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VIA ELECTRONIC FILING

July 15, 2019

Shonta Dunston
Deputy Clerk
North Carolina Utilities Commission
430 North Salisbury Street
Dobbs Building
Raleigh, North Carolina 27603-5918

Re: Docket No. E-22, Sub 418

Dear Ms. Dunston:

Consistent with Article XIV of the Agreement and Stipulation of Settlement filed with the North Carolina Utilities Commission and the Commission's order of December 22, 2016, in the above referenced docket, Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor for PJM Interconnection, L.L.C., submits the attached report. The report includes the information specified in Paragraph 6 of the Joint Offer of Settlement between Dominion North Carolina Power and PJM Interconnection, L.L.C., filed in Docket No. E-22, Sub 532, on December 10, 2004.

Please contact Joseph Bowring if you have any questions about this matter, at 610 271-8051 or at *joseph.bowring@monitoringanalytics.com*.

Yours truly,

Jeffrey Mayes

Jeffrey Mayes, General Counsel

cc: Andrea R. Kells, Esq.

REPORT TO THE NORTH CAROLINA UTILITIES COMMISSION

Congestion in the Dominion Service Territory in North Carolina: 2019

The Independent Market Monitor for PJM

July 15, 2019

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Overview of Congestion Calculations

This report provides details of the congestion in the part of the Dominion Zone in North Carolina for the years 2017 and 2018.[1] Congestion is defined to be load payments in excess of generation revenues. Congestion calculations are for the part of the Dominion Zone in North Carolina and not for any specific organization. The report includes congestion event hours for the constraints which had the largest impact on congestion charges in the part of the Dominion Zone in North Carolina, either positive or negative, and the congestion charges associated with each constraint.[2]

Congestion is calculated on a constraint specific basis. Constraint based congestion reflects differences between credits and charges caused by binding transmission limits on power flow from generators, regardless of location, to load in a specific area. In this report, constraint based congestion is the total congestion payments by at the buses in the part of the Dominion Zone in North Carolina minus total congestion credits received by all generation that supplied that load, given the transmission constraints, regardless of location in the PJM system.

Constraint based congestion reflects the underlying characteristics of the complete power system as it affects the defined area, including the nature and capability of transmission facilities, the offers and geographic distribution of generation facilities, the level and geographic distribution of incremental bids and offers and the geographic and temporal distribution of load.

In an LMP system, the only way to ensure that load receives the benefits associated with the use of the transmission system to deliver low cost energy is to use FTRs, or an equivalent mechanism, to pay back to load the difference between the total load payments and the total generation revenues. FTRs were the mechanism selected in PJM to offset the congestion costs that load pays in an LMP market. Congestion revenues are the source of the funds to pay FTRs. Congestion revenues are assigned to the load that paid them through FTRs. The only way to ensure that load receives the benefits

1 Any discussion of North Carolina congestion costs in this report refers to congestion costs associated with PJM related buses in North Carolina, rather than to the entire state of North Carolina.

2 Congestion event hours are hours in which a transmission constraint is binding. In day ahead, an interval equals one hour. In real time, an interval equals five minutes. In order to have a consistent metric for day-ahead and real-time congestion frequency, real-time congestion frequency is measured using the convention that an hour is constrained if any one of its component five-minute intervals is constrained.

associated with the use of the transmission system to deliver low cost energy is to ensure that all congestion revenues are returned to load.

The current ARR/FTR design does not serve as an efficient way to ensure that load receives all the congestion revenues, and has the ability to receive the auction revenues associated with rights to all the potential congestion revenues. The current ARR/FTR construct rules (put into effect for the 2017/2018 planning period) allocates balancing congestion and M2M payments to load[3] and allocates surplus day-ahead congestion and surplus FTR auction revenue to ARR holders[4]. Had the current ARR/FTR allocation rules been in place in the 2016/2017 and 2017/2018 planning periods, ARR and related self-scheduled FTRs that sunk in the Dominion Zone in North Carolina would have offset only 41.3 percent of congestion incurred in the Dominion Zone in North Carolina in 2016/2017 and 11.9 percent of congestion incurred in the Dominion Zone in North Carolina in the 2017/2018.

The ARR/FTR design does not serve as an efficient mechanism for returning congestion to load as a result of an FTR design that was flawed from its introduction and as a result of various distortions added to the design since its introduction. The distortions include the definition of target allocations based on day-ahead congestion only, the failure to assign all FTR auction revenues to ARR holders, differences between modeled and actual system capability and numerous cross subsidies among participants. One of the flaws in the original design was the link between congestion revenues and specific generation to load transmission paths. This link retained the contract path based view of congestion rooted in physical transmission rights and inconsistent with the role of FTRs in a nodal, network system with locational marginal pricing.

If the original PJM FTR approach had been designed to return congestion revenues to load without use of the generation to load paths, and if the distortions subsequently introduced into the FTR design not been added, many of the subsequent issues with the FTR design would have been avoided. The design should simply have provided for the return of all congestion revenues to load. This would eliminate much of the complexity associated with ARRs and FTRs and eliminate unnecessary controversy about the appropriate recipients of congestion revenues.

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3 On September 15, 2016, FERC ordered PJM to allocate balancing congestion to load, rather than to FTRs, to modify PJM's Stage 1A ARR allocation process and to continue to use portfolio netting. 153 FERC ¶ 61,180.

4 163 FERC ¶61,165 (2018).

Locational Marginal Price (LMP)

Components

LMP at a bus reflects the incremental price of energy at that bus. LMP at any bus can be deconstructed into three components: the system marginal price (SMP); the marginal loss component of LMP (MLMP); and the congestion component of LMP (CLMP).

SMP, MLMP and CLMP result from the least cost, security constrained dispatch of system resources to meet system load. SMP is the incremental cost of energy, given the current dispatch and given the choice of reference bus, or LMP net of losses and congestion. Losses refer to energy lost to physical resistance in the transmission and distribution network as power is moved from generation to load. The greater the resistance of the system to flows of energy from generation to loads, the greater the losses of the system and the greater the proportion of energy needed to meet a given level of load. Total losses refer to the total system wide losses as a result of moving power from injections to withdrawals on the system. Marginal losses are the incremental change in system losses caused by changes in the system load and generation patterns.[5] The first derivative of total losses with respect to the power flow equals marginal losses. The marginal loss associated with meeting load at a specific bus is the MLMP at that bus. The CLMP at a bus reflects the incremental cost of relieving transmission constraints, while maintaining system power balance, at that bus.

