

# **NYISO Price Validation Quarterly Reports**

Attachment E of the New York Independent System Operator's Market Services Tariff requires the NYISO to provide Market Participants with information on each of its Energy and Ancillary Service price corrections and provides a comprehensive list of required information for these reports.

Since June 2006 the NYISO has been posting to OASIS the Price Correction Report, which identifies the cause of each pricing error, the zonal prices impacted by each price correction, and additional information. These reports can be found on the NYISO website at

<https://www.nyiso.com/reports-information>

Attachment E also requires the NYISO to provide Quarterly Reports to the Market Participants reporting on the cause of each pricing error, the steps taken or planned to eliminate or diminish the incidence of the error in the future and details for any pricing errors which the NYISO becomes aware of after the deadlines for reservation and correction of the pricing error. This Quarterly Report offers this information in a chronology since October 2006.

## **October – December 2006**

In the fourth quarter of 2006, the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Consolidated Constraint Management – This enhanced software capability allows operators improved constraint management. This capability has reduced the incidence of pricing errors identified as “Operator Input” and “Operationally Ineffective Dispatch.”

Intelligent Source Selection (ISS) – Improved capability in the Real-Time Market software that identifies generating unit metering errors and automatically switches to alternative metering points to ensure data integrity. The ISS capability has significantly reduced the potential for pricing errors identified as “Telemetry - Metering Error.”

## **January - March 2007**

In the first quarter of 2007 the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Intelligent Source Selection (ISS) - The ISS capability has been expanded to cover additional real-time generation metering, and has significantly reduced the potential for pricing errors identified as “Telemetry - Metering Error.”

Improved Load Forecasting Performance – Enhancements through improved ISS capability and forecast model related improvements thereby minimizing the potential for pricing errors identified as “Load Forecasting Error.”

## **April - June 2007**

In the second quarter of 2007 the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Transmission shortage cost pricing – An improved transmission shortage cost pricing capability was implemented to avoid pricing errors identified as “Operationally Ineffective Dispatch.”

Intelligent Source Selection (ISS) - The ISS capability has been expanded to cover additional real-time phase angle regulator metering, and has significantly reduced the potential for pricing errors identified as “Telemetry - Metering Error.”

## **July - September 2007**

During the third quarter of 2007, the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Improved capability for the management of generating units operating without accepted bids, thereby minimizing the potential for pricing errors identified as “Uninstructed /Out of Merit Inconsistency.”

Intelligent Source Selection (ISS) – Minor improvements in ISS capability in the Real-Time Market software that identifies metering errors and automatically switches to alternative metering points to ensure data integrity. The ISS capability has significantly reduced the potential for pricing errors identified as “Telemetry - Metering Error.”

## **October - December 2007**

In the fourth quarter of 2007, the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Deployment Procedures - Improved administration procedures to verify the accuracy of telemetry related data subsequent to scheduled software deployments, thereby significantly reducing the potential for pricing errors identified as “Telemetry - Metering Error.”

## **January – March 2008**

In the first quarter of 2008, the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Intelligent Source Selection (ISS) – Minor improvements in ISS capability in the Real-Time Market software that identifies metering errors and automatically switches to alternative metering points to ensure data integrity. The ISS capability has significantly reduced the potential for pricing errors identified as “Telemetry - Metering Error.”

## **April - June 2008**

In the second quarter of 2008, the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Intelligent Source Selection (ISS) – Expansion and refinement of ISS capability in the Real-Time Market software to reduce metering errors and improve data integrity. The ISS capability has significantly reduced the potential for pricing errors identified as “Telemetry - Metering Error.”

### **July - September 2008**

In the third quarter of 2008, the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Intelligent Source Selection (ISS) – Enhancement and expansion of ISS capability in the Real-Time Market software to improve meter data quality. The ISS capability has upgraded metering integrity and reduced pricing errors identified as “Telemetry - Metering Error.”

### **October - December 2008**

In the fourth quarter of 2008, the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Intelligent Source Selection (ISS) – Minor improvements in ISS capability in the Real-Time Market software that identifies metering errors and automatically switches to alternative metering points to ensure data integrity. The ISS capability continues to effectively reduce pricing errors caused by incorrect telemetry and metering.

Deployment Procedures - Improved administration procedures to verify the accuracy of external proxy deployments, thereby reducing the potential for pricing errors identified as “Data Error – Static.”

