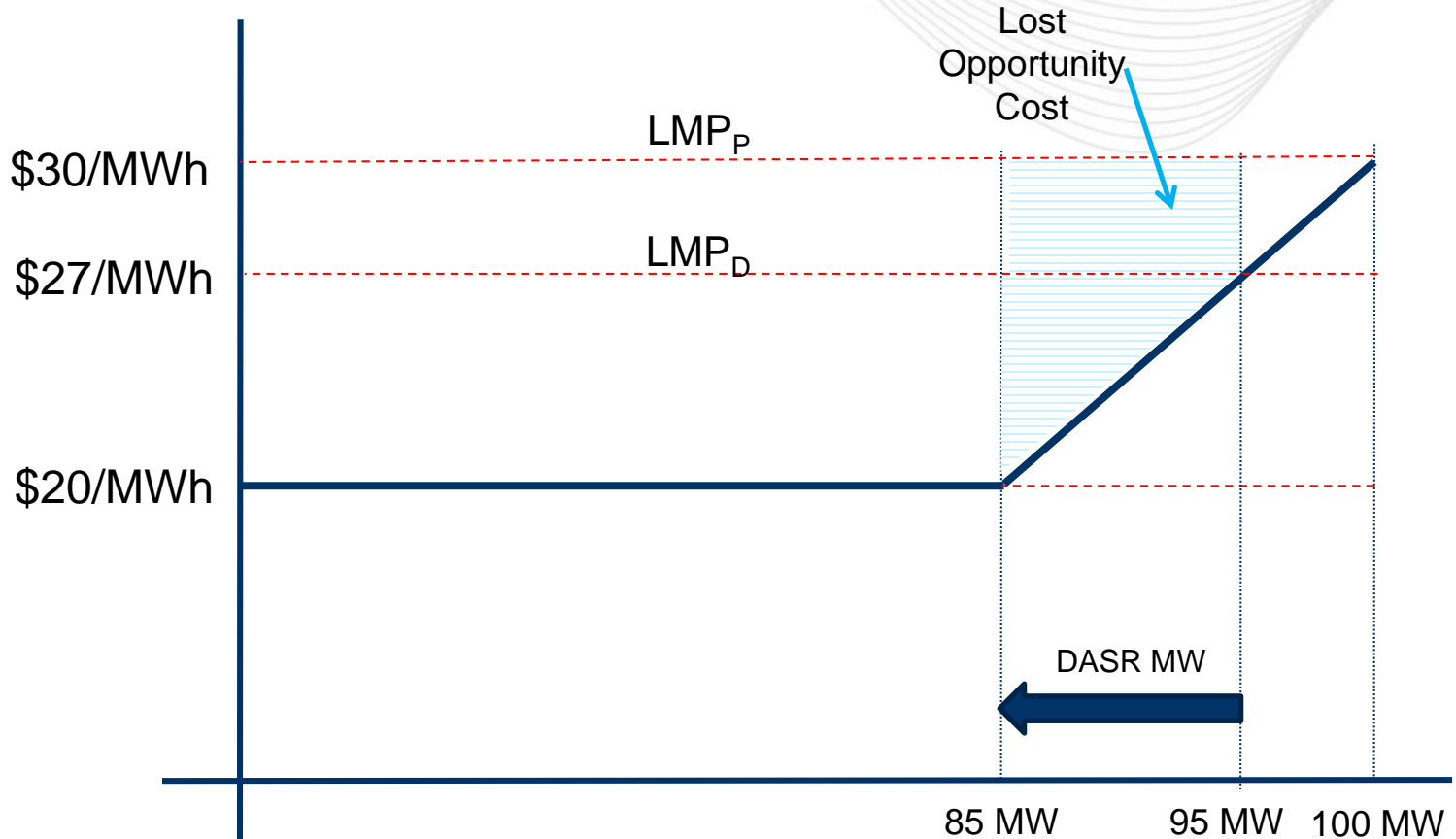
Day-ahead Scheduling Reserve (DASR) LOC

- With Fast Start Pricing, LOC is calculated to ensure that the DASR MW the resource is backed down in the Day-ahead dispatch run receives the same revenue above cost the resource could have received if it had been assigned energy for that same quantity
 - Goal is to maintain indifference between providing energy and reserves
- If DASR Clearing Price Credits $<$ (Offer + Lost Opportunity Cost), resource is eligible for DASR LOC credit
- Introduces new Billing Line Item for DASR LOC credit



Day-ahead Scheduling Reserve (DASR) LOC

Dispatch Run	
Energy MW	DASR MW
85 MW	15 MW assignment (backed down 10 MW)



Lost Opportunity Cost = \$65
 This value is the foregone revenue, not the Lost Opportunity Cost Credit.