CLMP is the incremental price of congestion at each bus, based on the shadow prices associated with the relief of binding constraints in the security constrained optimization. CLMPs are positive or negative depending on location relative to binding constraints and relative to the load-weighted reference bus. In an unconstrained system CLMPs are zero. The relative values of SMP and CLMP are arbitrary and depend on the choice of reference bus.

Positive or negative CLMPs caused by a specific constraint at a specific bus indicate whether that constraint results in a higher or lower LMP at that bus relative to the system marginal price, at the reference bus. The total CLMP at a specific bus is the net sum of the positive and negative CLMPs caused by all binding constraints affecting that bus. Whether congestion credits or charges associated with generation or load at a bus are positive or negative is determined by whether the total CLMP is positive or negative at that bus. CLMPs are not congestion. CLMPs are a component of price.

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5 For additional information, see the *MMU Technical Reference for PJM Markets,* at "Marginal Losses," <http://www.monitoringanalytics.com/reports/Technical_References/docs/2010-som-pjm-technical-reference.pdf>.

Congestion occurs when available, least-cost energy cannot be delivered to all loads because transmission facilities are not adequate to deliver that energy. When the least-cost available energy cannot be delivered to load in a transmission constrained area, higher cost units in the constrained area must be dispatched to meet that load.[6] The result is that the price of energy in the constrained area is higher than in the unconstrained area because of the combination of transmission limitations and the cost of local generation. Congestion is the difference between the total cost of energy paid by load in the transmission constrained area and the total revenue received by generation to provide that energy. Congestion equals the sum of day-ahead and balancing congestion.

Table 1 shows the real-time, load-weighted average LMP components for PJM for 2012 through 2018 and the real-time, load-weighted average LMP components for the part of the Dominion Zone in North Carolina for 2012 through 2018.[7]

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6 This is referred to as dispatching units out of economic merit order. Economic merit order is the order of all generator offers from lowest to highest cost. Congestion occurs when loadings on transmission facilities mean the next unit in merit order cannot be used and a higher cost unit must be used in its place.

7 The PJM real-time, load-weighted price is weighted by accounting load, which differs from the state-estimated load used in determination of the energy component (SMP). In the Real-Time Energy Market, the distributed load reference bus is weighted by state-estimated load in real time. When the LMP is calculated in real time, the energy component equals the system load-weighted price. But real-time bus-specific loads are adjusted, after the fact, based on updated load information from meters. This meter adjusted load is accounting load that is used in settlements and is used to calculate reported PJM load-weighted prices. This after the fact adjustment means that the Real-Time Energy Market energy component of LMP (SMP) and the PJM real-time load-weighted LMP are not equal. The difference between the real-time energy component of LMP and the PJM-wide real-time load-weighted LMP is a result of the difference between state-estimated and metered loads used to weight the load-weighted reference bus and the load-weighted LMP.

Table 1 PJM and the Dominion Zone in North Carolina real-time, load-weighted average LMP components (Dollars per MWh): 2012 through 2018

	PJM				NC			
	Real-Time LMP	Energy Component	Congestion Component	Loss Component	Real-Time LMP	Energy Component	Congestion Component	Loss Component
2012	$35.23	$35.18	$0.04	$0.01	$36.54	$35.19	$1.03	$0.32
2013	$38.66	$38.64	$0.01	$0.02	$40.31	$38.49	$1.61	$0.22
2014	$53.14	$53.13	($0.02)	$0.02	$59.64	$53.75	$5.43	$0.46
2015	$36.16	$36.11	$0.04	$0.02	$40.58	$37.03	$3.09	$0.46
2016	$29.23	$29.18	$0.04	$0.01	$31.04	$29.12	$1.78	$0.14
2017	$30.99	$30.96	$0.02	$0.01	$32.42	$30.77	$1.26	$0.38
2018	$38.24	$38.19	$0.04	$0.02	$43.73	$39.38	$3.73	$0.62

Table 2 shows the PJM day-ahead, load-weighted average LMP components for 2012 through 2018 and the day-ahead, load-weighted average LMP components for Dominion's service territory in the state of North Carolina.

Table 2 PJM and the Dominion Zone in North Carolina day-ahead, load-weighted average LMP components (Dollars per MWh): 2012 through 2018

	PJM				NC			
	Day-Ahead LMP	Energy Component	Congestion Component	Loss Component	Day-Ahead LMP	Energy Component	Congestion Component	Loss Component
2012	$34.55	$34.46	$0.11	($0.01)	$36.05	$34.80	$0.96	$0.29
2013	$38.93	$38.79	$0.13	$0.00	$41.36	$39.06	$2.49	($0.20)
2014	$53.62	$53.38	$0.26	($0.02)	$57.46	$53.82	$3.93	($0.29)
2015	$36.73	$36.51	$0.24	($0.01)	$42.34	$37.70	$4.03	$0.60
2016	$29.68	$29.55	$0.14	($0.01)	$32.01	$29.93	$2.02	$0.05
2017	$30.85	$30.81	$0.05	($0.02)	$32.88	$31.10	$1.48	$0.30
2018	$37.97	$37.83	$0.16	($0.01)	$43.22	$39.29	$3.57	$0.36

Table 3 shows the PJM real-time, monthly, load-weighted average congestion component of LMP for 2012 through 2018 and the real-time, monthly, load-weighted average LMP congestion component in the part of the Dominion Zone in North Carolina.