### **January – March 2009**

In the first quarter of 2009 the following measures were undertaken to eliminate or diminish the incidence of the pricing errors in the future:

Intelligent Source Selection (ISS) – Enhancement, refinement and expansion of ISS capability in the Real-Time Market software that identifies metering errors and automatically switches to alternative metering points to ensure data integrity. The ISS capability continues to find and correct erroneous meter values thereby reducing pricing errors identified as “Telemetry - Metering Error.”

### **April - June 2009**

In the second quarter of 2009 there were eight instances of pricing errors totaling eight hours of price corrections. Three of those instances were metering/telemetry errors; two were due to indeterminacies in the pricing and schedules; there was one operator error, one computer system failure, and one software error related to the handling of Out of Merits. The measures taken to reduce the incidence of pricing errors focused on the metering and software issues, as detailed below.

Intelligent Source Selection (ISS) – The ISS Real-Time Market software identifies metering errors and automatically switches to alternative metering points where available to ensure data integrity. This capability has been expanded and refined to reduce erroneous meter values thereby reduce pricing errors.

Software Improvements – A software modification was made to improve the internal logic for managing Out of Merit processing.

### **July - September 2009**

The third quarter of 2009 had 4 separate instances of price corrections totaling 5 hours of corrections for 47 intervals. There were 2 factors accounting for these corrections: a computer system failure (23 intervals over 3 hours), and a posting error (24 intervals over 2 hours).

The measures taken to reduce the incidence of pricing errors focused on metering. The ISS has been enhanced to expand and improve monitoring of interfaces and load pockets. The system now dynamically compares metering, the state estimator and RTD values for select elements of the system and alerts operators when variations exceed thresholds to reduce the probability of erroneous data being used in the scheduling systems.

In addition, there is one pricing error that was not found until after the correction deadline passed and hence has not been corrected. The erroneous prices are the RTC (Hour-Ahead) prices for East Regulation. The period impacted is 02 September 2009 from 17:30 through 19:30, inclusive. The posted price is \$0; the correct price is \$28. Importantly, these prices are only “advisory” and not used in customer settlement. The NYISO has reviewed and clarified its processes to ensure that such an error will not recur in the future.

### **October - December 2009**

The fourth quarter of 2009 had price corrections on four occasions totaling 7 intervals over 4 hours. For two of the price corrections, on 01 and 12 November, the erroneous pricing was due to incorrect external schedules being used in the scheduling systems. These totaled 2 hours and 5 intervals. There were two price corrections in December spanning 2 intervals and 2 hours. The first of these, on 15 December, was a generator schedule error caused by a unit that did not shut off in accordance with its schedule, was subsequently picked up in the scheduling system initialization as running, and then shut off. The unit was in fact off during the time the scheduling system had it on as uninstructed generation. The second price correction in December was due to an indeterminacy.

The principal actions taken to reduce pricing errors focused on refining the Integrated Source Selection (ISS) to expand and improve monitoring of lines, PARs, interfaces and load. As well, the scheduling system was modified to better handle uninstructed generation during Correction Action Modes (CAMs).

## **January - March 2010**

The first quarter of 2010 had a total of 11 RTD intervals corrected. Six of the eleven intervals were corrected due to a software error causing an incorrect limit was picked up in the scheduling systems. The incorrect limit was picked up due to an initialization that occurred before the new limit was completely entered. Three intervals were corrected because an out of merit record was improperly deleted for a unit that did not have an RTC commitment.

Measures taken to mitigate pricing errors include:

- The Integrated Source Selection (ISS), an automated system that screens telemetry and switches to alternate metering sources when erroneous values are found, has been enhanced to expand and improve monitoring of interfaces and load pockets. A generalized degrade feature has been added to include, where available, a third metering source.
- The NYISO has continued to enhance its network model to improve its performance in the scheduling systems.

## **April - June 2010**

The second quarter of 2010 had 33 intervals corrected spanning 6 days. Most of the corrections (25 intervals) were due to posting problems caused by hardware failures and deployment issues. The remaining corrections were due to load forecaster errors and generator schedule errors.

Measures taken to mitigate pricing errors include:

- On-going operator training has an enhanced curriculum to focus on the identification and response to pricing problems.
- The NYISO continues to enhance its Integrated Source Selection system. A screening system for zonal loads, sub-zonal loads and interface flows has been expanded.
- The NYISO has continued to enhance its network model to improve its performance in the scheduling systems.

