

Operations Performance Metrics Monthly Report



July 2018 Report

Operations & Reliability Department New York Independent System Operator

Prepared by NYISO Operations Analysis and Services, based on settlements initial invoice data collected on or before August 8, 2018.

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July 2018 Operations Performance Highlights

- Peak load of 31,293 MW occurred on 07/02/2018 HB 15
- All-time summer capability period peak load of 33,956 MW occurred on 7/19/2013 HB 16
- 22 hours of Thunder Storm Alerts were declared
- 0 hours of NERC TLR level 3 curtailment
- EDRP/SCR resources activated in Zone J on 7/2/2018 from HB13 to HB18.
- The outlier maximum hourly Load Forecast Error (MW) occurred on 7/17/2018 HB15 and is caused by thunderstorms reducing actual load.
- The following table identifies the estimated production cost savings associated with the Broader Regional Market initiatives.

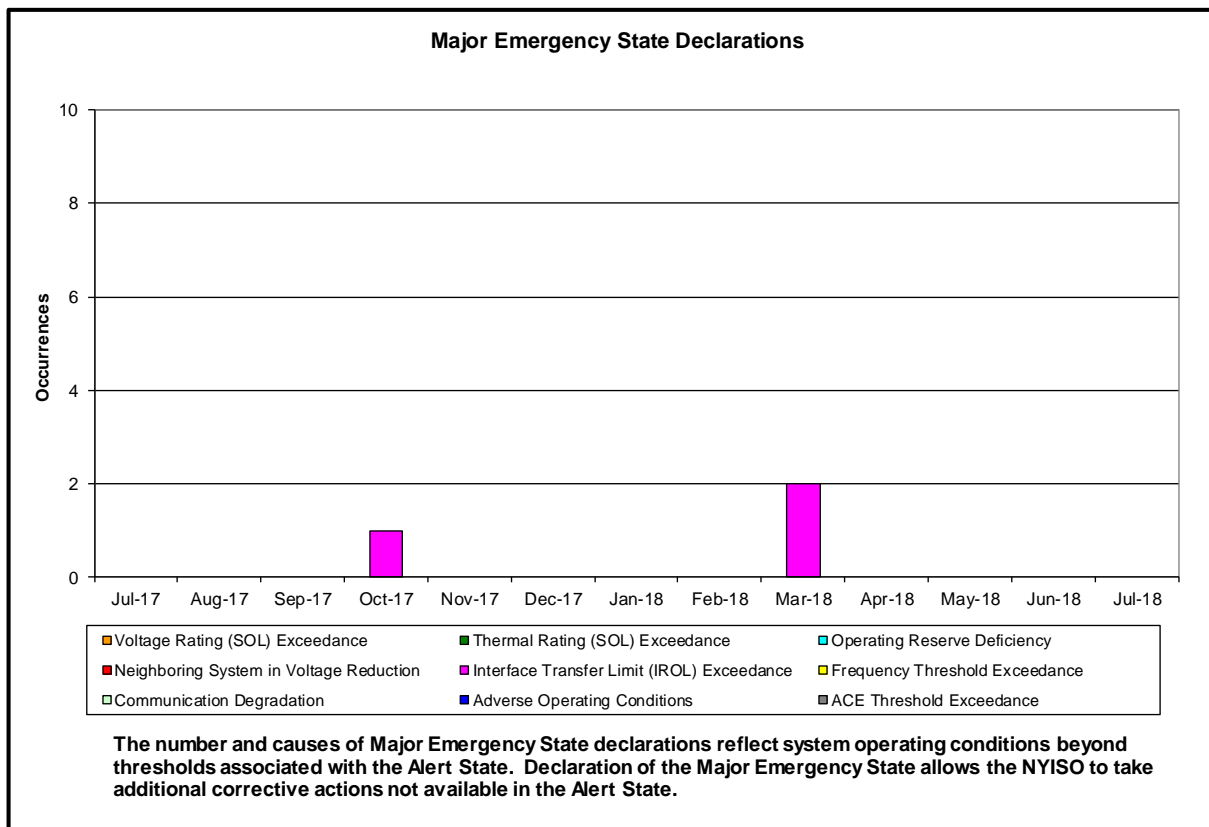
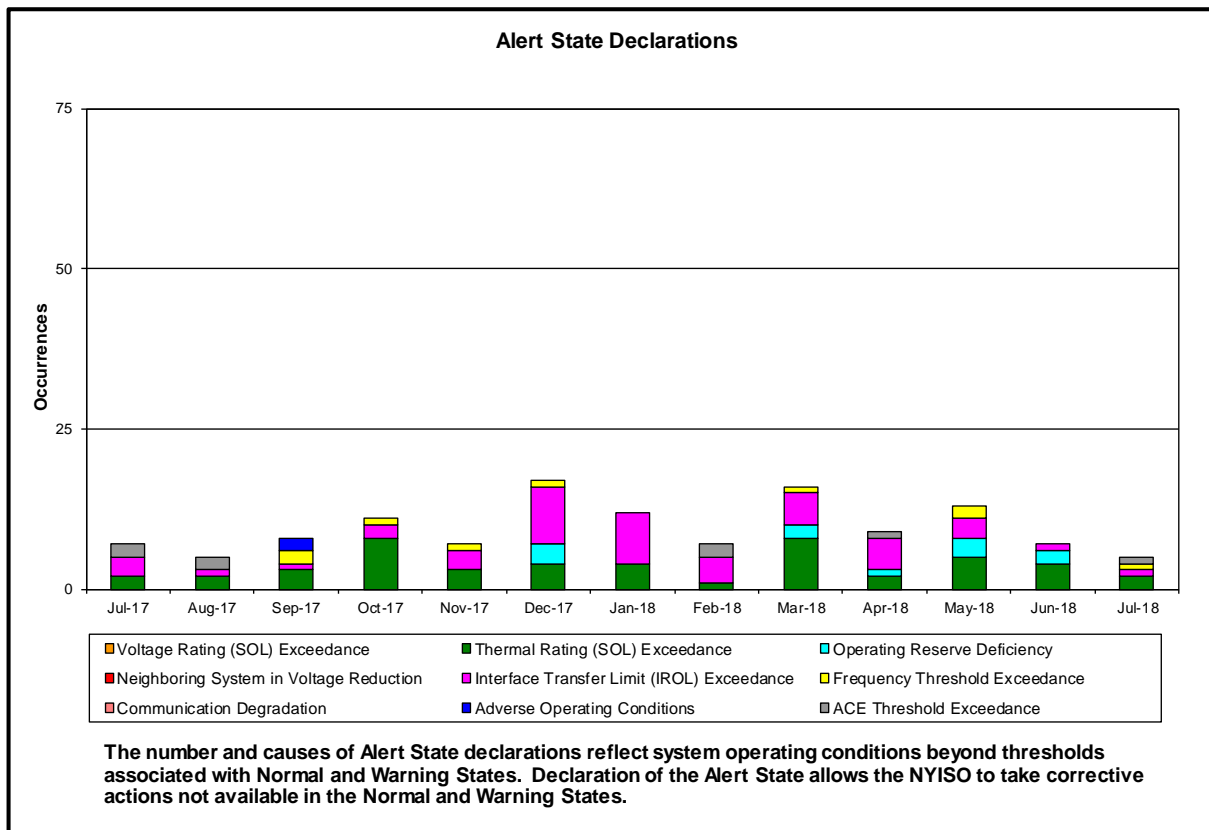
| | Current Month Value (\$M) | Year-to-Date Value (\$M) |
|--|---------------------------|--------------------------|
| NY Savings from PJM-NY Congestion Coordination | \$0.34 | \$9.24 |
| NY Savings from PJM-NY Coordinated Transaction Scheduling | (\$0.09) | \$0.66 |
| NY Savings from NE-NY Coordinated Transaction Scheduling | (\$0.23) | (\$0.92) |
| Total NY Savings | \$0.02 | \$8.98 |
| Regional Savings from PJM-NY Coordinated Transaction Scheduling | \$0.27 | \$1.73 |
| Regional Savings from NE-NY Coordinated Transaction Scheduling | \$0.10 | \$0.47 |
| Total Regional Savings | \$0.37 | \$2.20 |

- Statewide uplift cost monthly average was (\$0.57)/MWh
- The following table identifies the Monthly ICAP Spot Market prices and the price delta.

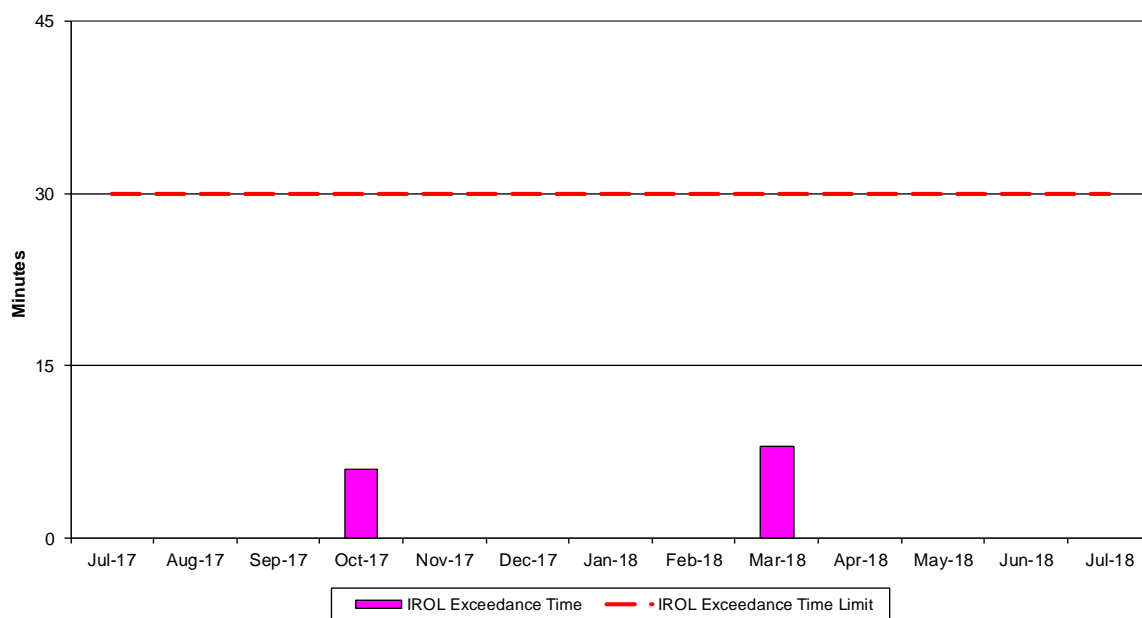
| Spot Auction Price Results | NYCA | Lower Hudson Valley Zones | New York City Zone | Long Island Zone |
|----------------------------|----------|---------------------------|--------------------|------------------|
| August 2018 Spot Price | \$3.88 | \$9.58 | \$9.58 | \$6.68 |
| July 2018 Spot Price | \$4.22 | \$10.16 | \$10.16 | \$6.68 |
| Delta | (\$0.34) | (\$0.58) | (\$0.58) | \$0.00 |

- NYC - Price decrease by \$0.58 due to an increase in Generation UCAP Available
- LHV - Price decrease by \$0.58 due to an increase in Generation UCAP Available
- NYCA - Price decrease by \$0.34 due to an increase in Generation UCAP Available and a reduction in Exports

Reliability Performance Metrics

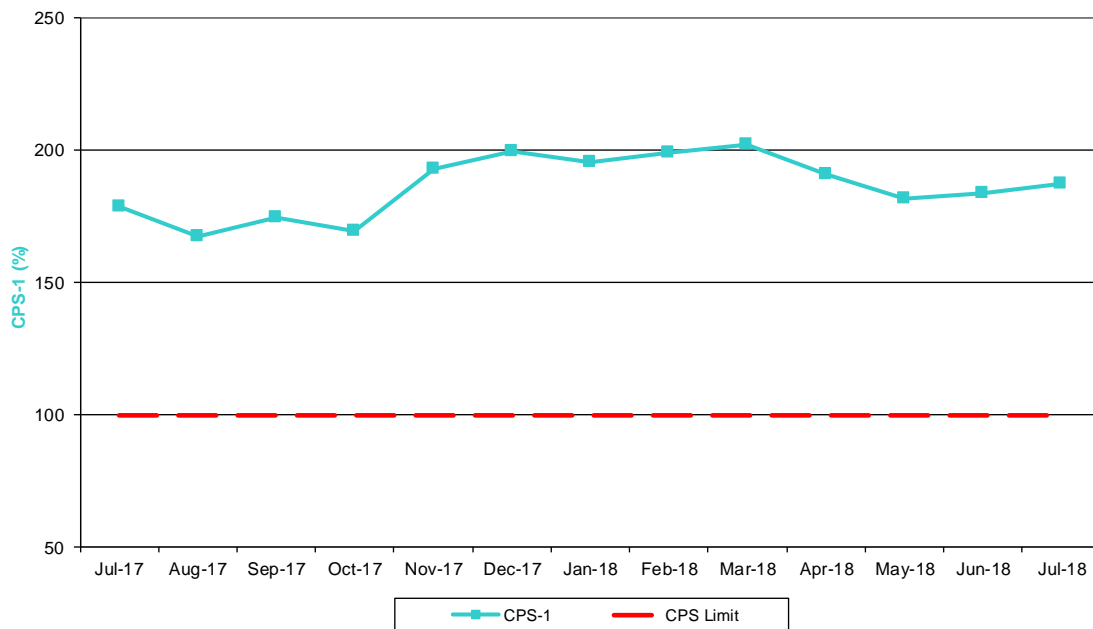


NERC IROL Time Over Limit



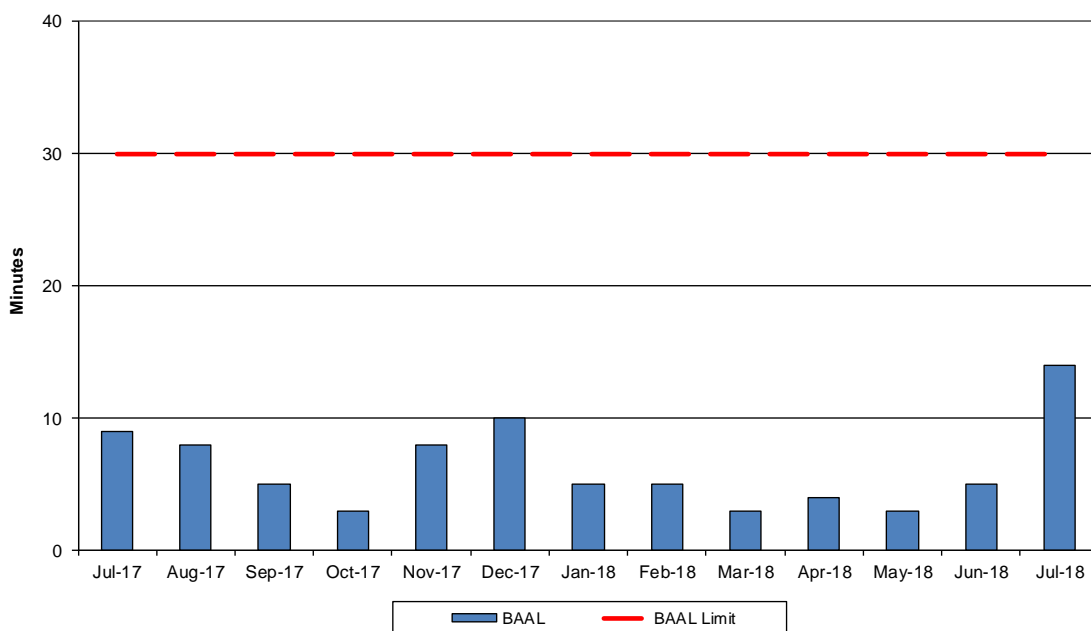
For IROL exceedances leading to Major Emergency State declarations, the maximum IROL exceedance time is identified. IROL exceedances of less than thirty minutes are considered NERC compliant.

NERC Control Performance Standards



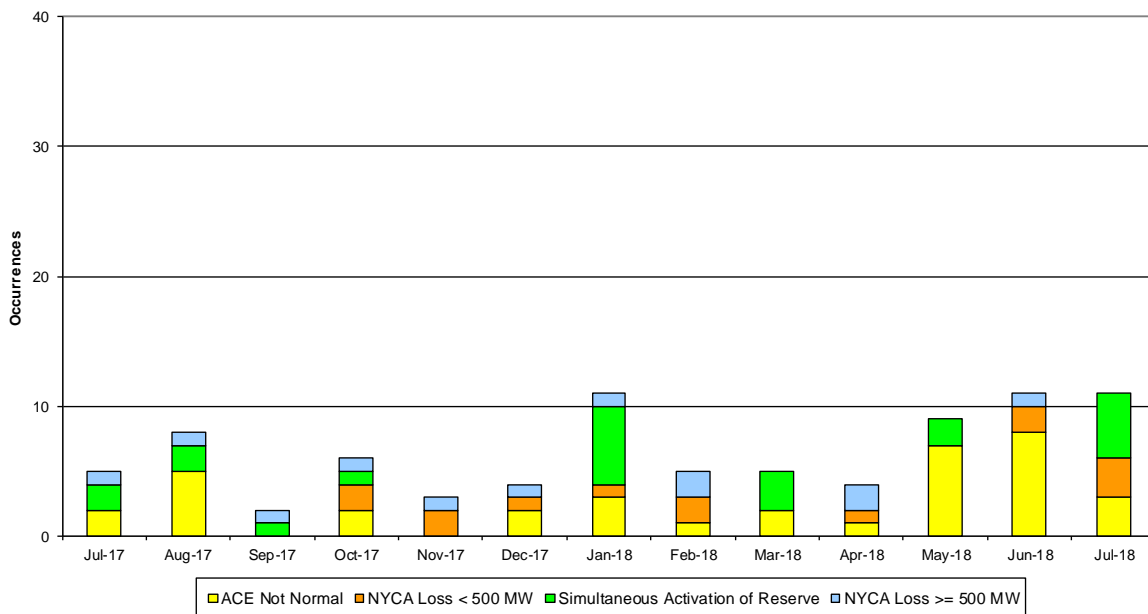
The value of NERC Control Performance Standards (CPS-1) is an indicator of the NYISO Area resource and demand balancing. Values exceeding the identified threshold are NERC compliant.