Table 3 PJM and the Dominion Zone in North Carolina real-time, monthly, load-weighted average LMP congestion component (Dollars per MWh): 2012 through 2018

	PJM							NC						
	2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018
Jan	$0.02	$0.03	($0.01)	$0.02	$0.03	$0.01	$0.05	$0.56	$2.95	$33.08	$0.96	$3.86	$2.14	$19.01
Feb	$0.01	$0.02	($0.33)	($0.02)	$0.02	$0.02	$0.01	$0.69	$0.51	$1.79	$2.29	$2.27	$0.86	$0.73
Mar	$0.04	$0.02	($0.06)	($0.00)	$0.04	$0.03	$0.04	$1.49	$1.65	$12.60	$6.67	$1.97	$0.45	$9.81
Apr	$0.07	$0.01	$0.02	$0.03	$0.07	$0.01	$0.04	$1.53	$0.59	$0.40	$5.16	$4.44	$0.87	$2.16
May	$0.05	$0.03	$0.04	$0.13	$0.02	$0.02	$0.09	$1.90	$2.08	$3.09	$3.68	$0.00	$1.27	$4.08
Jun	$0.03	$0.03	$0.03	$0.06	$0.02	$0.01	$0.04	($0.08)	($0.12)	$1.67	$5.30	$0.90	$0.10	$1.09
Jul	$0.04	($0.00)	$0.01	$0.02	$0.03	$0.02	$0.02	$0.89	($2.04)	$0.21	$3.01	$0.25	$0.84	$0.02
Aug	$0.02	$0.00	$0.01	$0.02	$0.04	$0.01	$0.02	$2.26	$5.33	$2.06	$1.68	($0.24)	$0.71	($0.18)
Sep	$0.07	($0.05)	$0.02	$0.04	$0.07	$0.08	$0.06	$0.70	$4.29	$2.76	$0.68	$2.77	$2.44	$1.19
Oct	$0.06	$0.02	$0.05	$0.06	$0.06	$0.02	$0.03	$2.49	$0.62	$3.83	$3.03	$4.21	$3.37	$1.94
Nov	$0.03	$0.00	$0.05	$0.05	$0.02	$0.01	$0.03	($0.49)	$1.96	($0.69)	$2.53	$2.05	$1.25	$0.53
Dec	$0.01	($0.02)	$0.02	$0.04	$0.02	($0.01)	$0.01	$0.50	$1.60	$0.19	$2.67	$0.44	$1.17	($0.43)
Annual	$0.04	$0.01	($0.02)	$0.04	$0.04	$0.02	$0.04	$1.03	$1.61	$5.43	$3.09	$1.78	$1.26	$3.73

Table 4 shows the PJM day-ahead, monthly, load-weighted average LMP congestion component for 2012 through 2018 and the day-ahead, monthly, load-weighted average LMP congestion component for the part of the Dominion' Zone in North Carolina. In January and March of 2014, the day-ahead, monthly, load-weighted average LMP congestion components for the Dominion's service territory in the state of Carolina were high due to cold weather.

Table 4 PJM and the Dominion Zone in North Carolina day-ahead, monthly, load-weighted average LMP congestion component (Dollars per MWh): 2012 through 2018

	PJM							NC						
	2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018
Jan	$0.07	$0.12	$0.76	$0.38	$0.19	$0.08	$0.56	$0.46	$2.53	$10.66	$2.55	$3.77	$1.65	$14.36
Feb	$0.10	$0.04	$0.30	$0.77	$0.17	$0.01	$0.06	$0.90	$1.29	$2.66	$10.10	$3.02	$0.73	$1.09
Mar	$0.07	$0.03	$0.19	$0.29	$0.07	$0.01	($0.07)	$1.61	$1.50	$9.84	$5.51	$2.44	$0.94	$4.96
Apr	$0.08	$0.03	$0.02	($0.06)	$0.04	($0.02)	($0.01)	$2.06	$0.58	$1.69	$4.48	$4.01	$1.20	$2.00
May	$0.10	$0.10	$0.14	$0.20	$0.06	($0.06)	($0.05)	$1.98	$1.68	$3.65	$4.81	$0.86	$1.31	$7.45
Jun	$0.17	$0.18	$0.23	$0.30	$0.16	$0.10	$0.11	($0.20)	$0.94	$2.53	$4.79	$1.24	$0.69	$1.91
Jul	$0.20	$0.29	$0.23	$0.18	$0.26	$0.13	$0.05	$0.31	$0.53	$2.65	$3.91	($0.16)	$0.97	$0.66
Aug	$0.10	$0.09	$0.12	$0.12	$0.29	$0.03	$0.17	$1.45	$3.87	$2.80	$1.94	$0.58	$1.13	$0.37
Sep	$0.18	$0.34	$0.18	$0.23	$0.19	$0.03	$0.15	$0.50	$11.09	$4.09	$1.30	$2.30	$3.00	$1.75
Oct	$0.03	$0.06	$0.27	$0.10	$0.06	$0.02	$0.27	$1.62	$2.65	$2.93	$2.45	$4.21	$2.51	$2.75
Nov	$0.09	$0.07	$0.36	$0.09	($0.01)	$0.06	$0.24	$0.43	$2.11	$1.07	$2.11	$2.13	$1.50	$1.51
Dec	$0.05	$0.20	$0.14	$0.09	$0.13	$0.16	$0.33	$0.94	$1.68	$1.20	$2.64	$1.39	$2.36	$0.27
Annual	$0.11	$0.13	$0.26	$0.24	$0.14	$0.05	$0.16	$0.96	$2.49	$3.93	$4.03	$2.02	$1.48	$3.57

Congestion

Congestion Accounting

Total congestion costs equal net congestion costs plus explicit congestion costs. Net congestion costs equal load congestion payments minus generation congestion credits. Explicit congestion costs are the net congestion costs associated with point to point energy transactions. Each of these categories of congestion costs is comprised of day-ahead and balancing congestion costs. Day-ahead congestion costs are based on day-ahead MWh while balancing congestion costs are based on deviations between day-ahead and real-time MWh priced at the congestion price in the Real-Time Energy Market.[8]

Load congestion payments, when positive, are the congestion cost to load in an area. Load congestion payments, when negative, are the congestion credit to load in an area. Negative load congestion payments result when load is on the lower priced side of a constraint or constraints. For example, congestion across the AP South Interface means lower prices in western control zones and higher prices in eastern and southern control zones. Load in western control zones will benefit from lower prices and receive a congestion credit (negative load congestion payment). Load in the eastern and southern control zones will incur a congestion charge (positive load congestion payment). The reverse is true for generation congestion credits. Generation congestion credits, when positive, measure the congestion credit to generation in an area. Positive generation congestion credits result when generation is on the higher priced side of a constraint or constraints. Generation congestion credits, when negative, measure the congestion cost to generation in an area. Negative generation congestion credits result when generation is on the lower priced side of a constraint or constraints.

For example, congestion across the AP South Interface means lower prices in the western control zones and higher prices in the eastern and southern control zones. Generation in the western control zones will receive lower prices and incur a congestion charge (negative generation congestion credit). Generation in the eastern and southern control zones will receive higher prices and receive a congestion credit (positive generation congestion credit).