## **July - September 2010**

The third quarter of 2010 had RTD price corrections in three hours totaling 17 intervals. There were two separate incidents that caused the pricing errors. The first instance, resulting in 5 intervals corrected over 2 hours, was a software problem that pushed

incorrect external schedules to the scheduling systems. In the second case, accounting for 12 intervals in 1 hour, a posting issue caused incorrect external prices.

In the third quarter there were several initiatives undertaken to reduce pricing errors and increase price awareness for the operators. These are:

- The NYISO continues to enhance its Integrated Source Selection (ISS) system. An improved detection and alarming capability has been added to proactively ensure the quality of critical metering.
- System operators now verify high dispatch costs for advisory intervals to identify potential pricing issues.
- System operators now validate large wind curtailments.

The 31 August 2010 RTD External prices for the period 16:05 to 17:00 were not accurately posted on OASIS. However, the correct RTD External prices and schedules were resident and applied in Settlements. The posted RTC prices were reserved on 01 September 2010 and were corrected on 02 September 2010. Due to special pricing rules invoked by external ramp constraints, posted RTD prices should have equaled the posted RTC prices for HB 16. The NYISO, on 28 October 2010, updated the OASIS posted RTD prices to match the correct prices used in settlements. The RTD prices now posted on OASIS correctly match RTC posted prices. Improvements have been made to the verification process in order to prevent a similar posting issue from occurring in the future.

## **October – December 2010**

The fourth quarter of 2010 had two hours with RTD price corrections totaling 12 intervals. There were two separate pricing error incidents, both in December. The first event was due to a series of system failures in the scheduling systems that resulted in 10 intervals corrected in 1 hour. In the second case, an incorrect derate was entered impacting 2 intervals in 1 hour.

In the fourth quarter there were several initiatives undertaken to reduce pricing errors and increase price awareness for the operators. These were:

- The Integrated Source Selection (ISS) has been enhanced with detection and alarming of data received through ICCP to allow the operators to proactively evaluate the quality of critical telemetry.

## **January - March 2011**

The first quarter of 2011 had two pricing errors affecting two intervals. The first of these was a generator schedule error in which a unit was unintentionally and inaccurately pinned to its upper operating limit. The second price correction was caused by a breaker status error that dropped a 300+ MW unit out of the dispatch.

In the first quarter the following feature was added to the ISS system to reduce pricing errors:

- ISS was expanded to include new equipment in its telemetry screening protocols, including two PARs and a transmission line

### **April - June 2011**

The second quarter of 2011 had ten separate pricing errors that resulted in the correction of forty-nine intervals over thirteen hours. The pricing errors that occurred in May 2011 (37 intervals over 9 hours) were primarily due to the deployment of Enhanced Inter-Regional Transaction Coordination (15-minute scheduling of external transactions).

In June 2011 there were twelve intervals corrected over four hours. The corrections were due to an operator error, a load forecast error, a metering error, and a software error that resulted in an incorrect limit being used during a software deployment.

In the second quarter the NYISO undertook an aggressive effort to identify and correct errors in the scheduling and posting logic associated with Enhanced Inter-Regional Transaction Coordination. As well, there were several enhancements made to the ISS to improve its telemetry evaluation and to provide more and better alternate telemetry sources when metering failures occur.

### **July - September 2011**

In the third quarter of 2011 there were three days that had price corrections: 22 July, 31 July and 23 August. In total they accounted for 56 intervals over 7 hours. The bulk of these corrections occurred on 22 July due to errors in the scarcity pricing posting logic. The correction on 31 July was again due to an error in the posting logic associated with Enhanced Inter-Regional Transaction Coordination. The 23 August price correction was due to a software deployment that resulted in prices being created and set incorrectly by the posting logic rather than using the prices calculated by the scheduling systems.

In the third quarter of 2011 the NYISO corrected the scarcity pricing posting logic. As well, minor enhancements were made to ISS to improve the evaluation and processing of telemetry problems.

### **October – December 2011**

The fourth quarter of 2011 had one price correction on 27 October. Two intervals were corrected because for an incorrect line limit was used in the RTD dispatch. Regarding initiatives to reduce price corrections, the NYISO has continued to improve its Integrated Source Selection system with an expansion of metering points.

## **January - March 2012**

The first quarter of 2012 did not have any price corrections in the Real-Time Market. As for improvements to processes that impact pricing, the NYISO continues to enhance, expand and upgrade the ISS to reduce telemetry errors.