NERC Balancing Authority ACE Limit Standard



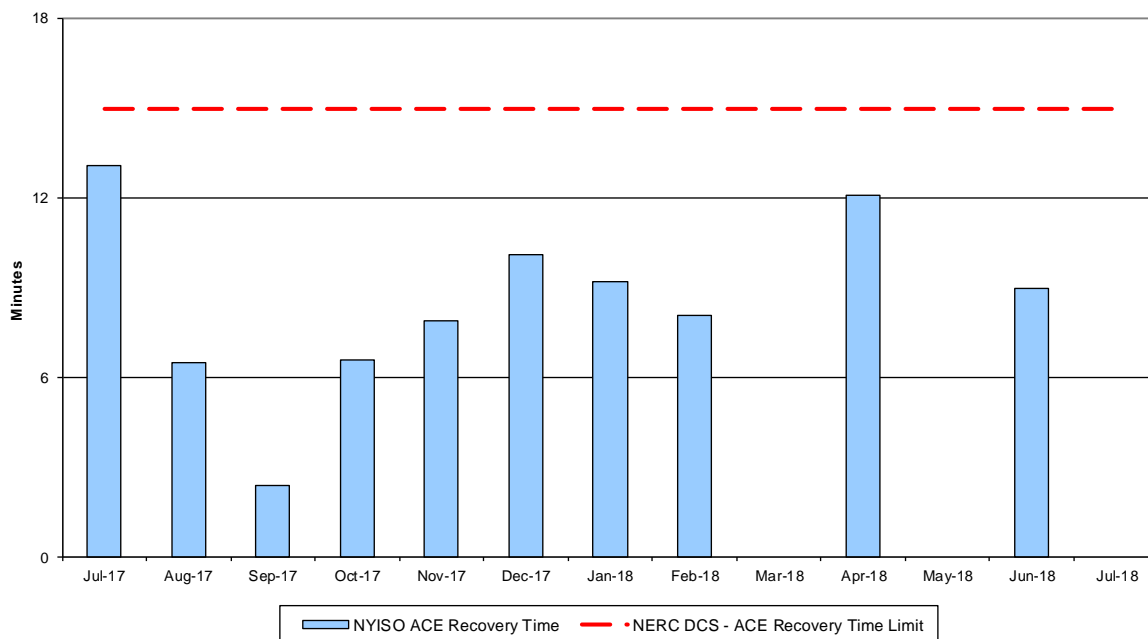
The amount of time the clock-minute average ACE exceeds the clock-minute Balancing Authority ACE Limit (BAAL) is an indicator of the NYISO Area resource and demand balancing. The maximum BAAL exceedance time is identified. BAAL exceedances of less than 30 consecutive clock-minutes are NERC compliant.

Reserve Activations



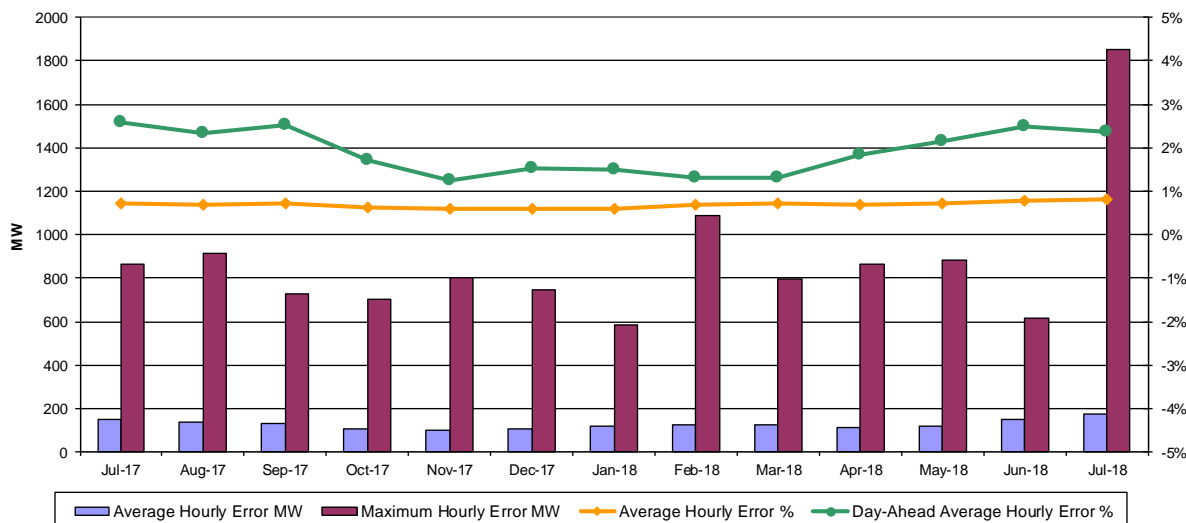
NYISO Reserve Activations are indicators of the need to respond to unexpected operational conditions within the NYISO Area or to assist a neighboring Area (Simultaneous Activation of Reserves) by activating an immediate resource and demand balancing operation.

DCS Event Time to ACE Recovery



For NYISO initiated Reportable Disturbances, the maximum ACE recovery time is identified. Recovery times of less than 15 minutes are considered NERC compliant.

Load Forecast Performance

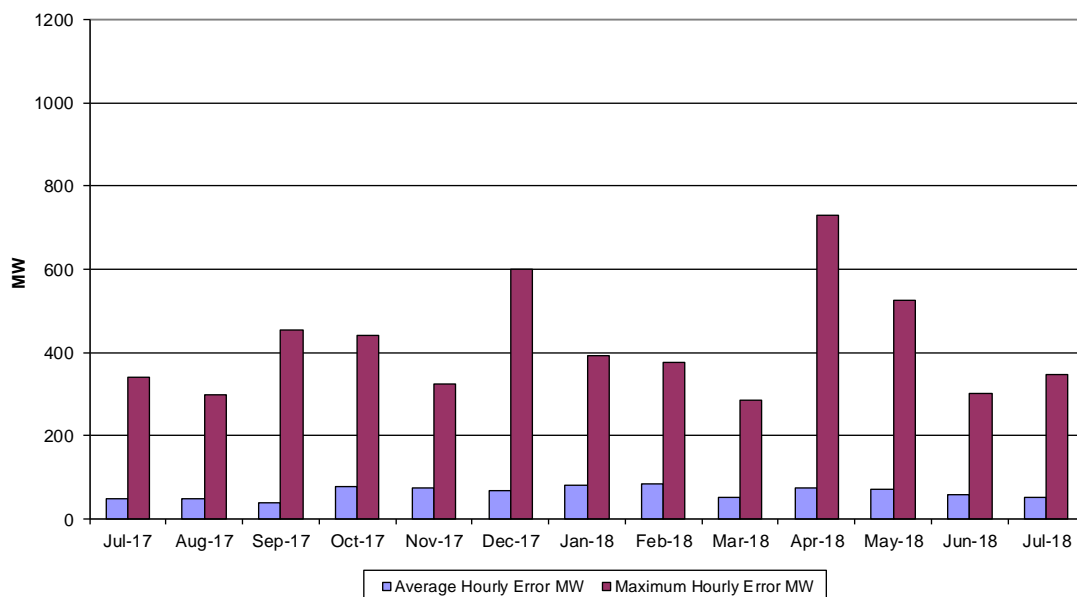


Hourly Error MW - Absolute value of the difference between the hourly average actual load demand and the average hour ahead forecast load demand.

Average Hourly Error % - Average value of the ratio of hourly average error magnitude to hourly average actual load demand.

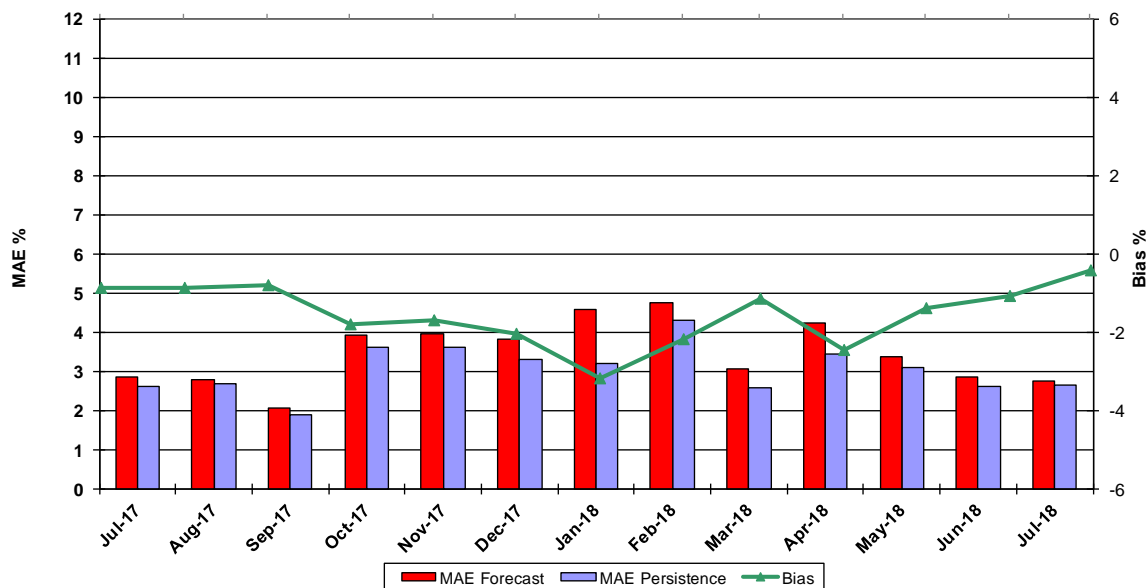
Day-Ahead Average Hourly Error % - Average across all hours of the month of the absolute value of the difference between actual load demand and the Day-Ahead forecast load demand, divided by the actual load demand.

Wind Forecast Performance Hour Ahead MW Error

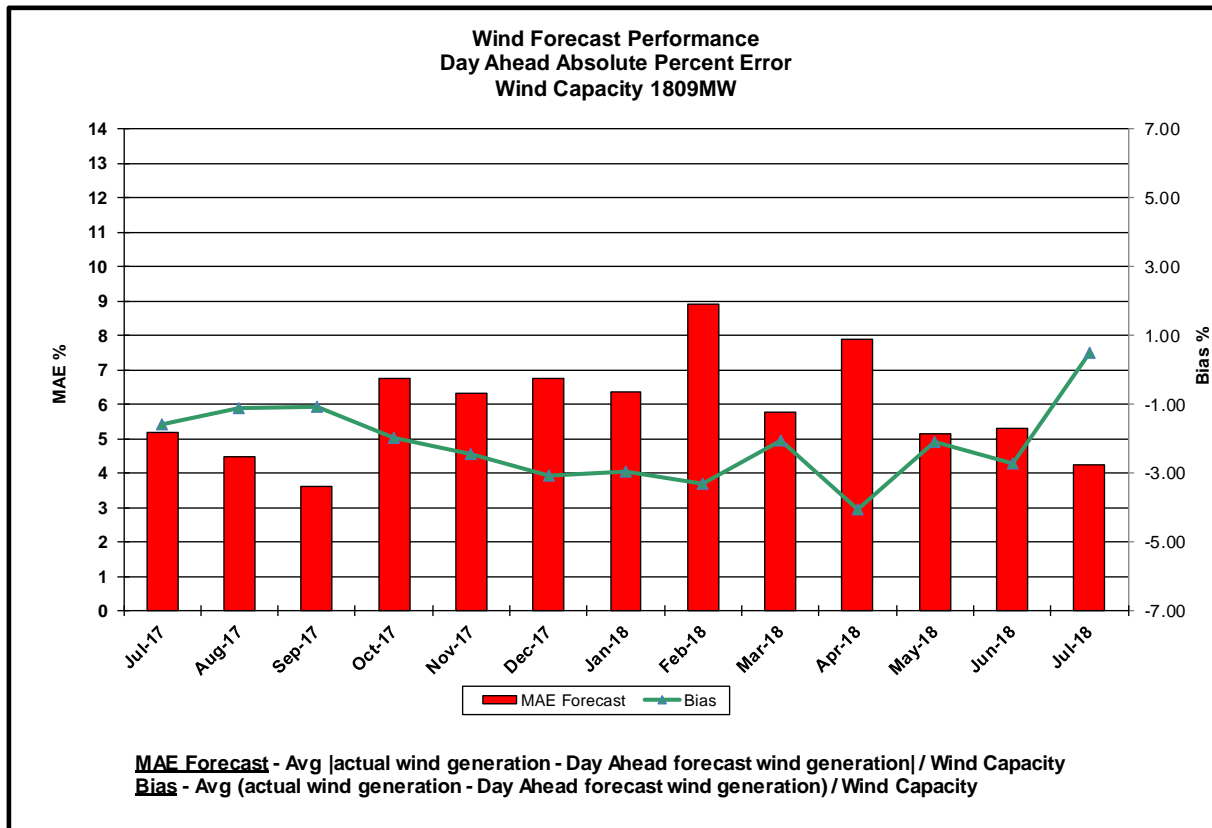
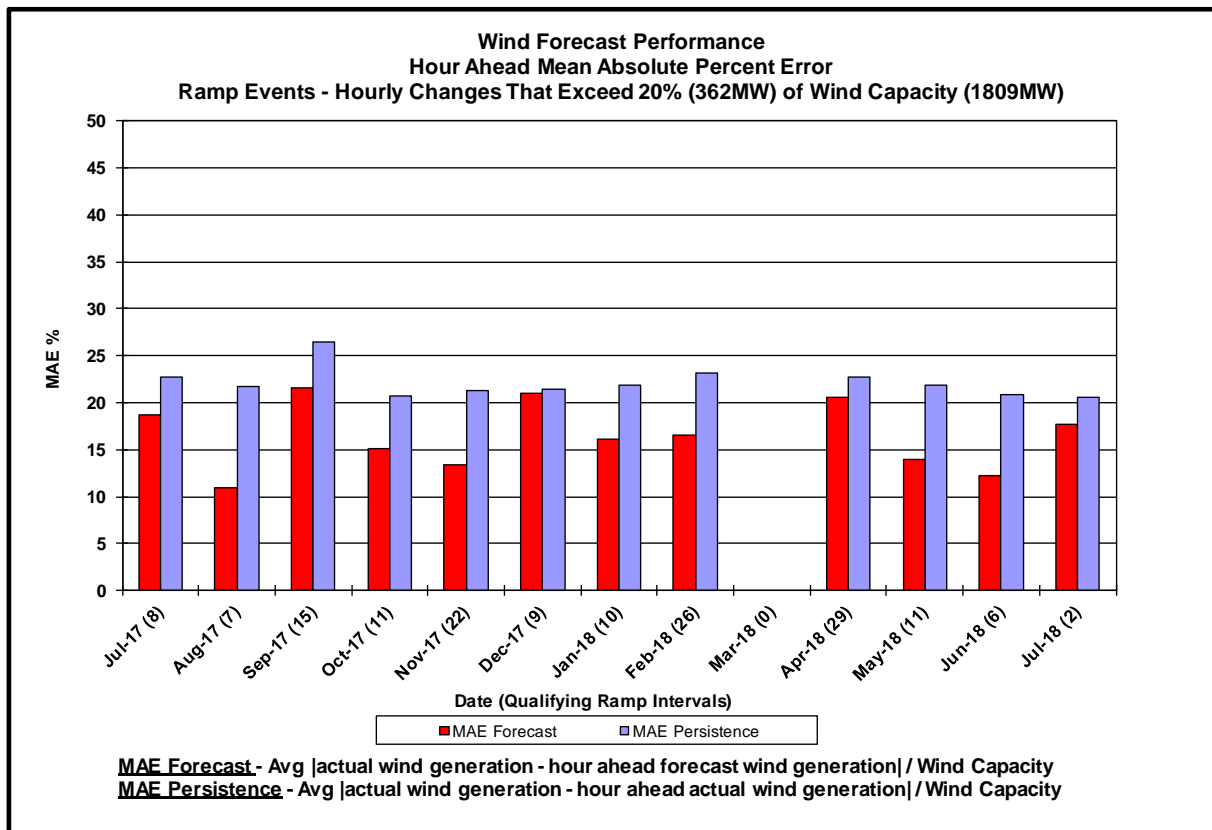