The congestion costs associated with specific constraints are the sum of the total day-ahead and balancing congestion costs associated with those constraints. The congestion costs in each zone are the sum of the congestion costs associated with each constraint that affects prices in the zone. The network nature of the transmission system means that congestion costs in a zone are frequently the result of constrained facilities located outside that zone.

Constraint based congestion calculates congestion on a constraint by constraint basis. On a system wide basis, congestion results from transmission constraints that prevent the lowest cost generation from serving some load that must be served by higher cost generation. Transmission constraints cause price separation (differences in LMP),

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8 See Table 17 “Congestion Definitions,” for a summary of relevant definitions.

defined by the marginal cost of resolving the constraint given the need to meet power balance requirements, indicated by the shadow price of the constraint. The LMP at any point is equal to the system marginal price (SMP) plus the shadow price of the constraint times the dfax of the binding constraint to the bus in question (the CLMP of the constraint at that bus).

The total congestion caused by a constraint is equal to the product of the constraint shadow price times the net flow on the binding constraint. Total congestion caused by the constraint can also be calculated using the CLMPs caused by the constraint at every bus and the net MW injections or MW withdrawals at every affected bus. Congestion associated with a specific constraint is equal to load congestion charges (CLMP of that specific constraint at each bus times load MW at each bus) caused by that constraint in excess of generation congestion credits (CLMP of that specific constraint at each bus times generation MW at each bus) caused by that constraint. Constraint specific CLMPs are determined relative to a reference bus, where there is no congestion and no losses. For purposes of allocating the congestion of an individual constraint, the reference bus for each constraint calculation is moved to the point that is just upstream of the constraint (the bus with the greatest negative price effect from the constraint), allowing any positive price effects of the constraint to be reflected as a positive CLMP.

Constraint specific congestion is allocated to downstream (positive CLMP) load buses that paid the congestion caused by the constraint, in proportion to the congestion charges collected from that load due to that constraint. The congestion collected from each load bus due to a constraint is equal to the CLMP caused by that constraint times the MW of load at that load bus. This calculation is done for both day-ahead congestion and balancing congestion.

Table 5 Monthly constraint based congestion costs (Dollars (Millions)) for the Dominion Zone in North Carolina : 20176 through 20187

	Congestion Costs (Millions)					
	2017			2018		
	Day-ahead	Balancing	Total	Day-ahead	Balancing	Total
Jan	$0.3	($0.1)	$0.3	$3.8	$0.2	$4.0
Feb	$0.2	($0.0)	$0.2	$0.2	$0.0	$0.2
Mar	$0.2	($0.0)	$0.2	$0.6	$0.0	$0.6
Apr	$0.2	($0.0)	$0.2	$0.2	$0.0	$0.2
May	$0.3	($0.0)	$0.2	$0.7	($0.1)	$0.6
Jun	$0.3	$0.0	$0.3	$0.5	($0.1)	$0.4
Jul	$0.3	($0.1)	$0.2	$0.3	($0.0)	$0.3
Aug	$0.2	($0.0)	$0.2	$0.3	($0.0)	$0.3
Sep	$0.7	($0.0)	$0.7	$0.5	($0.0)	$0.4
Oct	$0.2	$0.0	$0.3	$0.5	($0.1)	$0.4
Nov	$0.3	($0.0)	$0.3	$0.2	($0.1)	$0.1
Dec	$0.9	($0.1)	$0.7	$0.3	($0.1)	$0.2
Total	$4.1	($0.3)	$3.7	$8.0	($0.3)	$7.7

The system marginal price (SMP) is uniform for all areas, while the total of the congestion components of Locational Marginal Price (LMP) will either be positive or negative in a specific area, meaning that actual LMPs are above or below the SMP.[9] The area affected by a constraint will have increased prices and the unconstrained area will have lower prices. If an area is located downstream from the constrained element, the area will experience positive congestion costs. If an area is located upstream from the constrained element, the area will experience negative congestion costs (lower prices).

Day-ahead congestion charges and credits are based on MWh and CLMP in the Day-Ahead Energy Market. Balancing congestion charges and credits are based on load or generation deviations between the Day-Ahead and Real-Time Energy Markets and CLMP in the Real-Time Energy Market. If a participant has real-time generation or load that is greater than its day-ahead generation or load then the deviation will be positive. If there is a positive load deviation at a bus where real-time CLMP is positive, positive balancing congestion costs will result. Similarly, if there is a positive load deviation at a bus where real-time CLMP is negative, negative balancing congestion costs will result. If a participant has real-time generation or load that is less than its day-ahead generation

[9] The SMP is the price of the distributed load reference bus. The price at the reference bus is equivalent to the five minute real-time or hourly day-ahead load-weighted PJM LMP.

or load then the deviation will be negative. If there is a negative load deviation at a bus where real-time CLMP is positive, negative balancing congestion costs will result. Similarly, if there is a negative load deviation at a bus where real-time CLMP is positive, negative balancing congestion costs will result.

In order to provide a more detailed explanation of the congestion calculations from which the total congestion charges are derived, each category of congestion is defined and a table of the congestion charges or credits associated with each category is provided.

Net Congestion Bill

The net congestion bill for the Dominion Zone in North Carolina is calculated by subtracting constraint specific generating congestion credits from constraint specific load congestion payments.

Both day-ahead and balancing load congestion payments and generation congestion credits are calculated.

- **Day-ahead Load Congestion Payments.** Day-ahead load congestion payments are calculated for all cleared demand, decrement bids, and day-ahead energy sale transactions. (Decrement bids and energy sales can be thought of as scheduled load.) Day-ahead load congestion payments are calculated using load MWh and the congestion component of LMP (CLMP) for the load bus, decrement bid location, or the source of the sale transaction, as applicable.

- **Day-ahead Generation Congestion Credits.** Day-ahead generation congestion credits are calculated for all cleared generation, increment offers and day-ahead energy purchase transactions. (Increment offers and energy purchases can be thought of as scheduled generation.) Day-ahead generation congestion credits are calculated using generation MWh and the CLMP for the generator bus, increment offer location, or the sink of the purchase transaction, as applicable.

- **Balancing Load Congestion Payments.** Balancing load congestion payments are calculated for all deviations between a PJM participant's real-time load and energy sale transactions and their day-ahead cleared demand, decrement bids, and energy sale transactions. Balancing load congestion payments are calculated using MWh deviations and the real-time CLMP for each bus where a deviation from a member's day-ahead scheduled load exists.