The LOC Credit is based on the difference between the DASR credits and (Offer + LOC)

LOC not paid for MW from 95 to 100 MW. This is the equivalent of DD LOC, which is not being paid in the Day-ahead market.

Day-ahead Transaction Make Whole Payments

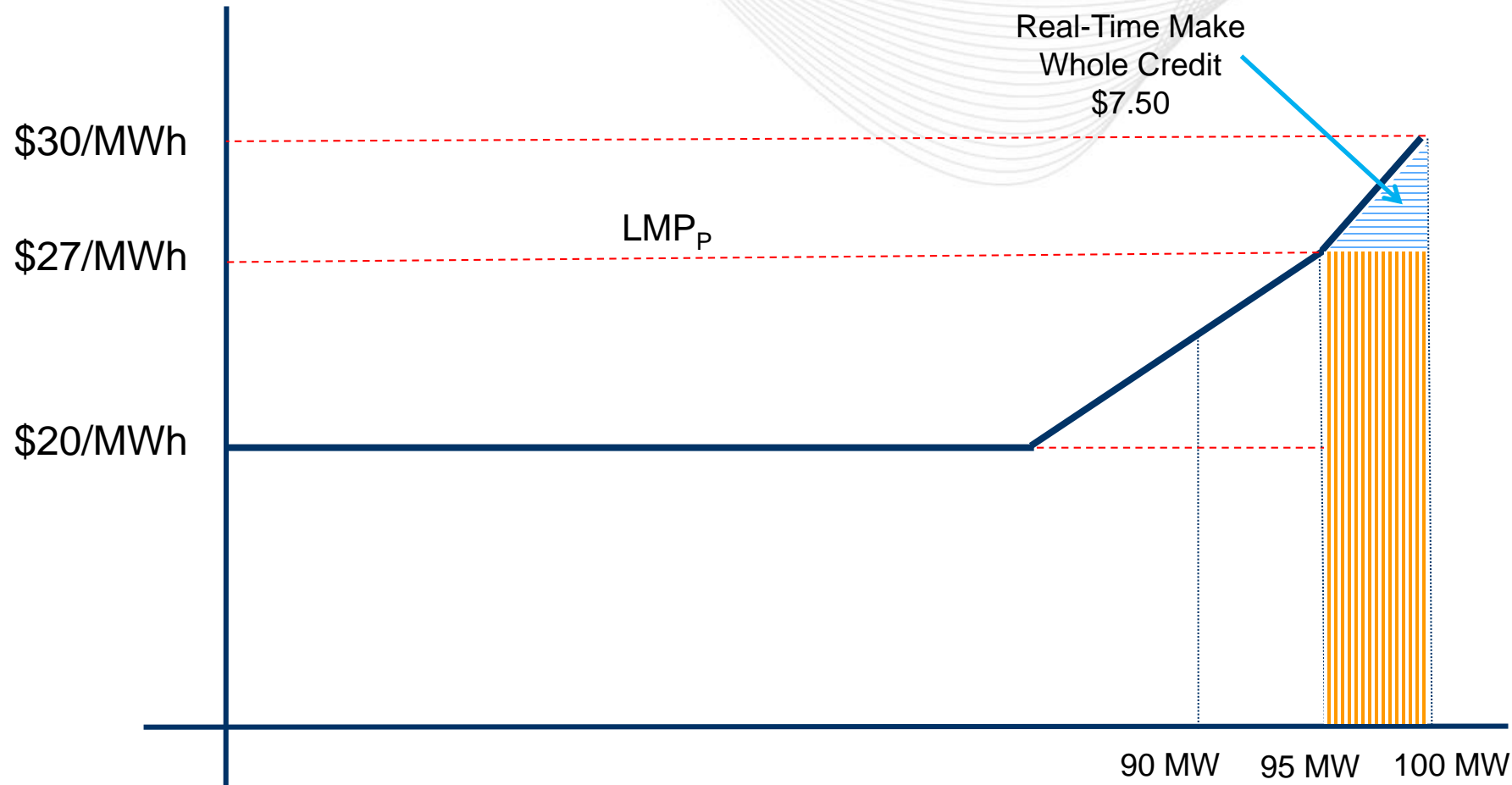
- Day-ahead Transactions include:
 - Virtual Transactions
 - Increment Offers
 - Decrement Bids
 - Up-to Congestion Transactions
 - Price Responsive Demand
 - Dispatchable Exports
- Transactions that clear in the Day-ahead dispatch run but are not economic in the Day-ahead pricing run will be made whole to their offer