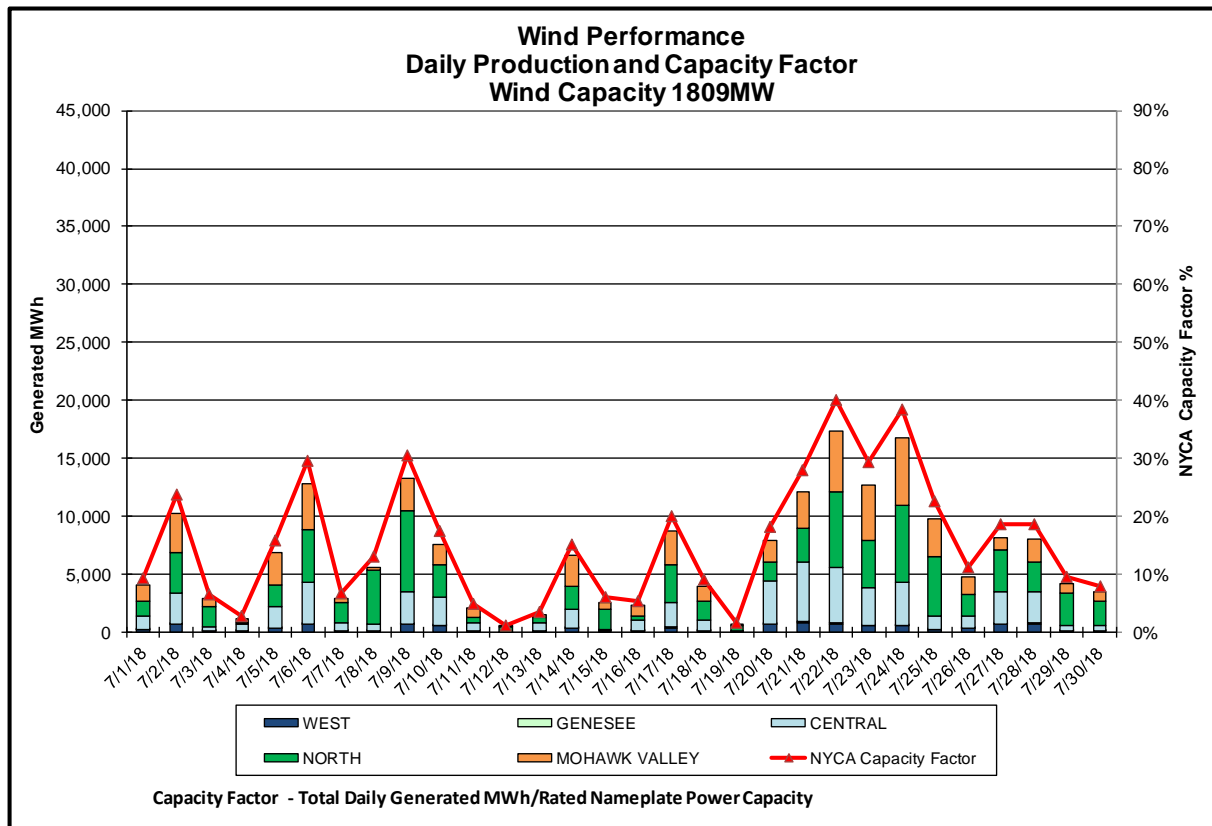
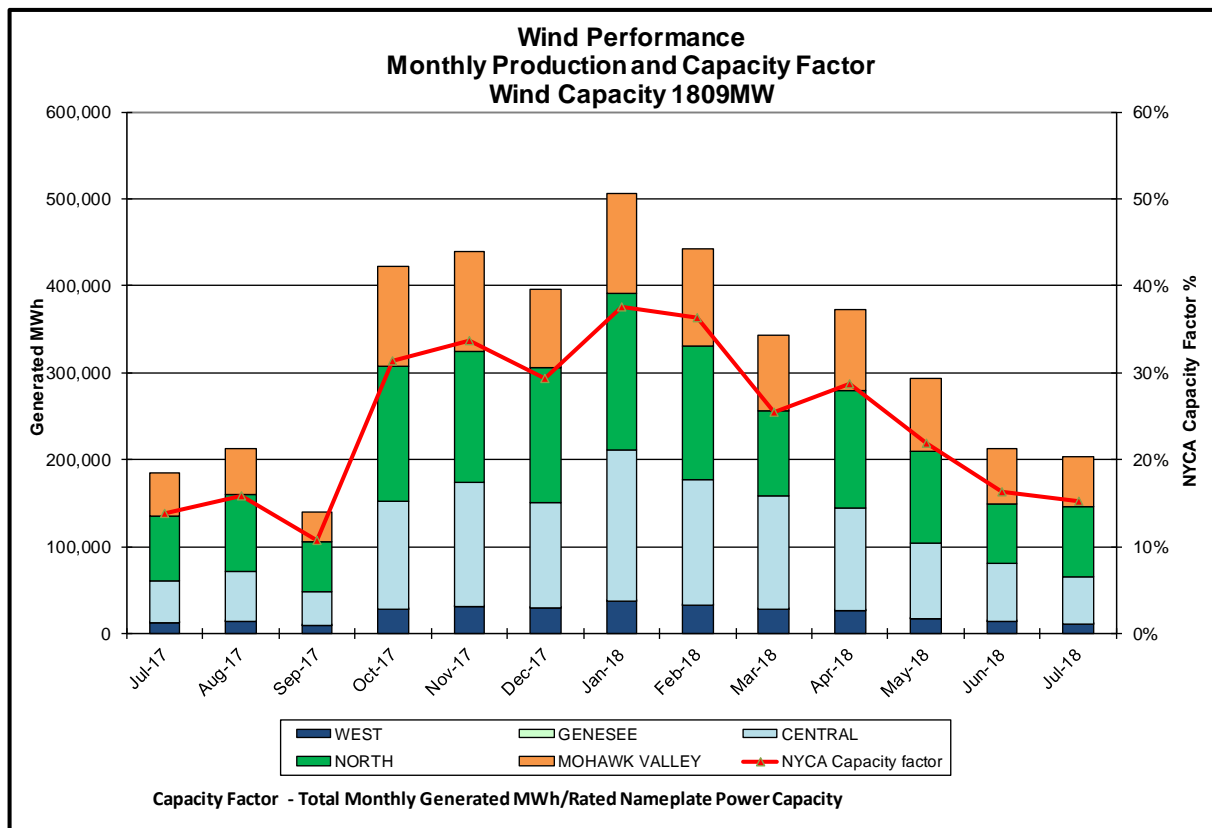
Hourly Error MW - Absolute value of the difference between the hourly average actual wind generation and the average hour ahead forecast wind generation.

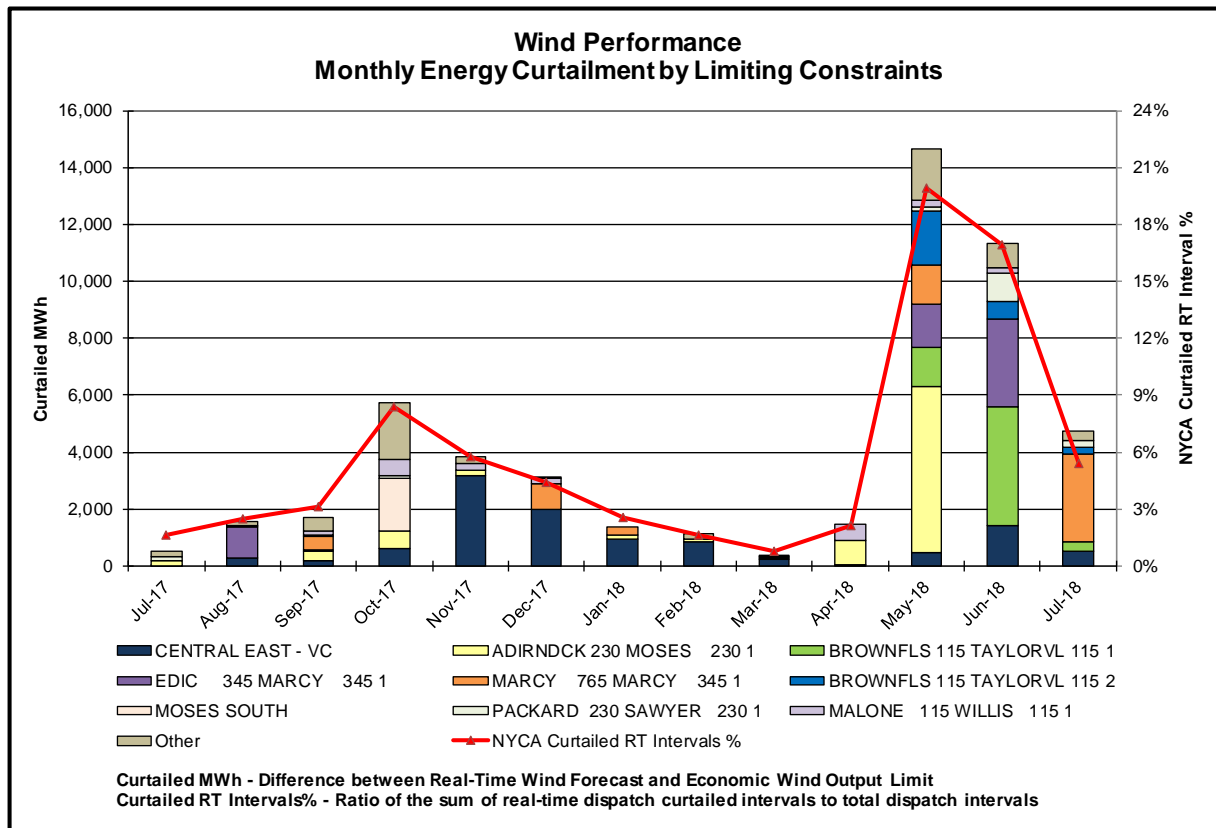
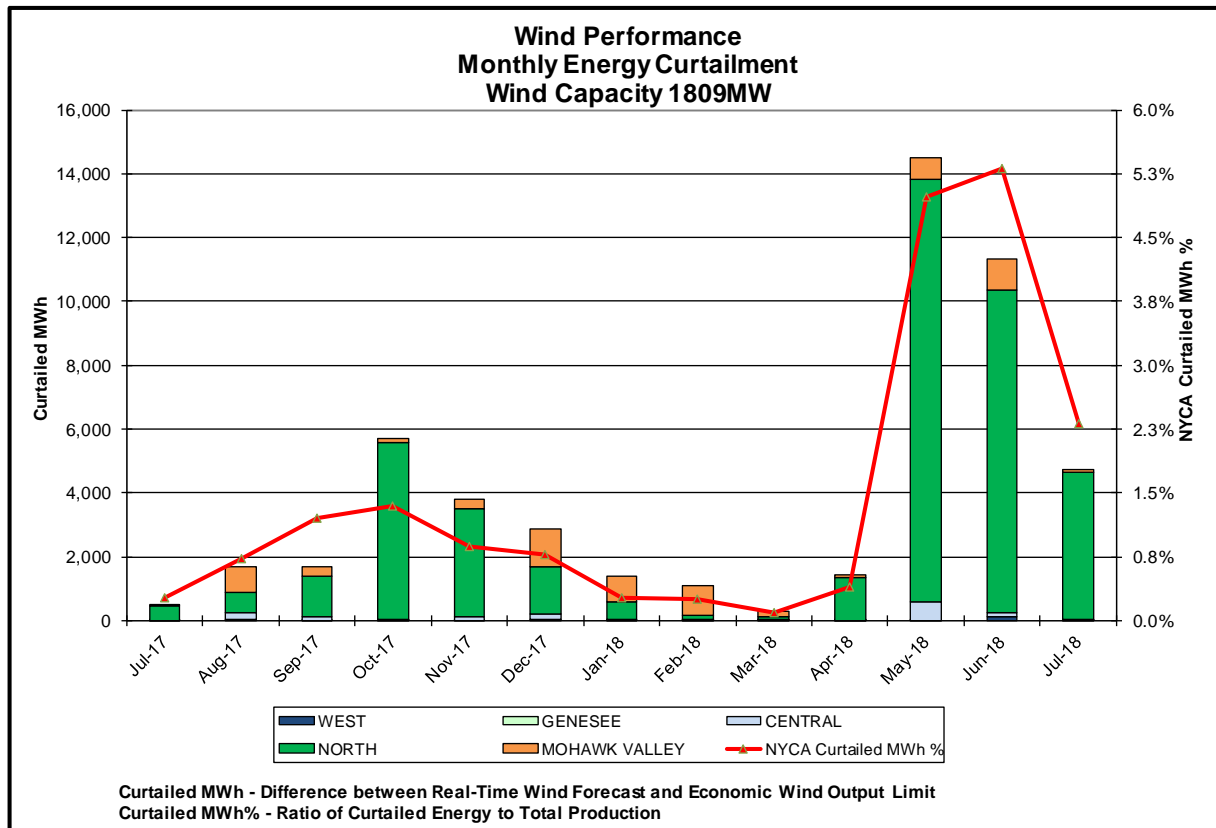
Wind Forecast Performance Hour Ahead Percent Error Wind Capacity 1809MW

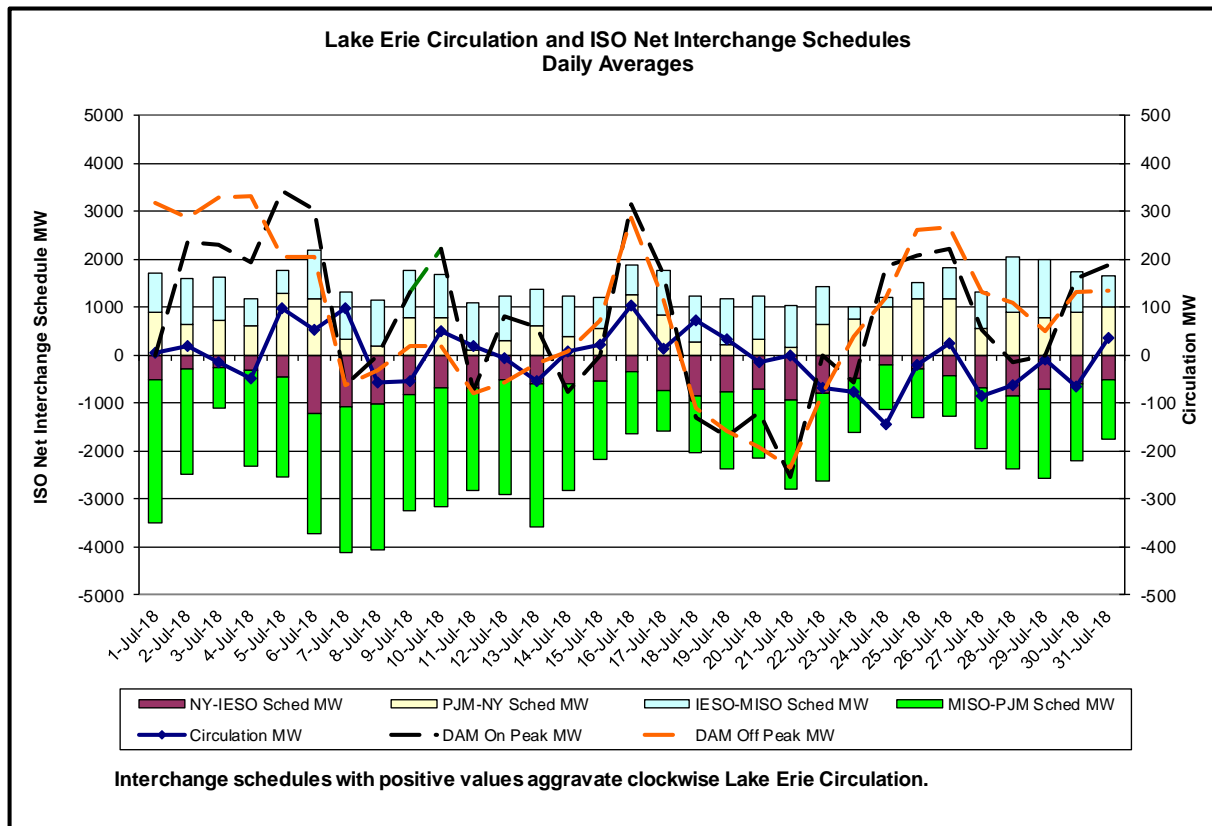
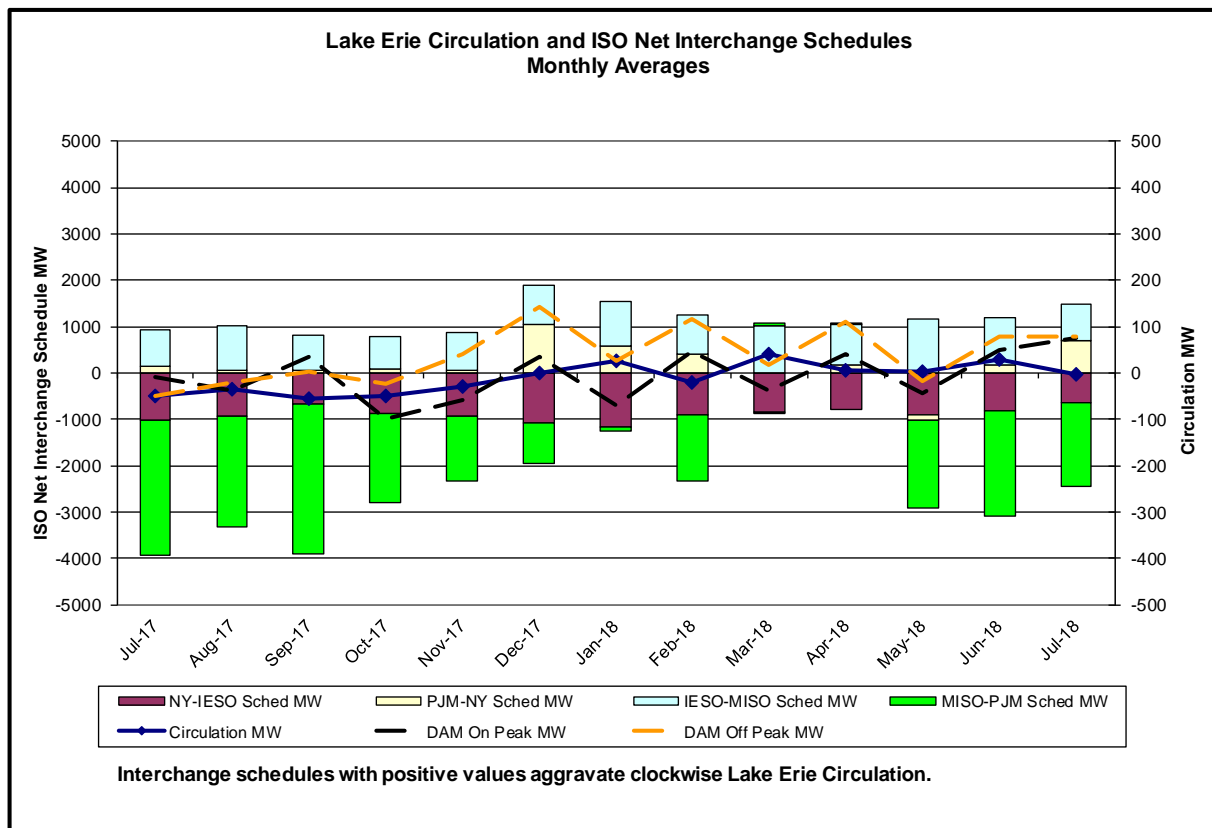