## **April - June 2012**

In the second quarter of 2012 there were price corrections spanning six days totaling RTD 45 intervals. In April there were two days with price corrections - 17 and 23 April for a total of 5 intervals; in May there were four days - 01, 11, 21 and 29 May accounting for 40 intervals.

Both of the April price corrections along with the 01 May price corrections were for load forecaster errors. The 11 and 21 May price corrections were due to an incorrect input. The 29 May price correction of RTD ancillary prices was due to incorrect scarcity pricing logic.

Measures taken to mitigate price corrections in the 2<sup>nd</sup> quarter include revisions to the scarcity pricing posting logic, and to expansion of and enhancements to ISS.

## **July - September 2012**

In the third quarter of 2012 there were price corrections to six intervals spanning six days.

The 7/4, 8/17, 8/21, and 8/31 corrections, for one interval each day, were due to a software error which caused non-convergence in the power flows. The 8/12 correction (1 interval) was due to a software error which caused an erroneous DNI value. The 8/29 correction (1 interval) was due to bad telemetry.

Measures taken to mitigate price corrections in the 3<sup>rd</sup> quarter include implementing a fix to the software which manages DNI. Additionally, the NYISO continues to upgrade the Intelligent Source Selector (ISS) software to reduce telemetry errors.

## **October - December 2012**

In the fourth quarter of 2012 there were seven days with a price correction, affecting 111 real-time intervals across 27 different hours.

The 10/4, 10/5, 10/15, and 11/17 corrections were due to software errors with the special External Proxy Pricing logic. The software errors only affected the PJM zone.



The 10/23 corrections were due to a failure of our web posting process. The prices were calculated correctly and were available to the NYISO's settlement software, but failed to get posted to OASIS in a timely manner.

The 10/31 corrections were due to a database failure.

The 12/30 corrections were due to a software error which affected the DNI values used in the real-time market solution.

Measures taken to mitigate price corrections in the 4<sup>th</sup> quarter included implementing fixes for the special External Proxy Pricing logic, as well as implementing a fix for the software which manages DNI.

### **January - March 2013**

In the first quarter of 2013 there were 9 days with a price correction, affecting 19 real-time intervals across 11 different hours.

The 1/1 corrections were due to a web posting error. Following a database failure, the web posting process posted prices incorrectly.

The 1/3 corrections were due to a software error with the special External Proxy Pricing logic. The software error affected only the PJM zone.

The 1/9 corrections were due to a data error which caused non-convergence in the power flows.

The 1/18, 2/19, 3/7, and 3/22 corrections were due to telemetry errors.

The 1/23 and 2/18 corrections were related to generator out-of-merit records.

Measures taken to mitigate price corrections in the 1<sup>st</sup> quarter included:

- Implementing a fix for the special External Proxy Pricing logic
- Working with Transmission Owners to correct telemetry problems
- Implementing a fix to the web posting software

### **April - June 2013**

In the second quarter of 2013 there were 5 days with a price correction, affecting 40 real-time intervals across 8 different hours.

The 4/19 and 5/27 corrections were due to telemetry errors.

The 5/5 corrections were due to a software error with the special External Proxy Pricing logic. The software error affected only the HQ zone.

The 5/21 corrections were due to a data error which caused incorrect prices for the HQ and PJM zones.

On 6/18, two real-time price corrections were due to a software error which affected the load forecast values used in the real-time market solution. Also on 6/18, posting errors following a deployment outage resulted in the correction of 15 real-time intervals.

To mitigate price corrections, the NYISO continued to work with Transmission Owners in the 2<sup>nd</sup> quarter to correct telemetry problems. Additionally, the NYISO has refined some deployment steps to minimize posting problems following deployment outages.

### **July - September 2013**

In the third quarter of 2013 there were 4 days with a real-time price correction, affecting 7 real-time intervals across 5 different hours.

The 7/8 correction was due to a telemetry error.

The 7/18 correction was related to a generator out-of-merit record.

The 9/10 correction was due to improper transaction cuts.

The 9/24 correction was related to an incorrectly entered outage record.

In addition, a web posting issue on 9/13 resulted in the RTC Ancillary Services prices for one RTC interval to be re-posted.

To mitigate price corrections, the NYISO continued to work with Transmission Owners in the 3<sup>rd</sup> quarter to correct telemetry problems. In addition, NYISO reviewed its outage record procedures internally to mitigate the likelihood of future errors.

