Order 825 – 5 Minute Settlements

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Energy Market Billing Line Item Changes

Billing Line Item	Resource Type	Current	Proposed
DA Spot Market	All	Use hourly DA MW multiplied by hourly DA Energy Price	No Change
Balancing Spot Market	Generation	Use hourly Balancing MW multiplied by hourly RT Energy Price	Use 5 minute telemetry profiled MW or 5 minute meter MW and 5 minute RT Energy Price
	Load		Use flat profile MW for hour and 5 minute RT Energy Price
	Load Management		Use flat profile MW over actual dispatch timeframe and 5 minute RT Energy Price
	Import/Export		Use 5 minute profile MW over 15 minute schedule and 5 minute RT Energy Price

Billing Line Item	Resource Type	Current	Proposed
DA Transmission Congestion Charge	All	**Implicit** – Hourly summed withdrawal charges at the applicable DA congestion bus prices minus the hourly summed injection charges at the applicable DA congestion bus prices **Explicit** – Hourly scheduled energy transactions MWh multiplied by the delta of DA sink and source congestion prices using the DA congestion aggregate prices	**Implicit** – Change calculation to use the congestion aggregate prices; Generation will continue to use current process **Explicit** – No Change
Balancing Transmission Congestion Charge	All	**Implicit** – Hourly summed deviations withdrawal charges at the applicable RT congestion bus prices minus the hourly summed deviation injection charges at the applicable RT congestion bus prices **Explicit** – Hourly deviations from the DA scheduled energy transactions MWh multiplied by the delta of RT sink and source congestion prices using the RT congestion aggregate prices	**Implicit** – Change calculation to use the congestion aggregate prices calculated every 5 minutes; Generation will continue to use current process and 5 minute prices **Explicit** – Change to calculate every 5 minutes
Transmission Congestion Credits	All	Allocation to FTR holders until Docket ER16-121 is effective, then Balancing Congestion hourly to load and exports	No Change

Billing Line Item	Resource Type	Current	Proposed
DA Transmission Losses Charge	All	**Implicit** – Hourly summed withdrawal charges at the applicable DA loss bus prices minus the hourly summed injection charges at the applicable DA loss bus prices **Explicit** – Hourly scheduled energy transactions MWh multiplied by the delta of DA sink and source loss prices using the DA loss aggregate prices	**Implicit** – Change calculation to use the loss aggregate prices; Generation will continue to use current process **Explicit** – No Change
Balancing Transmission Losses Charge	All	**Implicit** – Hourly summed deviations withdrawal charges at the applicable RT loss bus prices minus the hourly summed deviation injection charges at the applicable RT loss bus prices **Explicit** – Hourly deviations from the DA scheduled energy transactions MWh multiplied by the delta of RT sink and source loss prices using the RT loss aggregate prices	**Implicit** – Change calculation to use the loss aggregate prices calculated every 5 minutes; Generation will continue to use current process and 5 minute prices **Explicit** – Change to calculate every 5 minutes
Balancing Transmission Losses Credit	All	Total hourly DA and BAL Transmission Losses charges allocated on ratio shares of RT load plus exports	No Change

Billing Line Item	Resource Type	Current	Proposed
Meter Error Correction Charges	Generation	Uses the hourly generation weighted average LMP	Use the 5 minute interval generation weighted average LMP
Emergency Energy Charges/ Credits	All	Charges & Credits – Hourly credits of emergency energy purchases are allocated to RT deviations from DA Net Interchange that create shorter RT position	Charges & Credits – Change to calculate every 5 minutes
Load Recon for Spot Market; Trans. Cong.; Trans. Losses	All	Reconciliation is conducted on a two month lag and adjusts the line items based on "actual" load usage and calculated hourly	No Change
FTR Auctions /ARR	All	**FTR Auctions** – charged for purchases and credited for sales **ARR** – allocation of Annual FTR net revenues (with any updates from ER16-121)	No Change

Ancillary Services and Operating Reserves
Billing Line Item Changes

Billing Line Item	Resource Type	Current	Proposed
Regulation Charge	Load Serving Entities	Hourly obligation equal to their RT load (w/o losses) ratio share excluding mileage (adjusted for any bilaterals) multiplied by RMCCP; plus hourly mileage obligation equal to their adjusted obligation ratio share of the mileage component of the regulation supplied multiplied by RMPCP.	Obligation will remain at an hourly basis. Charges allocated hourly by summing the 12 five-minute Regulation intervals. Regulation bilaterals remain hourly
Regulation Credit	Generation and Load Management	Hourly credits for pool- and self-scheduled regulation priced at the RMCCP and RMPCP based on performance and mileage ratio. Additional credits provided to pool-scheduled regulating resources for any unrecovered portion of regulation offer plus opportunity cost.	Change to calculate on a 5 minute interval.