MAE Forecast - Avg [actual wind generation - hour ahead forecast wind generation] / Wind Capacity
MAE Persistence - Avg [actual wind generation - hour ahead actual wind generation] / Wind Capacity
Bias - Avg (actual wind generation - hour ahead forecast wind generation) / Wind Capacity

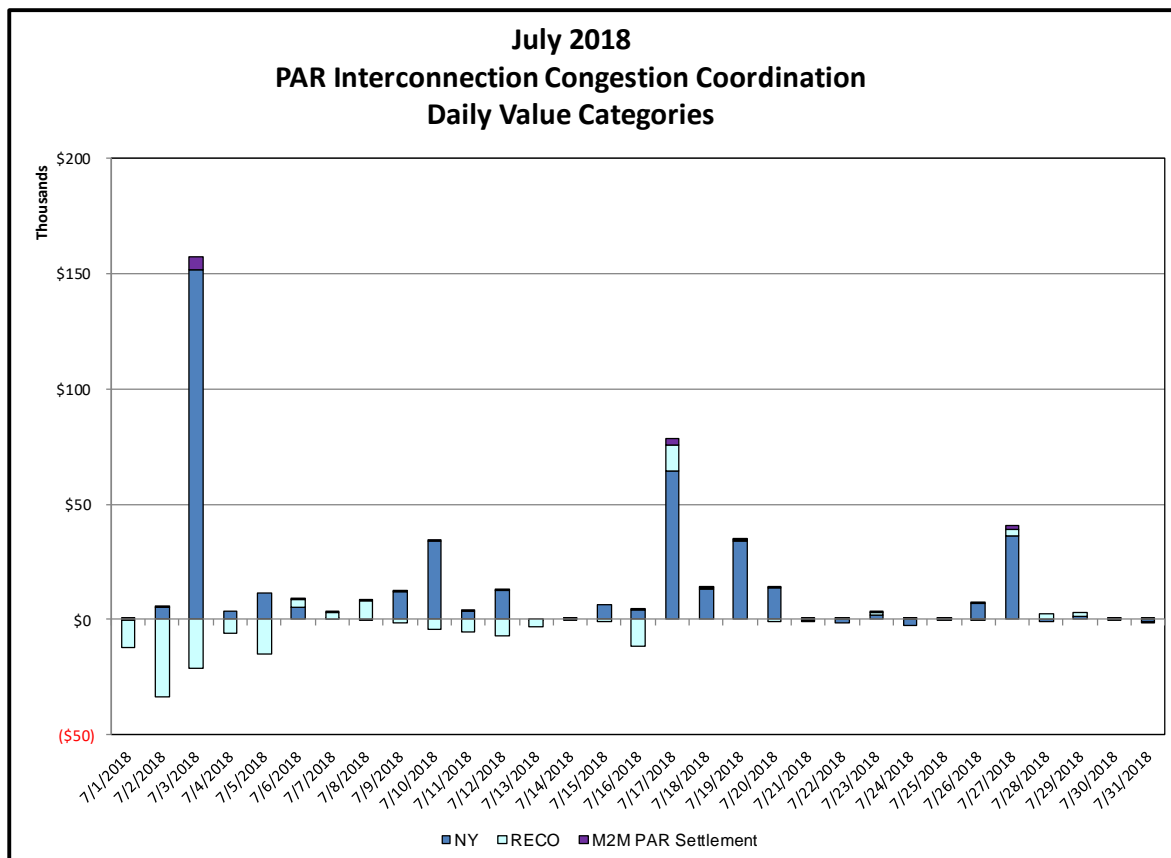
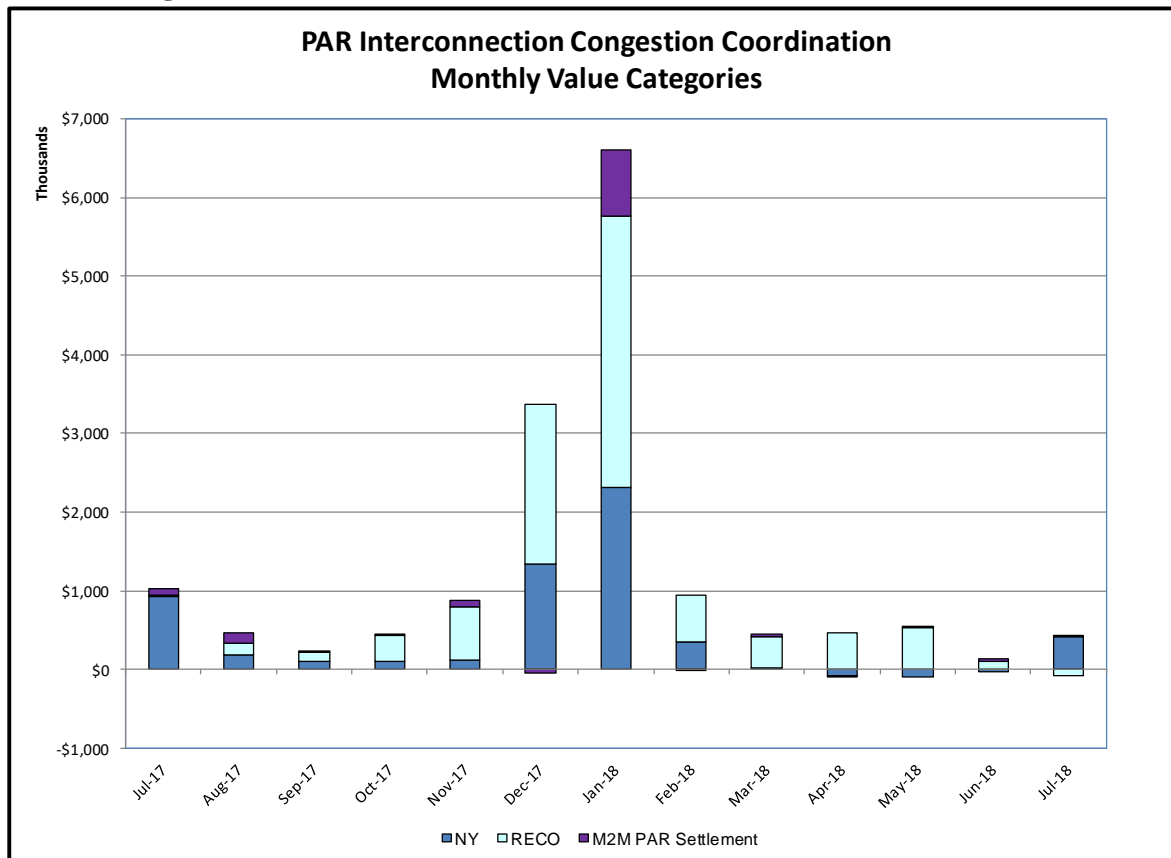






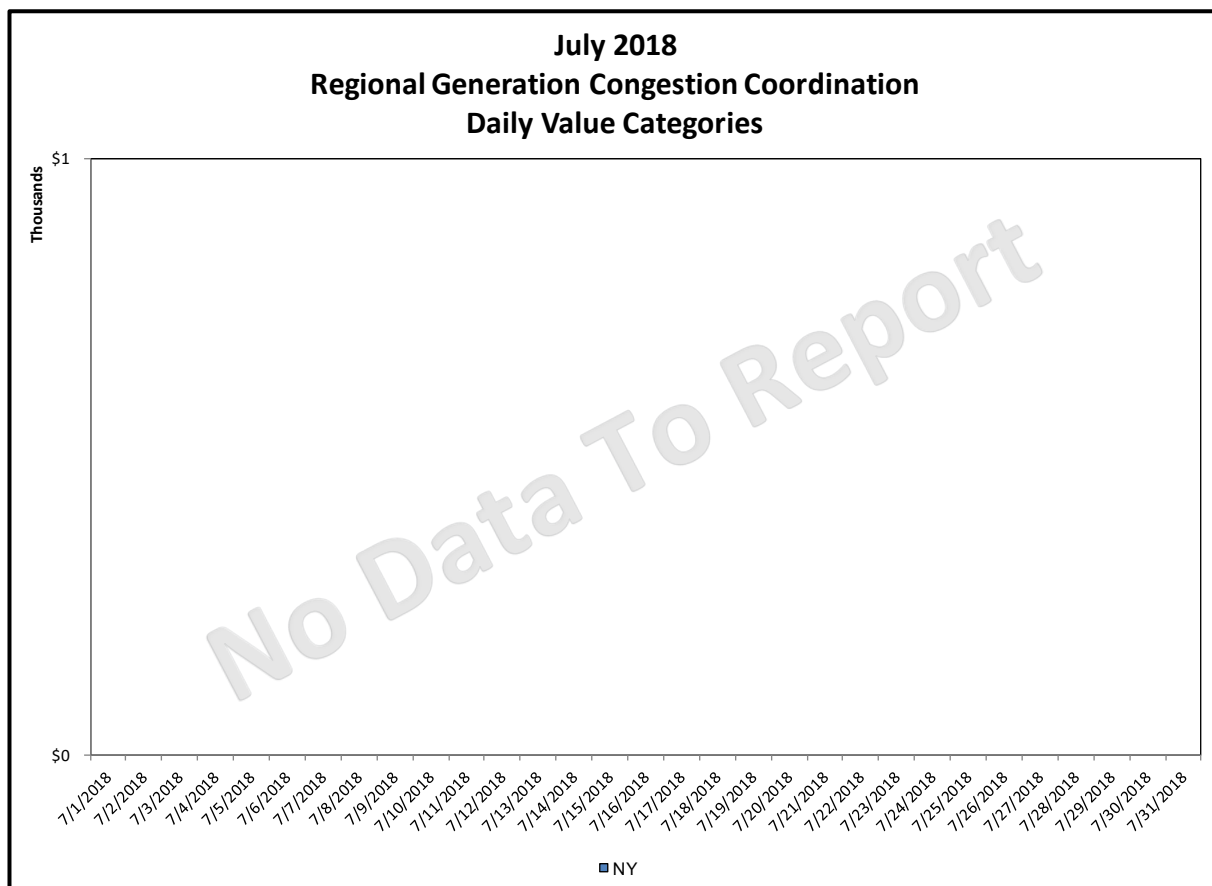
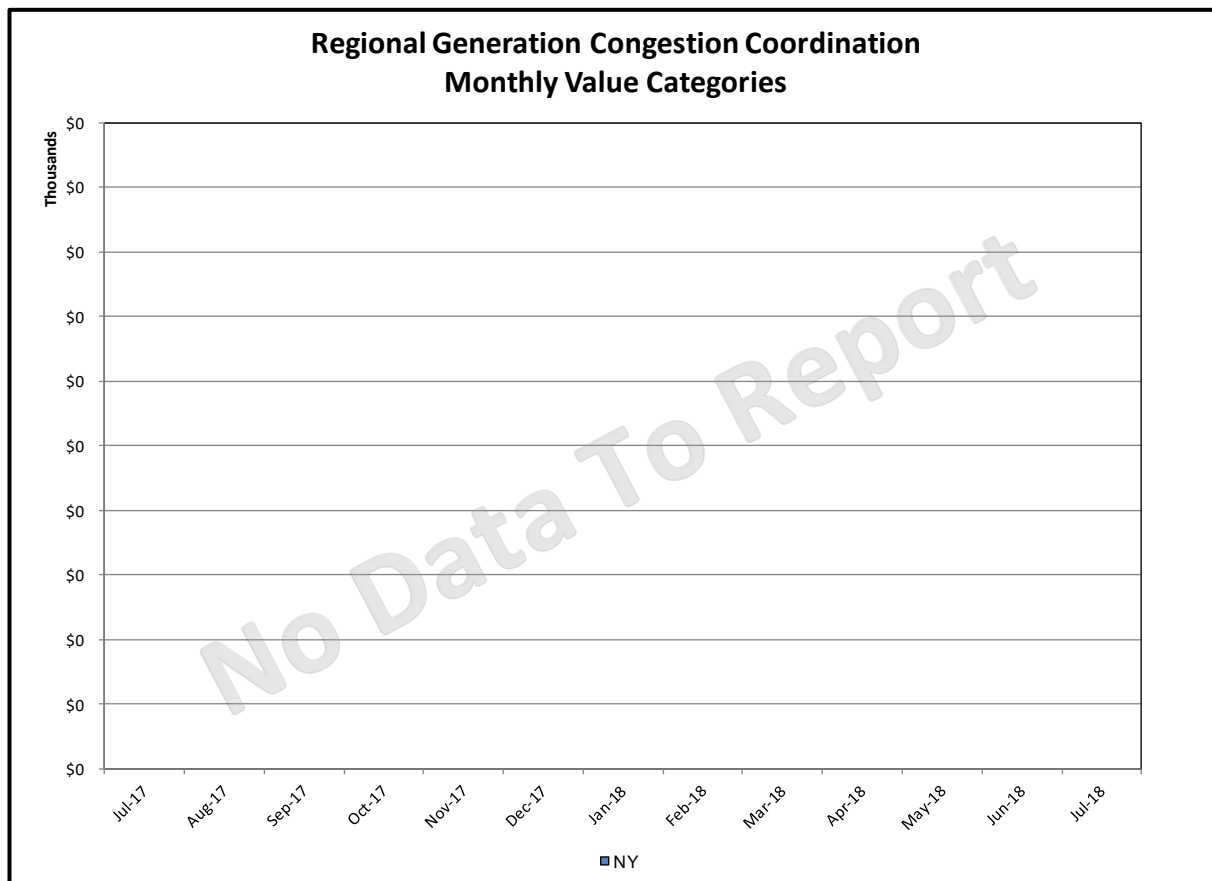


Broader Regional Market Performance Metrics



PAR Interconnection Congestion Coordination

| <u>Category</u> | <u>Description</u> |
|--------------------|--|
| NY | Represents the value NY realizes from Market-to-Market PAR Coordination when experiencing congestion. This is the estimated savings to NY for additional deliveries into NY |
| RECO | Represents the value of PJM's obligation to deliver 80% of service to RECO load over Ramapo 5018. This is the estimated reduction in NYCA congestion due to the PJM delivery of RECO over Ramapo 5018. |
| M2M PAR Settlement | Market-to-Market PAR Coordination settlement on coordinated flowgates. Through April 2017 this value was included in the NY and RECO categories. The positive sign convention indicates settlement to NY while the negative indicates settlement to PJM. |