- **Balancing Generation Congestion Credits.** Balancing generation congestion credits are calculated for all deviations between a PJM participant's real-time generation and energy purchase transactions and the day-ahead cleared generation, increment offers and energy purchase transactions. Balancing generation congestion credits are calculated using MWh deviations and the real-time CLMP for each bus where a deviation from a member's day-ahead scheduled generation exists.

Explicit Congestion Costs

Explicit congestion costs are the congestion costs associated with moving energy from one specific point to another across the transmission system. Such point to point transactions may be either internal to PJM or be import or export transactions.

- **Internal Purchases.** For internal purchases the explicit congestion costs equal the difference in CLMPs between the sink bus and source bus of the purchase multiplied by the transacted MWh. The buyer pays the congestion costs associated with internal purchases.

- **Import and Export Transactions.** For point to point and network secondary transmission customers, the Explicit congestion costs equal the difference in CLMPs between the sink bus and source bus multiplied by the transacted MWh. The transmission customer pays the congestion costs associated with an import or export transaction.

The explicit congestion costs calculated for the part of the Dominion Zone in North Carolina represent the costs associated with point to point transactions that source or sink in the part of the Dominion Zone in North Carolina. For example, if a transaction is sourced in Pennsylvania and sinks in the part of the Dominion Zone in North Carolina, the charges would be based on the MWh of the transaction multiplied by the difference between the sink CLMP and the source CLMP. The resulting congestion costs are allocated to the zone and state of the sink location, in this case of the part of the Dominion Zone in North Carolina. The sink location is the buyer's location and reflects the cost to the buyer of the internal purchase or external transaction.

Table 6 shows the combined day-ahead and balancing load congestion payments, generation congestion credits, and explicit congestion costs for the part of the Dominion Zone in North Carolina for 2017 and 2018 using both Area Based and Constraint Based methods.

Table 6 Total for the part of the Dominion Zone in North Carolina congestion costs by category: 2017 and 2018

	Congestion Costs (Millions)			
	Load Payments	Generation Credits	Explicit	Total
2017	$2.2	($1.6)	($0.0)	$3.7
2018	$2.7	($5.3)	($0.3)	$7.7

Table 7 shows the congestion costs categories separated by day-ahead and balancing to show the contributions from both the Day-Ahead and Real-Time Markets for 2017 and 2018 using both Area Based and Constraint Based methods.

Table 7 Total day-ahead and balancing for the part of the Dominion Zone in North Carolina congestion costs by category: 2017 and 2018

	Congestion Costs (Millions)								
	Day-Ahead				Balancing				
	Load Payments	Generation Credits	Explicit	Total	Load Payments	Generation Credits	Explicit	Total	Grand Total
2017	$1.9	($2.1)	$0.0	$4.1	$0.2	$0.5	($0.1)	($0.3)	$3.7
2018	$2.5	($5.7)	($0.3)	$8.0	$0.2	$0.5	$0.0	($0.3)	$7.7

Table 8 Monthly congestion costs (Dollars (Millions)) for the Dominion Zone in North Carolina: 2017 through 2018

	Congestion Costs (Millions)					
	2017			2018		
	Day-ahead	Balancing	Total	Day-ahead	Balancing	Total
Jan	$0.3	($0.1)	$0.3	$3.8	$0.2	$4.0
Feb	$0.2	($0.0)	$0.2	$0.2	$0.0	$0.2
Mar	$0.2	($0.0)	$0.2	$0.6	$0.0	$0.6
Apr	$0.2	($0.0)	$0.2	$0.2	$0.0	$0.2
May	$0.3	($0.0)	$0.2	$0.7	($0.1)	$0.6
Jun	$0.3	$0.0	$0.3	$0.5	($0.1)	$0.4
Jul	$0.3	($0.1)	$0.2	$0.3	($0.0)	$0.3
Aug	$0.2	($0.0)	$0.2	$0.3	($0.0)	$0.3
Sep	$0.7	($0.0)	$0.7	$0.5	($0.0)	$0.4
Oct	$0.2	$0.0	$0.3	$0.5	($0.1)	$0.4
Nov	$0.3	($0.0)	$0.3	$0.2	($0.1)	$0.1
Dec	$0.9	($0.1)	$0.7	$0.3	($0.1)	$0.2
Total	$4.1	($0.3)	$3.7	$8.0	($0.3)	$7.7

Table 9 lists the top 15 constraints affecting the part of the Dominion Zone in North Carolina congestion costs for 2018.

Table 9 provides the type of constraints (Line, Transformer, Flowgate, or Interface), the location of the constraints and the congestion cost for the period analyzed.[10]

Table 9 Congestion cost details for the top 15 constraints affecting the part of the Dominion Zone in North Carolina congestion costs: 2018

			Congestion Costs (Millions)								
			Day-Ahead				Balancing				
Constraint	Type	Location	Load Payments	Generation Credits	Explicit	Total	Load Payments	Generation Credits	Explicit	Total	Grand Total
AEP - DOM	Interface	500	$0.7	($0.9)	($0.1)	$1.5	$0.2	$0.3	$0.1	$0.1	$1.5
Cloverdale	Transformer	AEP	$0.3	($0.3)	($0.0)	$0.7	($0.0)	$0.0	$0.0	$0.0	$0.7
Tanners Creek - Miami Fort	Flowgate	MISO	($0.1)	($0.7)	($0.0)	$0.5	$0.0	$0.0	$0.0	$0.0	$0.5
Graceton - Safe Harbor	Line	BGE	$0.7	$0.2	$0.0	$0.5	$0.0	$0.0	($0.0)	($0.0)	$0.4
Pleasant View - Ashburn	Line	Dominion	$0.2	($0.1)	($0.0)	$0.3	$0.0	$0.0	$0.0	$0.0	$0.3
Batesville - Hubble	Flowgate	MISO	($0.1)	($0.4)	($0.1)	$0.2	($0.0)	($0.0)	$0.0	$0.0	$0.3
Conastone - Peach Bottom	Line	500	$0.2	$0.0	($0.0)	$0.2	$0.0	$0.0	($0.0)	$0.0	$0.2
5004/5005 Interface	Interface	500	($0.1)	($0.4)	($0.0)	$0.2	$0.0	$0.0	$0.0	$0.0	$0.2
Bedington - Black Oak	Interface	500	$0.1	($0.1)	($0.0)	$0.2	$0.0	$0.0	$0.0	$0.0	$0.2
AP South	Interface	500	$0.1	($0.1)	($0.0)	$0.2	$0.0	$0.0	($0.0)	($0.0)	$0.2
Conastone - Northwest	Line	BGE	$0.1	($0.0)	($0.0)	$0.1	($0.0)	($0.0)	$0.0	$0.0	$0.1
Northport - Albion	Flowgate	MISO	($0.0)	($0.2)	($0.0)	$0.1	($0.0)	($0.0)	$0.0	$0.0	$0.1
Gardners - Texas Eastern	Line	Met-Ed	($0.1)	($0.2)	($0.0)	$0.1	($0.0)	$0.0	$0.0	$0.0	$0.1
Broadford - Saltville	Line	AEP	$0.0	($0.1)	$0.0	$0.1	$0.0	$0.0	($0.0)	$0.0	$0.1
Nottingham	Other	PECO	$0.1	$0.0	$0.0	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1
Top 15 Total			$2.3	($3.1)	($0.3)	$5.1	$0.2	$0.3	$0.2	$0.1	$5.2
All Other Constraints			$0.3	($2.6)	($0.0)	$2.9	($0.0)	$0.2	($0.2)	($0.4)	$2.5
Total			$2.5	($5.7)	($0.3)	$8.0	$0.2	$0.5	$0.0	($0.3)	$7.7