Billing Line Item	Resource Type	Current	Proposed
Synchronized Reserve Charges	Load Serving Entities (not part of an agreement to share reserves with external entities)	Hourly obligation equal to their RT load (w/o losses) ratio share of their reserve market's total assignments (adjusted for any bilaterals).	Obligation will remain at an hourly basis. Charges allocated hourly by summing the 12 five-minute SR credit intervals. Synchronized Reserve bilaterals will remain hourly.
Synchronized Reserves Credits	Generation and Load Management	Tier 1 - When NSRMCP is zero, then credits equal to response [MWh times (average of 5 minute LMPs + $50/MWh)] less the hourly LMP; when NSRMCP is non-zero, then credits equal to the lesser of the response MWh or the Tier 1 estimate times the applicable reserve zone's SRMCP. Tier 2 - credits are priced at the applicable reserve zone's Tier 2 clearing price. Additional credits provided to pool-scheduled synchronized reserve resources for any unrecovered cost	Change all calculations to a 5 minute interval. Tier 1 - When NSRMCP is zero, then credits equal the response MWh times $50/MWh

Billing Line Item	Resource Type	Current	Proposed
Non-Synchronized Reserves Charges	Load Serving Entities (not part of an agreement to share reserves with external entities)	Hourly obligation equal to their RT load (w/o losses) ratio share of their reserve market's total NSR supplied (adjusted for any bilaterals).	Obligation will remain at an hourly basis. Charges allocated hourly by summing the 12 five-minute NSR credit intervals. Non-Synchronized Reserve bilaterals remain hourly.
Non-Synchronized Reserves Credits	Generation and Load Management	Hourly credits provided to generation resources supplying NSR at the NSRCP. Additional credits provided to NRS resources for any portion of NSR opportunity costs not recovered via NSRCP revenues.	Change to calculate on a 5 minute interval.

Billing Line Item	Resource Type	Current	Proposed
Balancing Operating Reserve Charges	All	**Credits for Deviations** - daily allocation based on RT deviations from DA (1) hourly for cleared generation offers; (2) hourly for cleared INC offers and purchase transactions; and (3) hourly for cleared Demand, DEC bids and sale transactions **Credits for Reliability** - daily allocation based on regional shares of real-time load (w/o losses) plus exports.	Allocation remains daily. Change to calculate deviations on a 5 minute interval.
Balancing Operating Reserve Credits	Generation, Load Management and Import Transactions	Calculated for specified operating period segments for each RT hour for any portion of their offer amount in excess their overall revenues from DA, DASR, SR, NSR or Reactive credits. **Cancellation credits** – daily credit based on actual costs submitted to PJM Market Settlements. **LOC credits** - hourly provided to generators reduced or suspended by PJM for reliability purposes.	Change to calculate on 5 minutes intervals, including LOC. Segments will remain at operating period, but are no longer bound by clock hour. Can be intra-hour. Cancellations credits remain daily

Billing Line Item	Resource Type	Current	Proposed
DA Operating Reserve Charges and Credits	All	**Charges** – Allocation of total daily cost based on DA load plus exports ratio share **Credits** – Offer amount in excess of their scheduled MWh times DA bus LMP	No Change
Reactive Services Charges		Allocate the total daily reactive service cost and the total DA Operating Reserve credits for resources scheduled to provide Reactive Services to PJM transmission zone based on RT load (w/o losses) ratio shares in the applicable transmission zone.	No Change
Reactive Service Credits	Generation	Daily credits are calculated in RT and equals either (1) the operating reserve credits for generation increased or (2) the LOC for generation reduced	Change to calculate on a 5 minute interval.
Performance Assessment Hour	Capacity Performance Resources	Calculated on an hourly basis compared Expected Performance to Actual Performance	Change to calculate on a 5 minute interval.