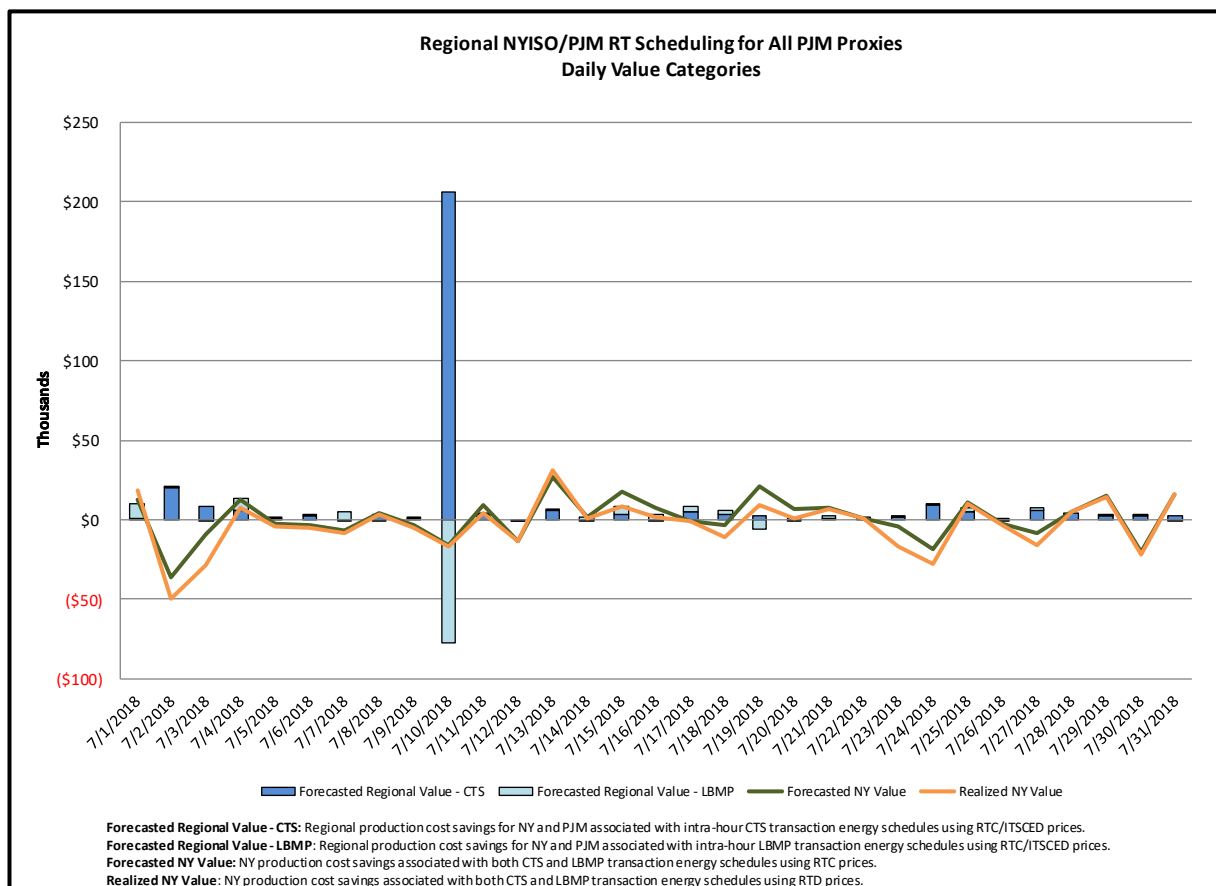
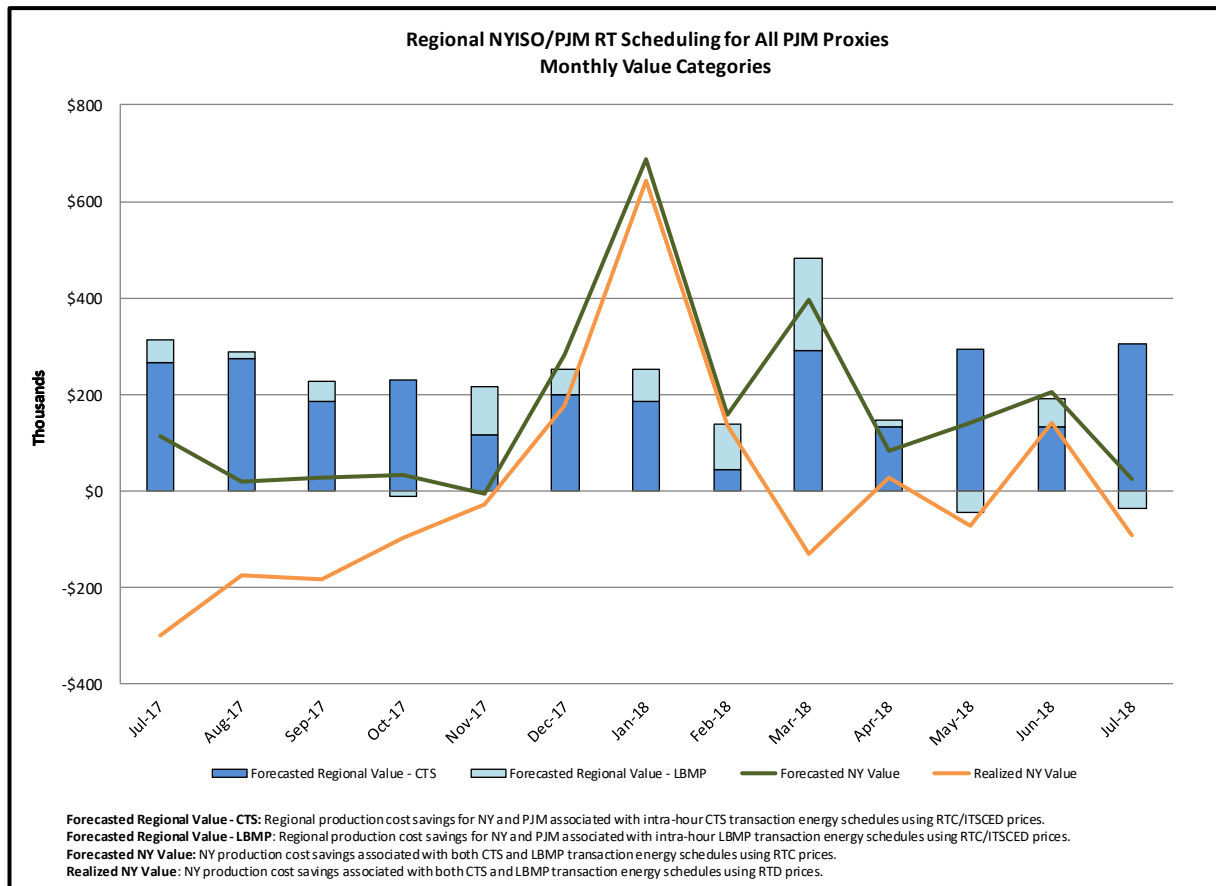
Regional Generation Congestion Coordination

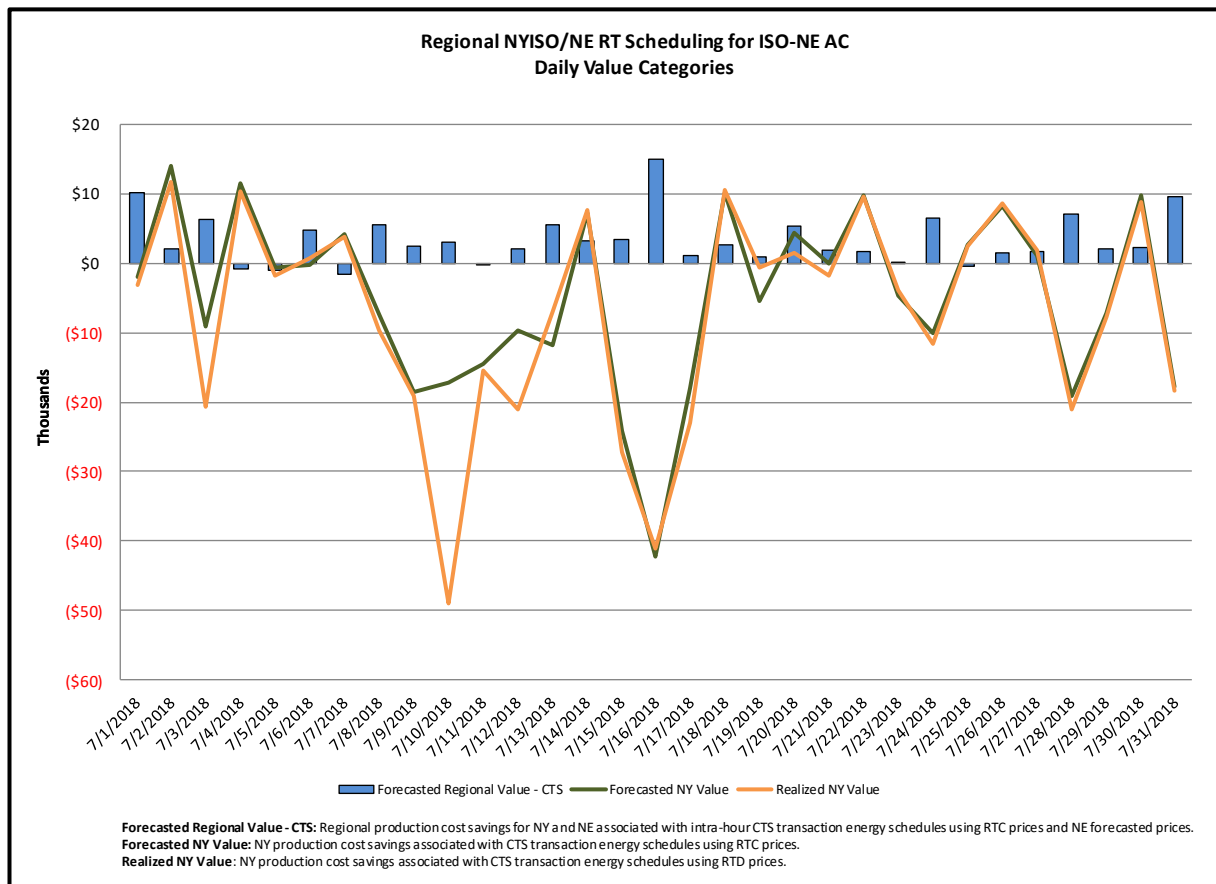
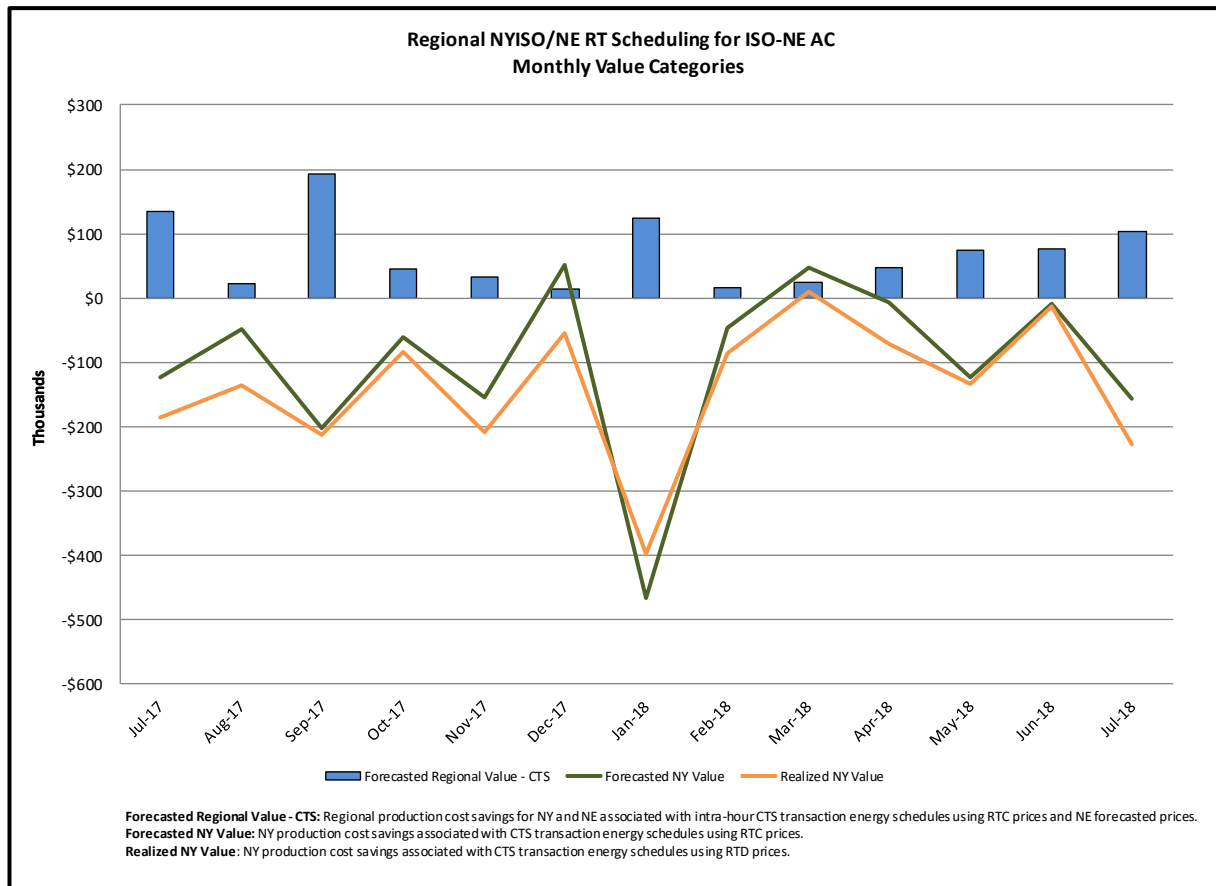
Category