### **October - December 2013**

In the fourth quarter of 2013, there was one price correction, affecting one RTC interval.

A web posting issue caused by a database error on 10/30 resulted in the re-posting of RTC Ancillary Services prices for one RTC interval.

### **January – March 2014**

In the first quarter of 2014, there were 4 days with real-time price corrections, affecting 44 real-time intervals across 11 different hours.

- The 2/23 corrections were due to a hardware failure which caused incorrect prices to be posted for the NPX zone.

- The 3/26 corrections were due to an error during a software deployment which impacted the HQ, NPX, OH, and PJM zones.
- The 3/27 corrections were due to an error introduced with a software deployment which impacted the HQ and PJM zones.
- The 3/28 corrections were due to a software error which caused an erroneous DNI value. All internal and external zones were impacted.
- In addition, the posting error on 2/23 resulted in the correction of 6 RTC intervals, while the software error on 3/28 resulted in the correction of 2 RTC intervals.

Measures taken in the 1<sup>st</sup> quarter to mitigate price corrections included:

- Implementing a fix to ancillary services pricing during particular scarcity events. (This issue was identified during testing and never resulted in a pricing error).
- Continued enhancements to the Intelligent Source Selector (ISS) software to reduce telemetry errors.

Also in the 1<sup>st</sup> quarter, a discrepancy was identified with the modeling of one of the Sithe Independence unit PTIDs in the energy markets, PTID 23800, which impacted the LBMP at this single PTID. PTID 23800 was the original PTID for the entire Sithe Independence generating facility at NYISO start-up. In 2005 NYISO began modeling the Sithe Independence facility as four distinct PTIDs, leaving the original PTID in the network model. In 2008 the Oswego Export constraint was introduced to the network model, with the intent that the four individual Sithe Independence PTIDs and the original PTID would all have the same impact on this constraint. However, the original PTID was inadvertently left out of the modeling of the Oswego Export constraint. This resulted in different LBMPs for the original PTID versus the four individual Sithe Independence PTIDs for intervals in which the Oswego Export constraint was binding. The only time the constraint bound was during one interval in March 2011 and again during January 2014. During those intervals the four individual Sithe PTIDs appropriately reflected the value of the binding constraint but the original PTID did not. The energy markets model was updated in March 2014 to include the Sithe Independence original PTID (23800) in the modeling of the Oswego Export constraint. However, since this discrepancy was identified later than the tariff-prescribed price correction window, the posted prices for the Sithe Independence original PTID (23800) will remain.

Intervals with impacted prices for Sithe Independence original PTID (23800) due to the modeling discrepancy are as follows:

- Day-Ahead Market prices:
  - January 22, 2014: 17:00, 18:00, 19:00
  - January 23, 2014: 07:00, 08:00, 09:00, 10:00, 16:00, 17:00, 18:00, 19:00, 20:00
  - January 24, 2014: 06:00, 07:00, 08:00, 09:00, 10:00, 16:00, 17:00, 18:00, 19:00, 20:00
- Real-Time Commitment prices:
  - January 22, 2014: 17:30, 17:45, 18:00, 18:15, 18:30, 18:45, 19:00, 19:15
- Real-Time prices:
  - March 3, 2011: 17:55

- January 22, 2014: 17:50, 17:55, 18:00, 18:05, 18:10, 18:15, 18:20, 18:25, 18:30, 18:35, 18:40, 18:45, 18:50, 18:55, 19:00, 19:05, 19:10, 19:15

### **April – June 2014**

In the second quarter of 2014, there were 4 days with real-time price corrections, affecting 15 real-time intervals across 7 different hours.

- On 4/1, a software issue resulted in an under-representation of interchange, which affected four RTC intervals and ten real-time intervals.
- The 4/30 corrections were due to an operator error related to the execution of RTC. Only the NPX zone was impacted.
- The 5/1 correction was due to an operator input error with a generator out-of-merit record. All internal and external zones were impacted.
- The 5/23 correction was due to an erroneous load forecast caused by a hardware failure. All internal and external zones were impacted.

To mitigate price corrections, the NYISO is currently working with our vendors on fixes to prevent a re-occurrence of the software and hardware failures that occurred in the second quarter.

### **July – September 2014**

In the third quarter of 2014, there were 3 days with real-time price corrections, affecting 12 real-time intervals across 5 different hours.