Table 10 lists the top 15 constraints affecting the part of the Dominion Zone in North Carolina Congestion costs for 2018. Table 10 provides the type of constraint (Line, Transformer, Flowgate, or Interface), the location of the constraint, the congestion event hours and congestion component of LMP contributed by the constraints for the period analyzed.

10 All the interfaces and the Mid-Atlantic 500 kV system are put in the 500 category for location. The Mid-Atlantic 500 kV system includes equipment that is located in the PENELEC, PPL, BGE, PEPCO, MetEd, PECO, PSEG, JCPL, DPL and AECO zones.

Table 10 Top 15 constraints affecting the part of the Dominion Zone in North Carolina Congestion costs: 2018

			Event Hours		Congestion Component	
Constraint	Type	Location	Day-Ahead	Real-Time	Day-Ahead	Real-Time
AEP - DOM	Interface	500	720	150	$1.45	$2.10
Cloverdale	Transformer	AEP	615	99	$0.22	$0.19
Tanners Creek - Miami Fort	Flowgate	MISO	1,494	-	($0.02)	$0.00
Graceton - Safe Harbor	Line	BGE	3,361	2,042	$0.60	$0.68
Pleasant View - Ashburn	Line	Dominion	303	33	$0.08	$0.04
Batesville - Hubble	Flowgate	MISO	254	134	($0.02)	($0.04)
Conastone - Peach Bottom	Line	500	1,100	422	$0.20	$0.11
5004/5005 Interface	Interface	500	175	47	($0.10)	($0.05)
Bedington - Black Oak	Interface	500	316	52	$0.09	$0.05
AP South	Interface	500	498	37	$0.15	$0.01
Conastone - Northwest	Line	BGE	336	234	$0.11	$0.17
Northport - Albion	Flowgate	MISO	132	28	$0.03	$0.01
Gardners - Texas Eastern	Line	Met-Ed	1,308	436	$0.01	$0.05
Broadford - Saltville	Line	AEP	355	56	($0.02)	($0.04)
Nottingham	Other	PECO	1,157	-	$0.11	$0.00
Top 15 Total			12,124	3,770	$2.90	$3.28
All Other Constraints			38,259	17,499	$0.67	$0.45
Total			50,383	21,269	$3.57	$3.73

Table 11 shows the Congestion cost details of the top 15 constraints affecting the part of the Dominion Zone of North Carolina for 2017. Table 11 provides the type of constraints (Line, Transformer, Flowgate, or Interface), the location of the constraints and the congestion cost for the period analyzed.

Table 11 Congestion cost details for the top 15 constraints affecting the part of the Dominion Zone in North Carolina: 2017

			Congestion Costs (Millions)								
			Day-Ahead				Balancing				
Constraint	Type	Location	Load Payments	Generation Credits	Explicit	Total	Load Payments	Generation Credits	Explicit	Total	Grand Total
Conastone - Peach Bottom	Line	500	$0.3	$0.0	$0.0	$0.3	$0.0	$0.0	$0.0	$0.0	$0.3
AP South	Interface	500	$0.2	($0.1)	($0.0)	$0.2	($0.0)	$0.0	$0.0	($0.0)	$0.2
Roxana - Praxair	Flowgate	MISO	$0.4	$0.3	$0.1	$0.2	$0.0	$0.0	($0.0)	($0.0)	$0.2
Graceton - Safe Harbor	Line	BGE	$0.2	$0.1	($0.0)	$0.2	$0.0	$0.0	$0.0	$0.0	$0.2
Conastone - Northwest	Line	BGE	$0.1	($0.0)	($0.0)	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1
5004/5005 Interface	Interface	500	($0.1)	($0.2)	($0.0)	$0.2	$0.0	$0.1	$0.0	($0.0)	$0.1
Carson - Rawlings	Line	Dominion	$0.1	($0.0)	$0.0	$0.1	$0.0	$0.0	($0.0)	($0.0)	$0.1
AEP - DOM	Interface	500	$0.0	($0.1)	($0.0)	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1
Conastone - Otter Creek	Line	PPL	$0.2	$0.1	($0.0)	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1
Three Mile Island	Transformer	500	$0.1	($0.0)	($0.0)	$0.1	($0.0)	($0.0)	$0.0	$0.0	$0.1
Pleasant View - Ashburn	Line	Dominion	$0.1	($0.0)	($0.0)	$0.1	($0.0)	$0.0	($0.0)	($0.0)	$0.1
Bedington - Black Oak	Interface	500	$0.0	($0.0)	($0.0)	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1
Westwood	Flowgate	MISO	($0.1)	($0.2)	$0.0	$0.1	$0.0	$0.0	($0.0)	($0.0)	$0.1
Alpine - Belvidere	Flowgate	MISO	($0.0)	($0.1)	($0.0)	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1
Brunner Island - Yorkanna	Line	Met-Ed	$0.1	($0.0)	($0.0)	$0.1	($0.0)	($0.0)	$0.0	$0.0	$0.1
Top 15 Total			$1.7	($0.4)	$0.0	$2.1	$0.1	$0.2	$0.1	($0.0)	$2.1
All Other Constraints			$0.3	($1.7)	$0.0	$2.0	$0.1	$0.3	($0.1)	($0.3)	$1.7
Total			$1.9	($2.1)	$0.0	$4.1	$0.2	$0.5	($0.1)	($0.3)	$3.7

Table 12 lists the top 15 constraints affecting the part of the Dominion Zone in North Carolina congestion costs for 2017. Table 12 provides the type of constraints (Line, Transformer, Flowgate, or Interface), the location of the constraints, the congestion event hours and congestion component of LMP contributed by the constraints for the period analyzed.