NY

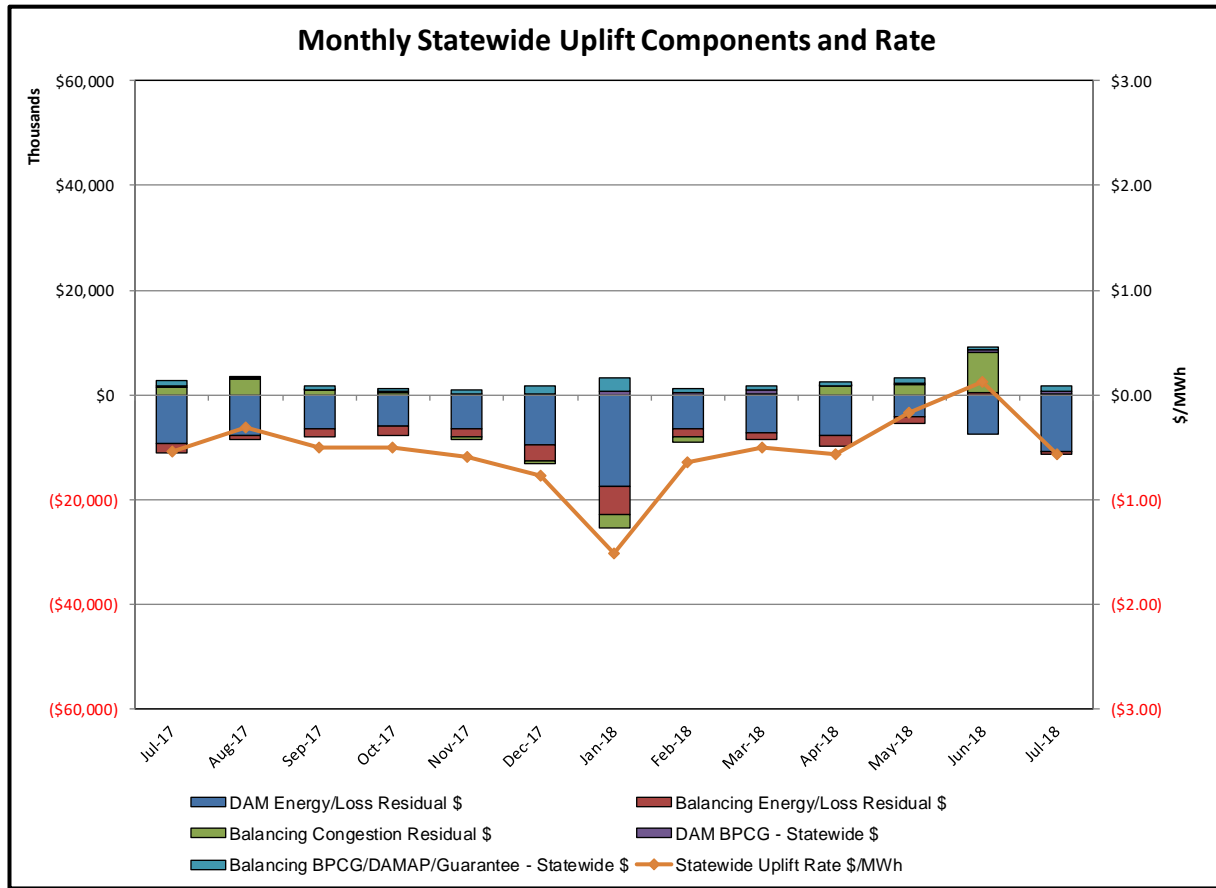
Description

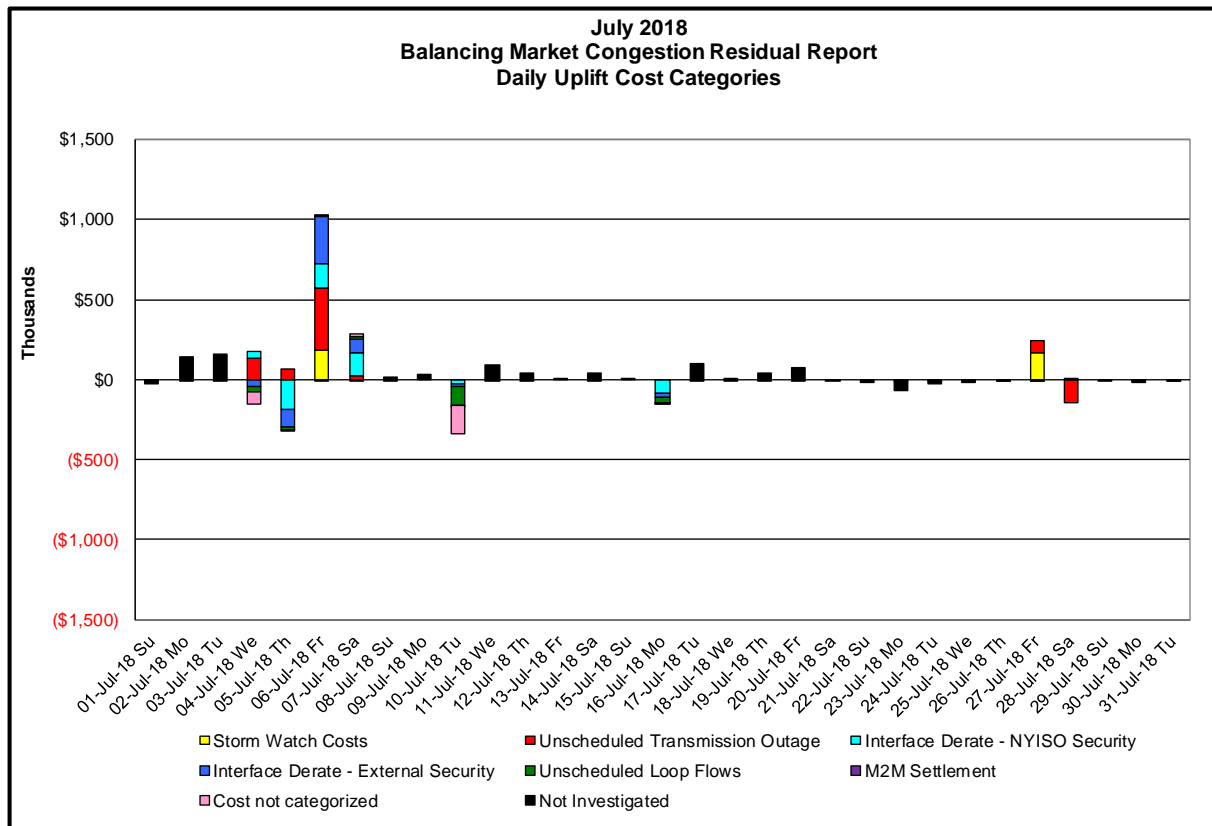
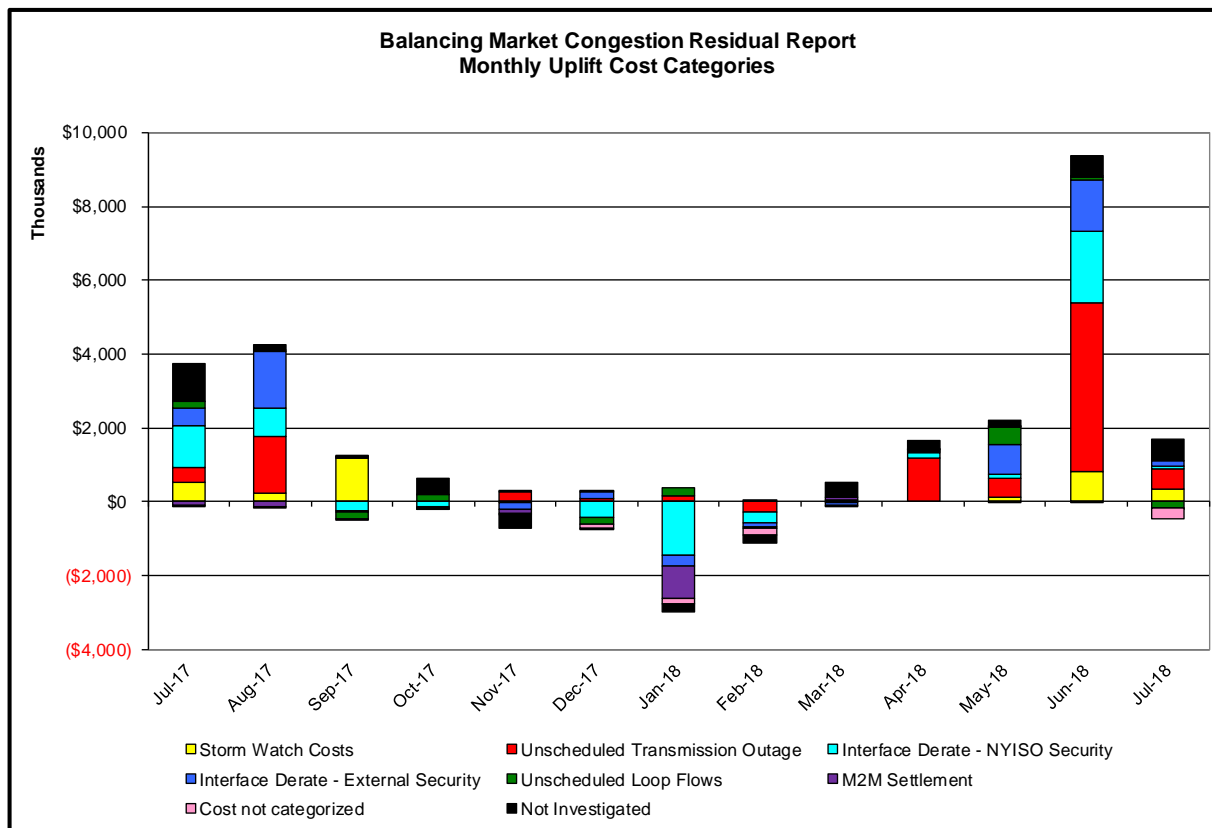
NYISO savings that result from PJM payments to NYISO when PJM's transmission use (PJM's market flow) is greater than PJM's entitlement of the NY transmission system and NYISO is incurring Western or Central NY congestion. Additionally, NYISO savings may result from the more efficient regional utilization of PJM's generation resources to directly address Western or Central NY transmission congestion.





Market Performance Metrics





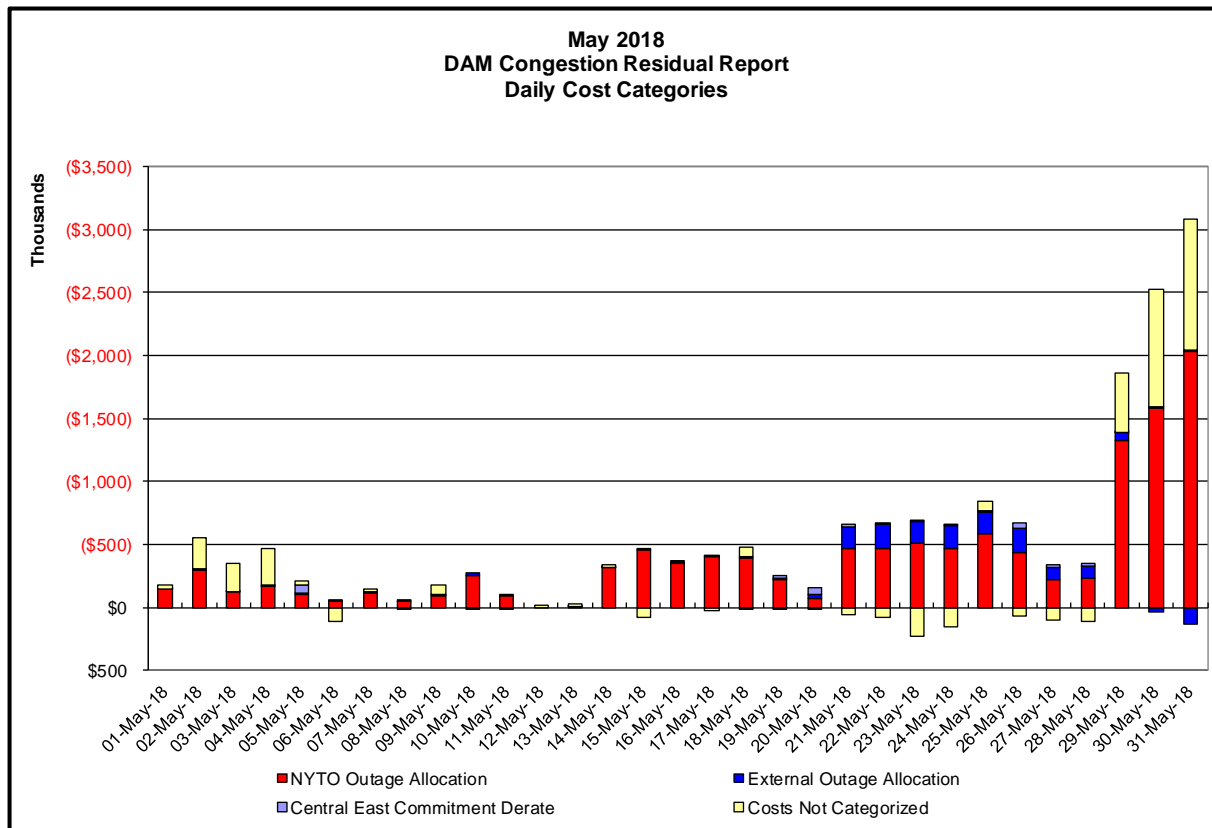
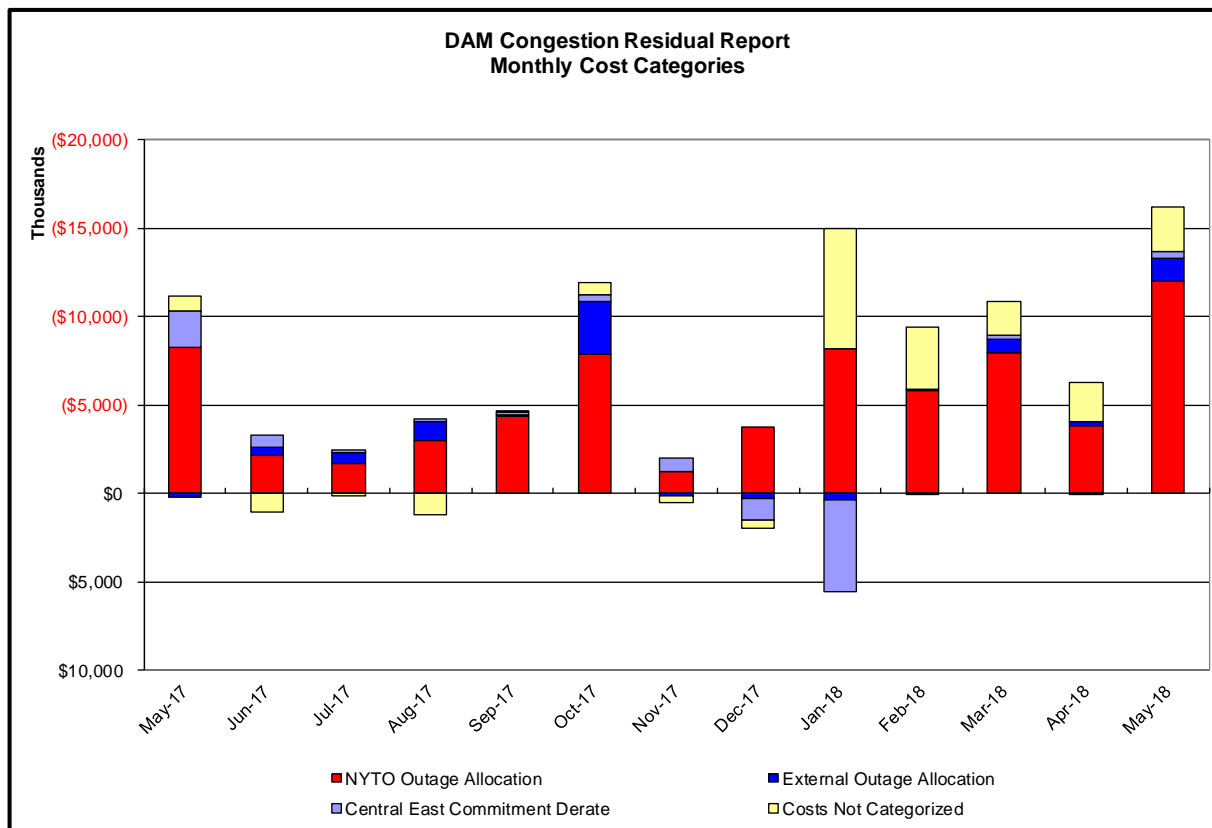
| Day's investigated in July: 4,5,6,7,10,16,27,28 | | | |
|---|-----------------|----------------|--|
| Event | Date (yyyymmdd) | Hours | Description |
| | 7/4/2018 | 23 | Forced Outage Massena-Marcy 765kV (#MSU1), Marcy AT1&AT2 |
| | 7/4/2018 | 0,23 | NYCA DNI Ramp Limit |
| | 7/4/2018 | 23 | Derate Central East |
| | 7/4/2018 | 11,23 | Derate Scriba-Volney 345kV (#20) for I/o Scriba-Volney 345kV (#21) |
| | 7/4/2018 | 13-16 | Uprate East Garden City-Valley Stream 138kV (#262) for I/o BUS:BARRETT 292&459&G2&IC9-12 |
| | 7/4/2018 | 23 | HQ_Cedars-NY Scheduling Limit |
| | 7/4/2018 | 1,2 | NE_AC-NY Scheduling Limit |
| | 7/4/2018 | 13 | NE-NNC1385-NY Scheduling Limit |
| | 7/4/2018 | 0-2 | Lake Erie Circulation, DAM-RTM exceeds +/-125MW; Central East |
| | 7/4/2018 | 12 | Lake Erie Circulation, DAM-RTM exceeds +/-125MW; Packard-Sawyer |
| | 7/5/2018 | 3-5,8,23 | Forced Outage Massena-Marcy 765/345kV Bank (#AT2) |
| | 7/5/2018 | 1-4 | Derate Dunwoodie-Shore Road 345kV (#Y50) for I/o SCB:SPBK(RNS2):Y49&M29&Y49_ST |
| | 7/5/2018 | 10,11,13-20 | Uprate East Garden City-Valley Stream 138kV (#262) for I/o BUS:BARRETT 292&459&G2&IC9-12 |
| | 7/5/2018 | 23 | Derate Scriba-Volney 345kV (#20) for I/o Scriba-Volney 345kV (#21) |
| | 7/5/2018 | 0,15,18 | NYCA DNI Ramp Limit |
| | 7/5/2018 | 10,11,15-17,20 | NE_AC-NY Scheduling Limit |
| | 7/5/2018 | 0 | Lake Erie Circulation, DAM-RTM exceeds +/-125MW; Central East |
| | 7/6/2018 | 8-11 | Thunder Storm Alert |
| | 7/6/2018 | 0-19 | Forced Outage Massena-Marcy 765/345kV Bank (#AT2) |
| | 7/6/2018 | 3 | NYCA DNI Ramp Limit |
| | 7/6/2018 | 1-8,13,15 | Derate Central East |
| | 7/6/2018 | 1-14,16-18 | HQ_Cedars-NY Scheduling Limit |
| | 7/6/2018 | 21 | Lake Erie Circulation, DAM-RTM exceeds +/-125MW; Central East |
| | 7/7/2018 | 10,11 | Forced Outage Brownsfalls-Taylorville 115kV (#3) |
| | 7/7/2018 | 3,4,10 | Derate Central East |
| | 7/7/2018 | 0-5 | Derate Marcy 765/345kV Bank (#AT1) for I/o TWR:MOSES MA1 & MA2 |
| | 7/7/2018 | 0-3 | HQ_Cedars-NY Scheduling Limit |
| | 7/7/2018 | 21 | IESO_AC DNI Ramp Limit |
| | 7/7/2018 | 3,4 | Lake Erie Circulation, DAM-RTM exceeds +/-125MW; Central East |
| | 7/10/2018 | 16 | NYCA DNI Ramp Limit |
| | 7/10/2018 | 16 | NE_AC DNI Ramp Limit |
| | 7/10/2018 | 16 | PJM_AC DNI Ramp Limit |
| | 7/10/2018 | 16,17 | Lake Erie Circulation, DAM-RTM exceeds +/-125MW; Packard-Sawyer |
| | 7/16/2018 | 9 | NYCA DNI Ramp Limit |
| | 7/16/2018 | 8 | Uprate Dunwoodie-Mothaven 345kV (#72) |
| | 7/16/2018 | 10,11 | Uprate Packard-Sawyer 230kV (#77) for I/o BUS:PACKARD BK3 & 61 & 78 |
| | 7/16/2018 | 10,11,13 | Uprate Packard-Sawyer 230kV (#78) for I/o Packard-Sawyer 230kV (#77) |
| | 7/16/2018 | 11,13 | Uprate Packard-Sawyer 230kV (#77) for I/o Packard-Sawyer 230kV (#78) |
| | 7/16/2018 | 9-11,13 | Uprate Scriba-Volney 345kV (#20) for I/o Scriba-Volney 345kV (#21) |
| | 7/16/2018 | 16,17 | PJM_AC-NY Scheduling Limit |
| | 7/16/2018 | 9,11 | PJM_AC DNI Ramp Limit |
| | 7/16/2018 | 10,11 | Lake Erie Circulation, DAM-RTM exceeds +/-125MW; Packard-Sawyer |
| | 7/16/2018 | 10 | Lake Erie Circulation, DAM-RTM exceeds +/-125MW; Niagara-Packard |
| | 7/27/2018 | 14-22 | Thunder Storm Alert |
| | 7/27/2018 | 16-22 | Forced Outage Gowanus-Goethals 345kV (#25), Linden-Goethals 345kV #(A2253) |
| | 7/28/2018 | 0 | Forced Outage Gowanus-Goethals 345kV (#25), Linden-Goethals 345kV #(A2253) |