Implicit Congestion and Losses

- Zone and Residual Aggregate definitions
  - Day-ahead Market
    - Real-time bus distribution from HE 08 one week prior to Operating Day
    - Static for all 24 hours in day-ahead clearing
      - E.g. Definitions for December 8 are from HE 08 on December 1
  - Real-time
    - Based on State Estimator solution
      - Calculated for each hour for the Operating Day

- Settlement Calculation applicable to DA and Balancing
  - Zone and Residual Aggregates are broken down to the bus level
    - Congestion
      - Sum of hourly withdrawal charges at the applicable congestion bus LMP minus the sum of hourly injection charges at the applicable congestion bus LMP
    - Losses
      - Sum of hourly withdrawal charges at the applicable loss bus LMP minus the sum of hourly injection charges at the applicable loss bus LMP

- Zone and Residual Aggregate definitions
  - Day-ahead Market
    - No change
  - Real-time
    - Based on State Estimator solution
      - Calculated for each 5 minute interval for the Operating Day

- Settlement Calculation applicable to DA and Balancing
  - Zone and Residual Aggregates are NOT broken down to the bus level
    - Congestion
      - Sum of hourly withdrawal charges at the applicable congestion aggregate LMP minus the sum of hourly injection charges at the applicable congestion aggregate LMP
    - Losses
      - Sum of hourly withdrawal charges at the applicable loss aggregate LMP minus the sum of hourly injection charges at the applicable loss aggregate LMP

Zone A	DA Definitions	DA MW based on 100 MW	RT MW based on 100 MW	Deviation (RT - DA)	RT Congestion LMP	Balancing Implicit Congestion Charge
Bus 1	20%	20 MW	25 MW	5 MW	$15	$75
Bus 2	35%	35 MW	30 MW	- 5 MW	$5	($25)
Bus 3	5%	5 MW	10 MW	5 MW	$10	$50
Bus 4	15%	15 MW	10 MW	- 5 MW	$5	($25)
Bus 5	25%	25 MW	25 MW	0 MW	$10	$0
						$75

Balancing Congestion Charge
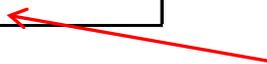
- Even though this participant is perfectly hedged between DA and RT at 100 MW, breaking Zone A down to the bus level results in a $75 Balancing Implicit Congestion Charge.
- This charge is a result of the different definitions for Zone A between DA and RT.

	DA MW	RT MW	Deviation (RT - DA)	Balancing Implicit Congestion Charge
Zone A	100 MW	100 MW	0 MW	$0

- Using the Zone or Residual Aggregate, the participant is perfectly hedged between DA and RT at 100 MW.

- This results in no Balancing Implicit Congestion Charge.

Specific to zone and residual aggregate transactions

1. Straightforward calculations – easier to manage in shadow settlements
2. Elimination of Balancing Implicit Congestion and Loss charges if Day-ahead and Real-time load matches
3. Increment offers and Decrement bids with no covered position in Real-time currently have charges calculated using the DA bus definition and RT bus LMPs. Change will utilize the zone or residual aggregate RT LMP.
4. Performance improvements
   a) Reporting system – simplified reports for Implicit Congestion and Loss details
   b) PJM settlement calculation system

PJM Open Access Transmission Tariff

- PJM conducting in-depth review of Tariff for January 11, 2017 Order 825 Compliance Filing
- Majority of changes occurring in Attachment K – Appendix
  - Section 2: Calculation of LMP
  - Section 3: Accounting and Billing
  - Section 5: Calculation of Charges and Credits for Transmission Congestion and Losses
- Duplicate changes will occur in the Operating Agreement – Schedule 1

- PJM is proposing language to more clearly describe settlement processes taking into account 5 Minute Settlements
- Spot Market Energy, Transmission Congestion and Losses
  - Focus is on moving from the Market Buyer / Market Seller concept and utilize net withdrawal and injection terminology
- PJM also plans to add a new sub-section on the categories of revenue data for settlements
  - Generation – telemetry scaling for hourly revenue meter data
  - All other transactions – flat profiling values for the 5 minute settlement intervals