Table 12 Top 15 constraints affecting the part of the Dominion Zone in North Carolina Congestion costs: 2017

			Event Hours		Congestion Component	
Constraint	Type	Location	Day-Ahead	Real-Time	Day-Ahead	Real-Time
Conastone - Peach Bottom	Line	500	3,159	840	$0.24	$0.22
AP South	Interface	500	1,315	75	$0.16	$0.10
Roxana - Praxair	Flowgate	MISO	1,734	289	$0.06	$0.04
Graceton - Safe Harbor	Line	BGE	3,118	1,149	$0.20	$0.24
Conastone - Northwest	Line	BGE	975	228	$0.09	$0.09
5004/5005 Interface	Interface	500	173	105	($0.06)	($0.11)
Carson - Rawlings	Line	Dominion	720	231	$0.08	$0.07
AEP - DOM	Interface	500	948	32	$0.08	$0.07
Conastone - Otter Creek	Line	PPL	1,336	868	$0.13	$0.18
Three Mile Island	Transformer	500	540	86	$0.05	$0.04
Pleasant View - Ashburn	Line	Dominion	473	85	$0.08	$0.11
Bedington - Black Oak	Interface	500	1,215	61	$0.04	$0.03
Westwood	Flowgate	MISO	2,182	198	($0.01)	($0.00)
Alpine - Belvidere	Flowgate	MISO	339	-	($0.00)	$0.00
Brunner Island - Yorkanna	Line	Met-Ed	681	74	$0.04	$0.01
Top 15 Total			18,908	4,321	$1.18	$1.08
All Other Constraints			53,734	16,159	$0.31	$0.18
Total			72,642	20,480	$1.48	$1.26

Table 13 shows the Congestion Cost details of the top 15 constraints affecting the part of the Dominion Zone in North Carolina for 2016. Table 13 provides the type of constraints (Line, Transformer, Flowgate, or Interface), the location of the constraints and the congestion cost for the period analyzed.

Table 13 Congestion Cost details for the top 15 constraints affecting the part of the Dominion Zone in North Carolina: 2016

			Congestion Costs (Millions)								
			Day-Ahead				Balancing				
Constraint	Type	Location	Load Payments	Generation Credits	Explicit	Total	Load Payments	Generation Credits	Explicit	Total	Grand Total
Conastone - Northwest	Line	BGE	$1.1	$0.1	($0.0)	$1.0	$0.0	($0.0)	$0.1	$0.1	$1.1
Graceton	Transformer	BGE	$0.4	($0.2)	($0.0)	$0.6	($0.0)	($0.0)	$0.0	$0.0	$0.7
Bagley - Graceton	Line	BGE	$0.6	$0.1	($0.0)	$0.6	$0.0	($0.0)	$0.0	$0.1	$0.6
Bremo	Transformer	Dominion	($0.1)	($0.5)	$0.0	$0.4	($0.0)	($0.0)	$0.0	$0.0	$0.4
Conastone - Peach Bottom	Line	500	$0.3	($0.0)	$0.0	$0.3	$0.0	$0.0	$0.0	$0.0	$0.3
Cherry Valley	Flowgate	MISO	($0.0)	($0.3)	($0.0)	$0.3	$0.0	$0.0	$0.0	$0.0	$0.3
East Danville - Banister	Line	AEP	$0.0	($0.2)	$0.0	$0.2	($0.0)	($0.0)	$0.0	$0.0	$0.2
AP South	Interface	500	$0.2	($0.1)	($0.0)	$0.2	$0.0	$0.0	$0.0	($0.0)	$0.2
Meadow Brook - Strasburg	Line	APS	$0.3	$0.2	($0.0)	$0.2	($0.0)	($0.0)	$0.0	$0.0	$0.2
Mercer IP - Galesburg	Flowgate	MISO	($0.1)	($0.3)	($0.1)	$0.2	($0.0)	$0.0	$0.0	($0.0)	$0.2
Kanawha River - Matt Funk	Line	AEP	$0.0	($0.2)	($0.0)	$0.2	($0.0)	$0.0	($0.0)	($0.1)	$0.1
Bedington - Black Oak	Interface	500	$0.1	($0.1)	($0.0)	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1
Dixon - McGirr Rd	Flowgate	MISO	($0.0)	($0.2)	($0.0)	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1
Byron - Cherry Valley	Flowgate	MISO	($0.0)	($0.2)	$0.0	$0.1	$0.0	$0.0	$0.0	$0.0	$0.1
AEP - DOM	Interface	500	$0.0	($0.1)	$0.0	$0.1	$0.0	($0.0)	$0.0	$0.0	$0.1
Top 15 Total			$2.7	($1.9)	($0.1)	$4.5	$0.0	($0.0)	$0.1	$0.2	$4.6
All Other Constraints			$0.3	($2.1)	$0.2	$2.6	($0.1)	$0.3	($0.4)	($0.7)	$1.9
Total			$3.1	($4.0)	$0.1	$7.1	($0.0)	$0.2	($0.3)	($0.5)	$6.6

Table 14 lists the top 15 constraints affecting the part of the Dominion Zone in North Carolina congestion costs for 2016. Table 14 provides the type of constraint (Line, Transformer, Flowgate, or Interface), the location of the constraint, the congestion event hours and congestion component of LMP contributed by the constraint for the period analyzed.