Real-Time Balancing Market Congestion Residual (Uplift Cost) Categories

| <u>Category</u> | <u>Cost Assignment</u> | <u>Events Types</u> | <u>Event Examples</u> |
|--------------------------------------|------------------------|---|--|
| Storm Watch | Zone J | Thunderstorm Alert (TSA) | TSA Activations |
| Unscheduled Transmission Outage | Market-wide | Reduction in DAM to RTM transfers related to unscheduled transmission outage | Forced Line Outage, Unit AVR Outages |
| Interface Derate - NYISO Security | Market-wide | Reduction in DAM to RTM transfers not related to transmission outage | Interface Derates due to RTM voltages |
| Interface Derate - External Security | Market-wide | Reduction in DAM to RTM transfers related to External Control Area Security Events | TLR Events, External Transaction Curtailments |
| Unscheduled Loop Flows | Market-wide | Changes in DAM to RTM unscheduled loop flows impacting NYISO Interface transmission constraints | DAM to RTM Lake Erie Loop Flows exceeding +/- 125 MW |
| M2M Settlement | Market-wide | Settlement result inclusive of coordinated redispatch and Ramapo flowgates | |

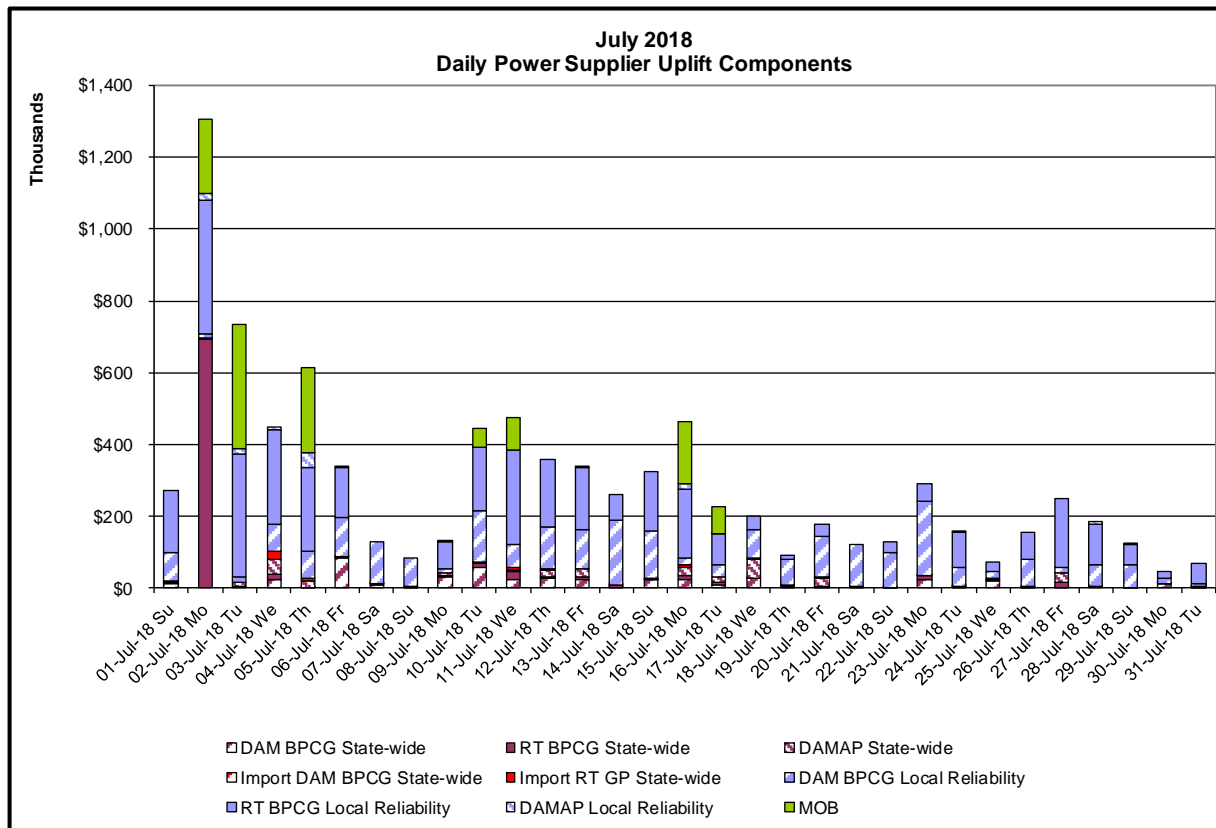
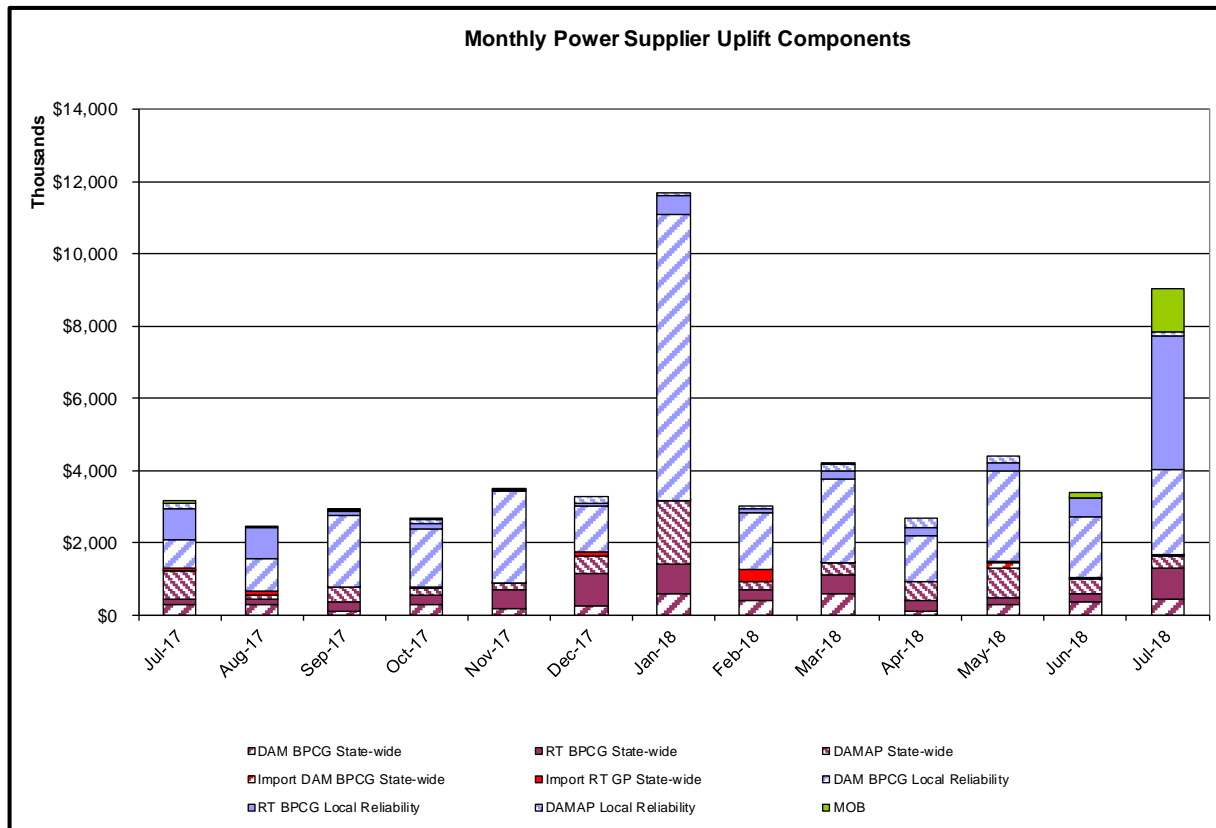
Monthly Balancing Market Congestion Report Assumptions/Notes

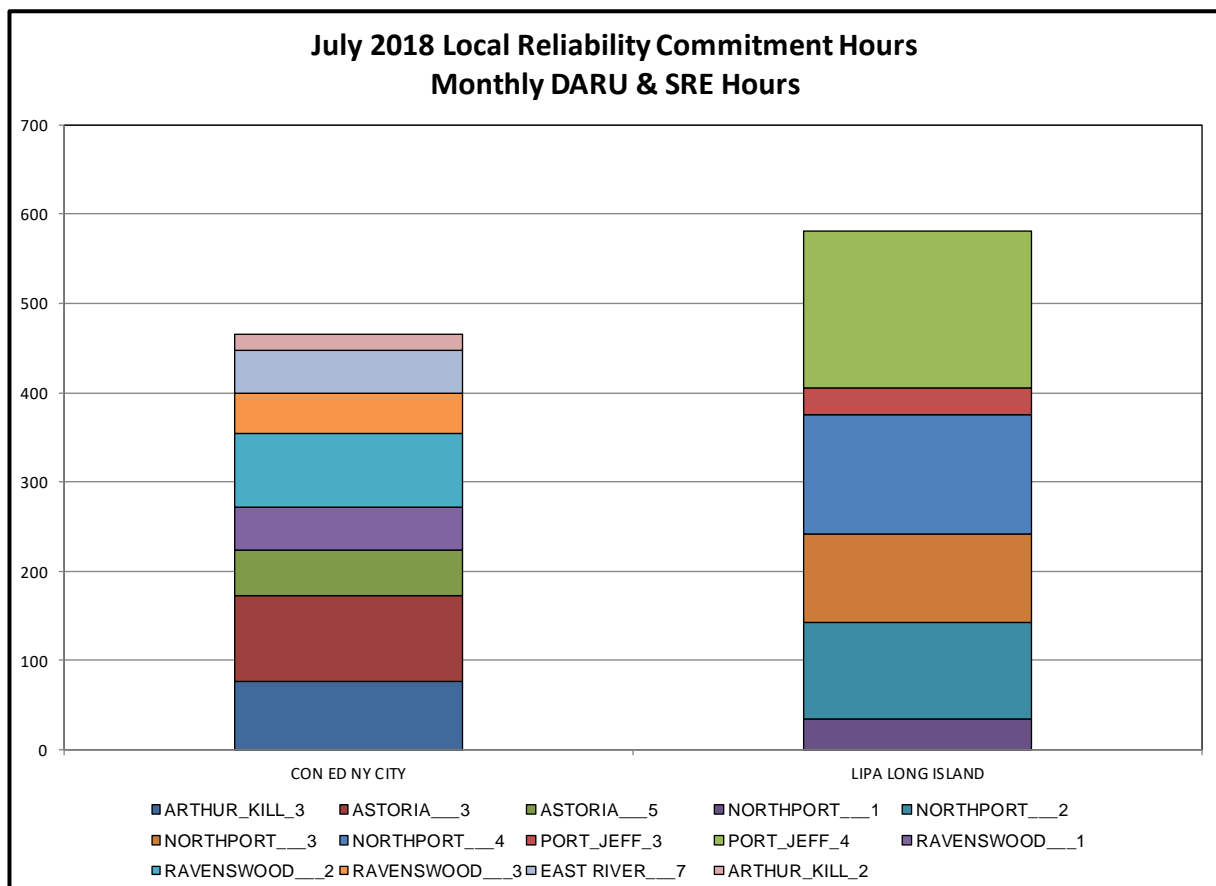
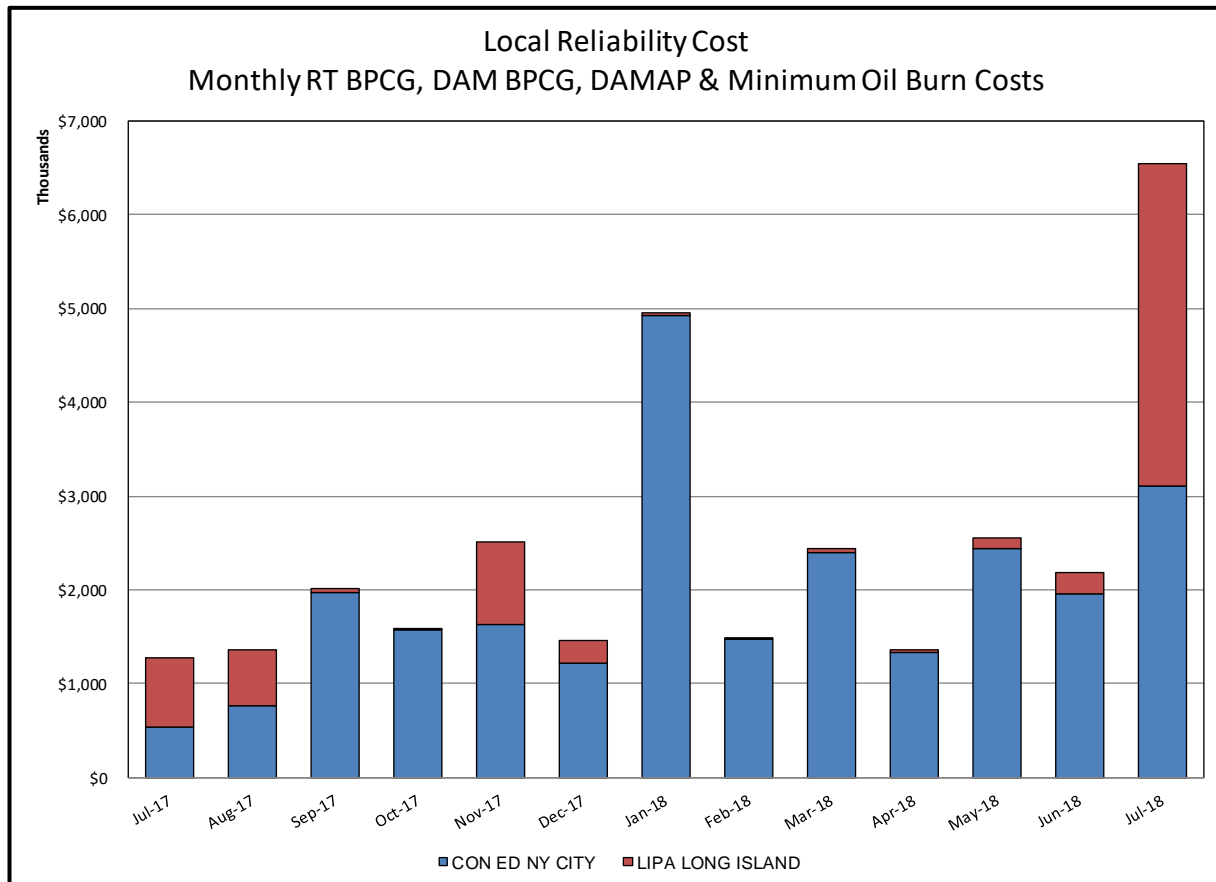
- 1) Storm Watch Costs are identified as daily total uplift costs
- 2) Days with a value of BMCR less M2M Settlement of \$100K/HR, shortfall of \$200K/Day or more, or surplus of \$100K/Day or more are investigated.
- 3) Uplift costs associated with multiple event types are apportioned equally by hour