- These credits represent the cost of MWs that are provided in real-time in excess of the resource's day-ahead assignment that are not compensated by real-time LMP
- Credits only apply to pool-scheduled or dispatchable self-scheduled resources


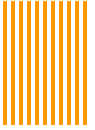
- Eligibility rules:
 1. Real-time dispatch MW greater than day ahead assignment
 2. Real-time dispatch MW greater than the output level of the resource based on the intersection of RT LMP with the offer curve

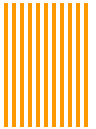
- A. Using Final Offer, calculate the cost of the MWs between the:
 - (1) Greater of DA Schedule MW and expected MW output at RT LMP
 - AND
 - (2) Lesser of RT Dispatch MW and actual MW output
- B. Calculate the revenue for the MW difference between (1) and (2) at RT LMP
- C. The Real-Time Make Whole Credit is equal to the positive difference between the cost and revenue: $A - B$.

Real-Time Make Whole Credit Calculation



DA Schedule = 90 MW
 Expected MW at RT LMP = 95 MW
 RT Dispatch = 100 MW
 Actual Output = 100 MW

Cost of MWs \$142.50  + 

Revenue for MW difference \$135 

- Status Quo
 - Balancing Operating Reserve segments
- Changes
 - Real-Time Make Whole Credit is an additional revenue component to offset Balancing Operating Reserve credits

A resource is dispatched higher in real-time than in day-ahead
(positive balancing MW)

AND

The resource is made-whole for 100% of its startup and
no-load costs in day-ahead.

When these are true, the resource has an opportunity to collect revenues in real-time to cover costs that have already been compensated via day-ahead uplift.

This situation can occur today and is not unique to Fast-Start Pricing.

- Costs recovered via uplift in the Day-Ahead Market that are subsequently recovered in Real-time Market revenues are subtracted from Day-ahead uplift
- Implemented by calculating Operating Reserve Targets:
 - Day-Ahead Operating Reserve Target = Total DA Offer Cost* – DA Revenue
 - Balancing Operating Reserve Target = Total RT Offer Cost* – Total Revenue**

*Total Offer Cost includes Incremental Offer + Startup + No Load

**Total Revenue includes DA Credits + Balancing Credits + Ancillary Service Revenue + Real-time Make Whole Credits

- The total Operating Reserve Credits are capped to ensure no over payment
 - $DA\ OR\ Credit\ Offset = \text{MAX}(DA\ OR\ Target - Bal\ OR\ Target, 0)$
 - $Bal\ OR\ Credit = \text{MAX}(Bal\ OR\ Target - DA\ OR\ Credit, 0)$
 - The balancing credit is equal to the portion of balancing uplift that wasn't recovered via Day-Ahead uplift (Status quo)
- This calculation will apply to all resources, not only Fast-Start

DA OR Target	Bal OR Target	Day-ahead OR Credit Offset	Day-Ahead OR Credit	Bal OR Credit	
\$90	\$100	\$0	\$90	\$10	Status Quo
\$100	\$100	\$0	\$100	\$0	Status Quo
\$110	\$100	\$10	\$100	\$0	Over Payment Resolved
\$50	\$0	\$50	\$0	\$0	Over Payment Resolved