Table 14 Top 15 constraints affecting the part of the Dominion Zone in North Carolina Congestion costs: 2016

			Event Hours		Congestion Component	
Constraint	Type	Location	Day-Ahead	Real-Time	Day-Ahead	Real-Time
Conastone - Northwest	Line	BGE	2,776	1,840	$0.76	$0.80
Graceton	Transformer	BGE	3,117	1,297	$0.37	$0.32
Bagley - Graceton	Line	BGE	3,313	1,685	$0.49	$0.51
Bremo	Transformer	Dominion	1,465	241	($0.04)	($0.03)
Conastone - Peach Bottom	Line	500	2,407	693	$0.17	$0.13
Cherry Valley	Flowgate	MISO	1,329	-	($0.01)	$0.00
East Danville - Banister	Line	AEP	3,643	20	($0.08)	($0.01)
AP South	Interface	500	1,076	14	$0.13	$0.01
Meadow Brook - Strasburg	Line	APS	1,055	97	$0.04	$0.07
Mercer IP - Galesburg	Flowgate	MISO	3,510	1,115	$0.01	$0.00
Kanawha River - Matt Funk	Line	AEP	275	107	$0.14	$0.23
Bedington - Black Oak	Interface	500	1,515	105	$0.06	$0.03
Dixon - McGirr Rd	Flowgate	MISO	1,779	-	($0.01)	$0.00
Byron - Cherry Valley	Flowgate	MISO	298	-	($0.01)	$0.00
AEP - DOM	Interface	500	1,604	6	$0.09	$0.05
Top 15 Total			29,162	7,220	$2.12	$2.11
All Other Constraints			51,472	17,329	($0.10)	($0.36)
Total			80,634	24,549	$2.02	$1.76

ARR/FTR as a Congestion Offset in the Dominion Zone in North Carolina

ARRs are allocated to zonal load based on historical generation to load transmission paths, in many cases based on pre 1999 information. ARRs are allocated within zones based on zonal base load (Stage 1A) and zonal peak loads (other Stages). ARR revenue is the result of the prices that result from the sale of FTRs through the FTR auctions. ARR revenue for each zone is the revenue for the ARRs that sink in each zone.

Congestion paid by load in a zone is the total difference between what the zonal load pays in congestion charges net of payments to the generation that serves the zonal load.

Table 15 shows the congestion offsets paid to load in the Dominion Zone in North Carolina: the allocation of ARR revenue; self scheduled FTR revenue; and the allocation of end of planning year surplus. Table 15 also shows payments by load in the Dominion Zone in North Carolina: the allocation of balancing congestion; the allocation of M2M payments. The total offset available to load, which is the revenue load receives to offset their congestion charges, is the sum of all of those credits and charges.

Table 15 shows day-ahead congestion and balancing congestion paid by load in Dominion Zone in North Carolina, plus the allocation of M2M charges.[11]

The zonal offset percentage shown in Table 15 is the sum of the congestion related revenues (offset) paid to load in Dominion Zone in North Carolina divided by the total congestion payment made by load in Dominion Zone in North Carolina, including M2M payments.

Table 15 Dominion Zone in North Carolina ARR and FTR total congestion offset (in millions) for ARR holders: 2016/2017 and 2017/2018 planning period <<NC Offset.xlsx FINAL>>

Planning Period	ARR Credits	FTR Credits	Balancing+ M2M Charge	Surplus Allocation	Total Offset	Day Ahead Congestion	Balancing Congestion	M2M Payments	Total Congestion	Offset
2016/2017	$ 0.01	$ 2.39	$ (0.64)	$ 0.01	$ 1.76	4.98604	-0.45181	$ (0.27)	4.26672346	41.3%
2017/2018	$ 0.01	$ 1.50	$ (0.63)	$ 0.04	$ 0.91	8.25954	-0.09879	$ (0.51)	7.65330915	11.9%

The total congestion offset paid to load in Dominion Zone in North Carolina was 41.3 percent of congestion costs in the 2016/2017 Planning Period and 11.9 percent in the 2017/2018 Planning Period. The amount of the offset varies significantly by zone and by bus. The offsets are a function of the assignment of ARRs and the valuation of ARRs in the FTR auctions. The results shown in Table 15 illustrate the fundamental issues with the FTR/ARR construct in PJM. If ARRs were assigned correctly, based on actual zonal congestion, and if balancing congestion were appropriately included in total congestion, the zonal offsets to load should equal zonal congestion payments by load.

Conclusion

Total congestion charges, using constraint based metrics, increased from 2017 to 2018 as a result of the high congestion component of LMP in January 2018 (Table 3 and Table 4). *Congestion Definitions*

[11] See *2018 State of the Market Report* for PJM, Section 11: Congestion and Marginal Losses.

Table 16 Congestion Definitions

Congestion Category	Calculation
Day-Ahead Load Congestion Payments	Day-Ahead Demand MWh * Day-Ahead CLMP
Day-Ahead Generation Congestion Credits	Day-Ahead Supply MWh * Day-Ahead CLMP
Day-Ahead Net Congestion Bill	Day-Ahead Load Congestion Payments - Day-Ahead Generation Congestion Credits
Day-Ahead Explicit Congestion Costs	Day-Ahead Transaction MW * (Day-Ahead Sink CLMP - Day-Ahead Source CLMP)
Day-Ahead Total Congestion Costs	Day-Ahead Load Congestion Payments - Day-Ahead Generation Congestion Credits + Day-Ahead Explicit Congestion Costs
Balancing Load Congestion Payments	Balancing Demand MWh * Real-Time CLMP
Balancing Generation Congestion Credits	Balancing Supply MWh * Real-Time CLMP
Balancing Net Congestion Bill	Balancing Load Congestion Payments - Balancing Generation Congestion Credits
Balancing Explicit Congestion Costs	Balancing Transaction MW * (Real-Time Sink CLMP - Real-Time Source CLMP)
Balancing Total Congestion Costs	Balancing Load Congestion Payments - Balancing Generation Congestion Credits + Balancing Explicit Congestion Costs
Total Congestion Costs	Day-Ahead Total Congestion Costs + Balancing Total Congestion Costs

MWh Category	Definition
Day-Ahead Demand MWh	Cleared Demand, Decrement Bids, Energy Sale Transactions
Day-Ahead Supply MWh	Cleared Generation, Increment Bids, Energy Purchase Transactions
Real-Time Demand MWh	Load and Energy Sale Transactions
Real-Time Supply MWh	Generation and Energy Purchase Transactions
Balancing Demand MWh	Real-Time Demand MWh - Day-Ahead Demand MWh
Balancing Supply MWh	Real-Time Supply MWh - Day-Ahead Supply MWh