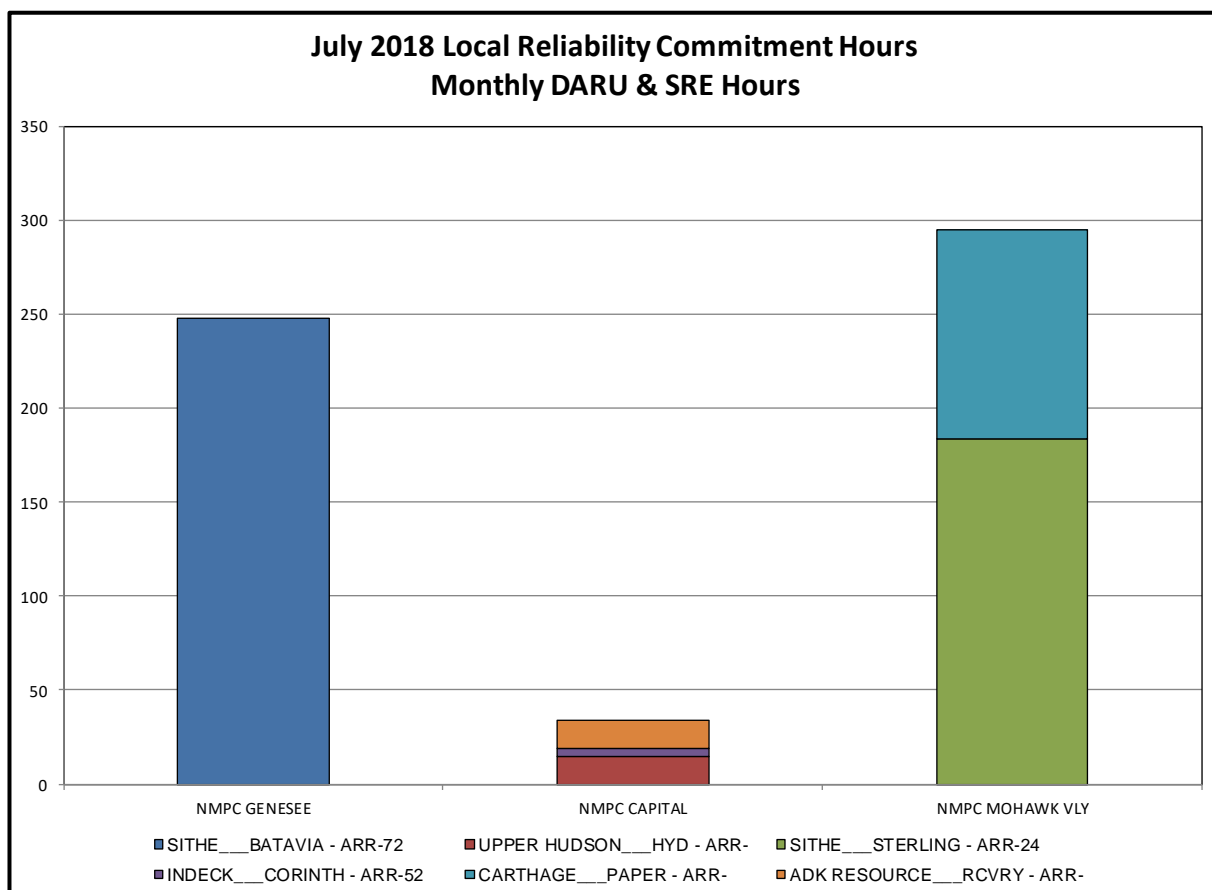
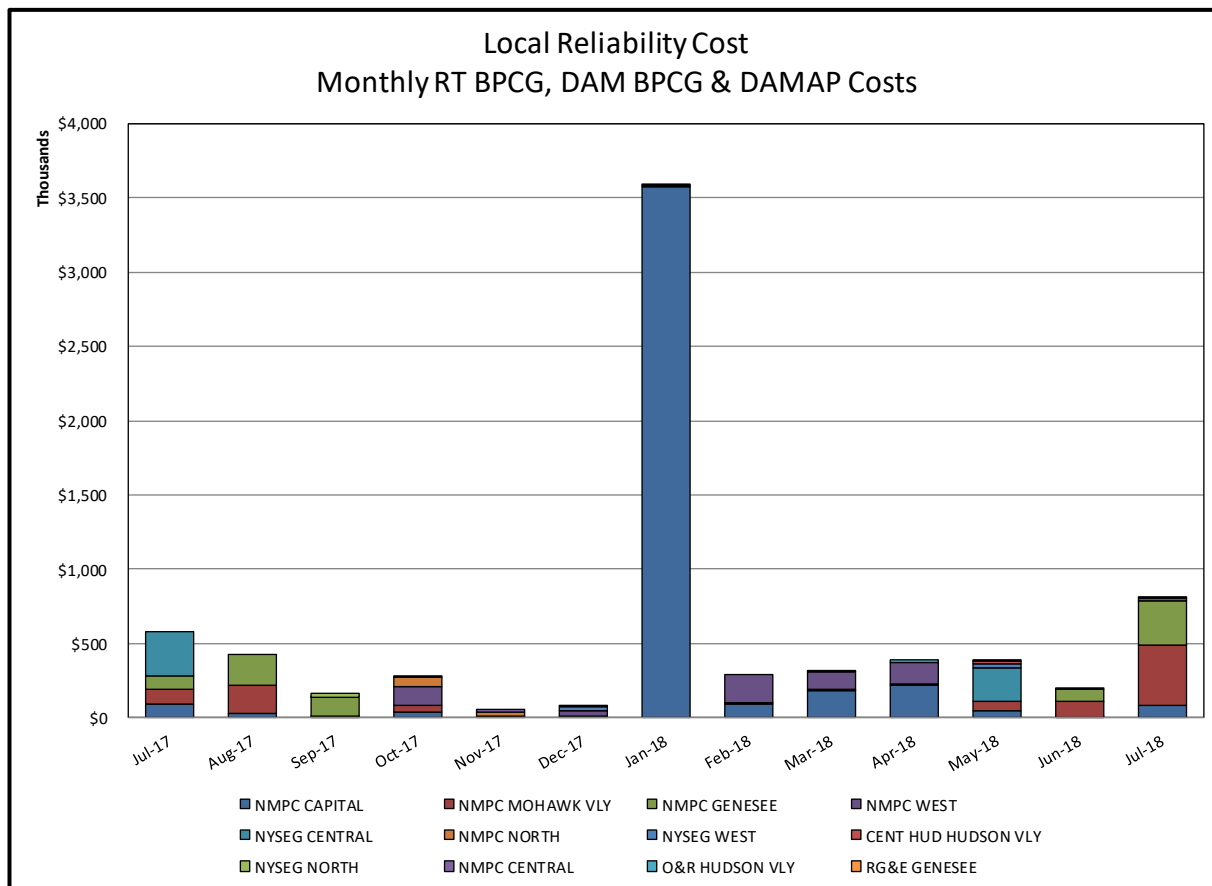


Day-Ahead Market Congestion Residual Categories

| <u>Category</u> | <u>Cost Assignment</u> | <u>Events Types</u> | <u>Event Examples</u> |
|--------------------------------|-------------------------------------|--|--|
| NYTO Outage Allocation | Responsible TO | Direct allocation to NYTO's responsible for transmission equipment status change. | DAM scheduled outage for equipment modeled in-service for the TCC Auction. |
| External Outage Allocation | All TO by Monthly Allocation Factor | Direct allocation to transmission equipment status change caused by change in status of external equipment. | Tie line required out-of-service by TO of neighboring control area. |
| Central East Commitment Derate | All TO by Monthly Allocation Factor | Reductions in the DAM Central East_VC limit as compared to the TCC Auction limit, which are not associated with transmission line outages. | |

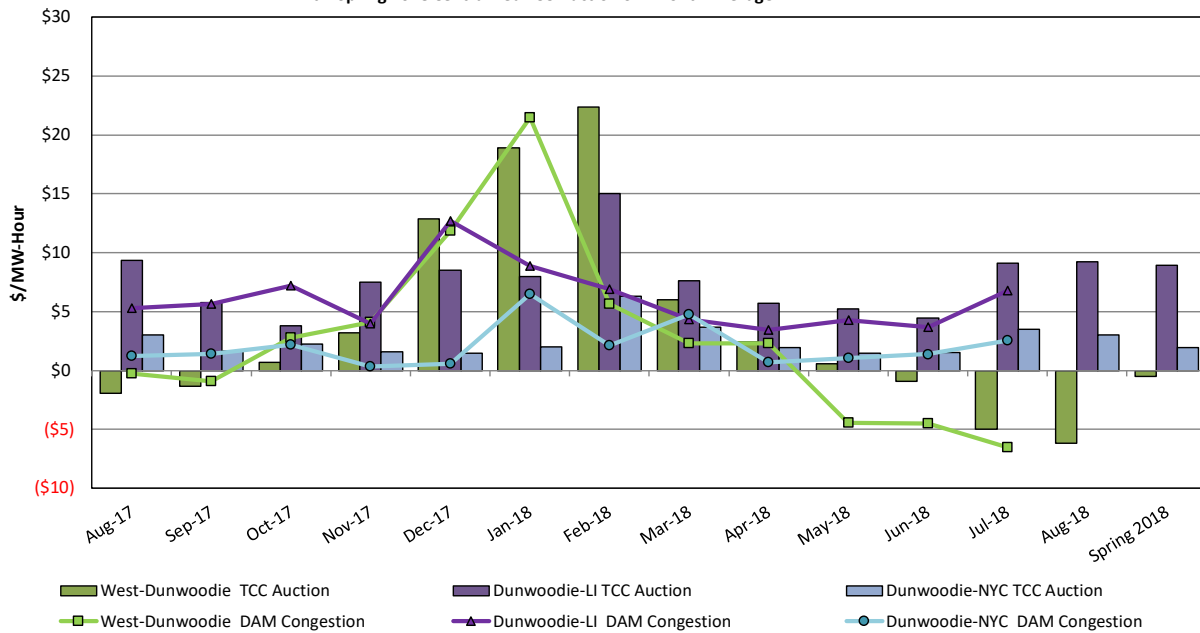






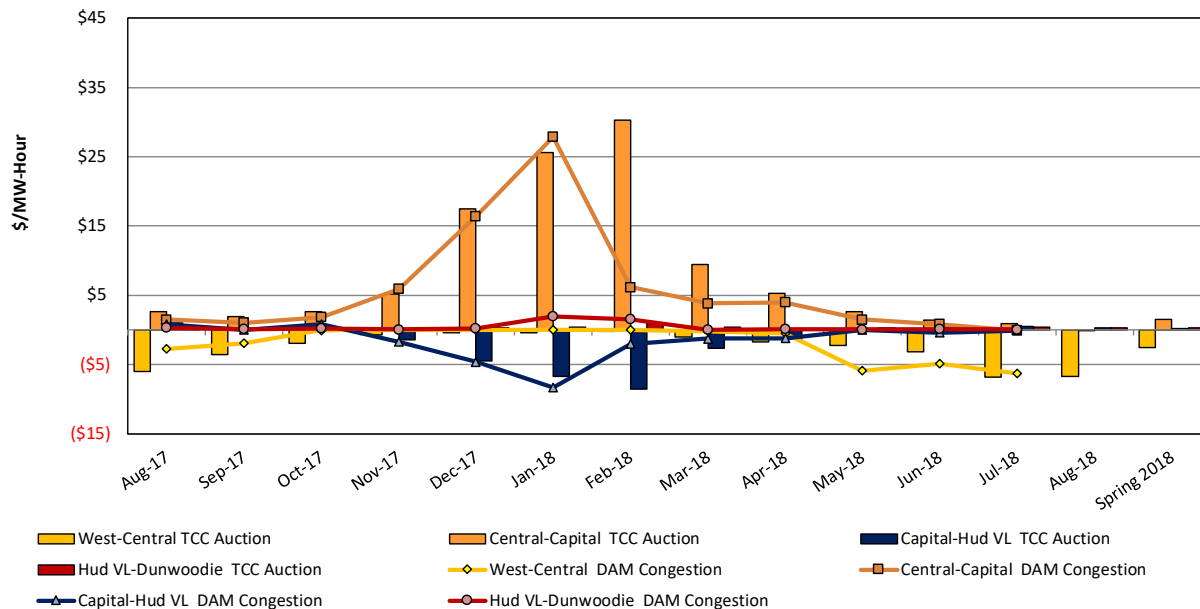
TCC & Day Ahead Market Selected Internal Path Congestion

TCC Monthly Reconfiguration Auction vs. Monthly DAM Average
with Spring 2018 Centralized TCC Auction Six-Month Average



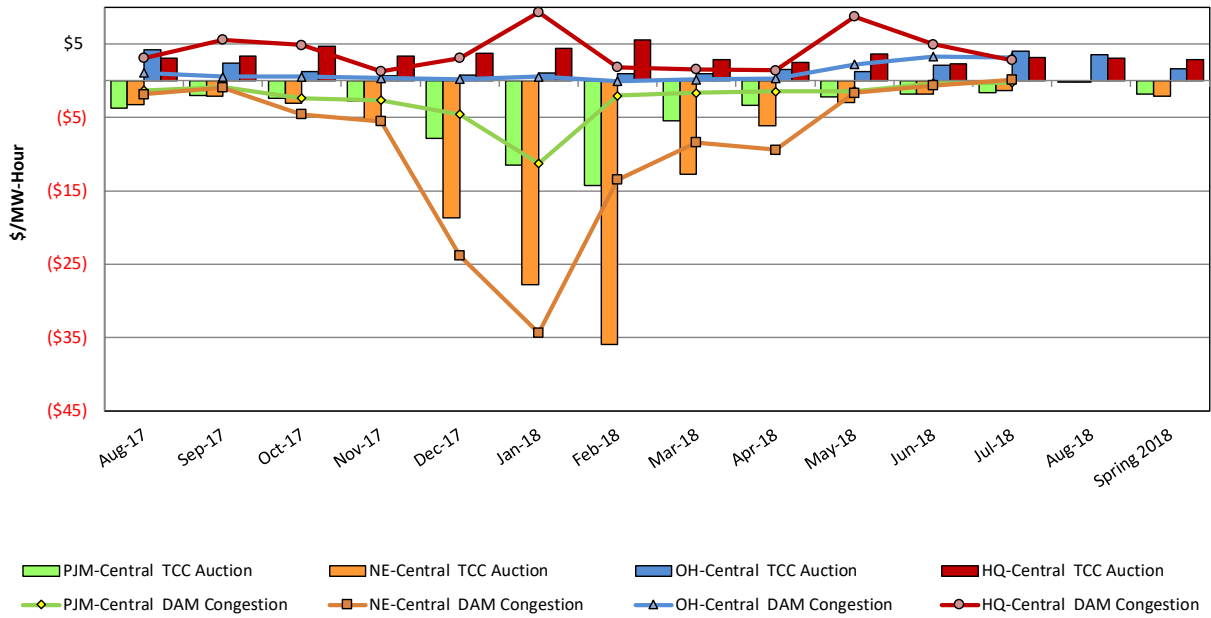
TCC & Day Ahead Market West to Dunwoodie Path Congestion

TCC Monthly Reconfiguration Auction vs. Monthly DAM Average
with Spring 2018 Centralized TCC Auction Six-Month Average

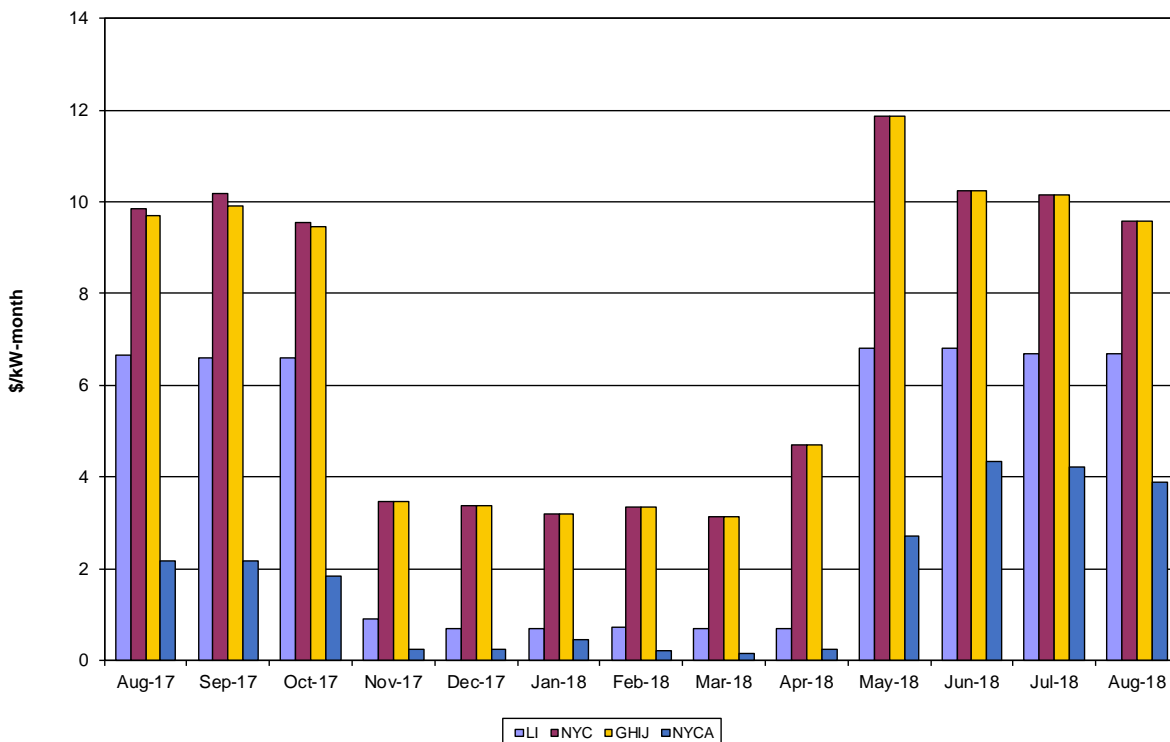


TCC & Day Ahead Market Selected External Path Congestion

TCC Monthly Reconfiguration Auction vs. Monthly DAM Average
with Spring 2018 Centralized TCC Auction Six-Month Average



ICAP Spot Market Clearing Price



UCAP Sales