- The three real-time price corrections for 8/8 were due to bad metering data which caused the Load Forecaster to see erroneous data. All internal and external zones were impacted.
- The eight real-time price corrections for 8/18 were due to a software issue which caused RTD to see inaccurate interchange schedules. All internal and external zones were impacted.
- On 9/20, a software design issue caused RTD to see inaccurate interchange schedules. Prices for one real-time interval were corrected, impacting all internal and external zones.

To mitigate price corrections, the NYISO is currently working with its IT department on the software issues which contributed to price corrections in the third quarter.

### **October – December 2014**

In the fourth quarter of 2014, there were 6 days with real-time price corrections, affecting 43 real-time intervals across 9 different hours.

- The five real-time price corrections for 10/6 were due to a software issue related to handling of generator out-of-merit records, resulting in a decrease of available MWs. All internal and external zones were impacted.
- The one real-time price correction for 10/21 was due to a Load Forecaster software issue which resulted in an erroneous forecast value. All internal and external zones were impacted.
- The three real-time price corrections for 10/29 were due to a software error related to the hand-off of interchange schedules between RTC and RTD, which also affected the calculation of Lake Erie Circulation values. This resulted in erroneous binding constraints. All internal and external zones were impacted.
- The twelve real-time price corrections for 11/1 and twenty-one real-time price corrections for 11/2 were due to a software error related to the 25-hour day that prevented correctly-calculated prices from being published/posted successfully. All internal and external zones were impacted.
- The one real-time price correction for 12/19 was due to an operator input error with a generator out-of-merit-record. All internal and external zones were impacted.

To mitigate price corrections, the NYISO is working on design improvements to the software that contributed to price corrections in the fourth quarter. Additional training was provided and process improvements were made so the results of various actions will be more apparent to the user. The NYISO is also continuing to improve its Intelligent Source Selection (ISS) modeling.

Additionally in the 4<sup>th</sup> quarter, on December 9<sup>th</sup>, during a routine review of market outcomes, the NYISO discovered a number of intervals where RTD failed to utilize the reserve demand curve to price reserve shortages. The affected intervals during which RTD did not utilize the reserve demand curve to price reserve shortages were:

- December 4<sup>th</sup>, 10:05, 10:07, 10:10, 10:15, 10:20, 10:21, 10:25, 10:30, 11:05, 11:07, 11:10, 11:15, 15:50, and 15:52
- December 8<sup>th</sup>, 18:20, 18:24, 18:25, 18:30, 18:45, 18:50, 18:51, 18:55, and 19:00.

The NYISO timely reserved the impacted operating reserves and energy prices for December 8<sup>th</sup>, per Attachment E, and subsequently determined that the already-posted December 8<sup>th</sup> prices best reflected system conditions within the terms of Attachment E and should remain as posted. However, the reservation window for the impacted operating reserves and energy prices for December 4<sup>th</sup> had closed. Therefore, the NYISO did not reserve or correct these prices per Attachment E.

On December 16<sup>th</sup>, the NYISO self-reported this issue, in conjunction with a related issue regarding the implementation of the new Mixed Integer Programming (MIP) that impacted reserve schedules, to FERC and informed Market Participants of the issue.

## **January – March 2015**

In the first quarter of 2015, there were 5 days with real-time price corrections, affecting 30 real-time intervals across 7 different hours.

- The six real-time price corrections for 1/22 resulted from a software issue affecting the Special Pricing rules at the Chateauguay Interface when 15-minute scheduling is disabled. Only prices for the HQ Wheel Proxy Bus were impacted.
- The three real-time price corrections for 2/8 were due to a software issue related to handling of generator out-of-merit records. Following the deletion of an out-of-merit record, the unit's schedule was erroneously reduced to 0 MW. All internal and external zones were impacted.
- The fourteen real-time price corrections for 3/7 were due to a software issue related to Daylight Savings Time that prevented correctly-calculated prices from being published/posted successfully. All internal and external zones were impacted.
- The three real-time price corrections for 3/26 resulted from an incorrect entry of a generator out-of-merit record. The incorrect entry resulted in a decrease of available MWs for scheduling. All internal and external zones were impacted.
- The four real-time price corrections for 3/31 were due to a software issue related to handling of generator out-of-merit records, resulting in a decrease of available MWs for scheduling. All internal and external zones were impacted.

The 1/22 pricing error noted above was detected within the NYISO's price correction deadline and was corrected per Attachment E. However, during the NYISO's analysis of the pricing error, it was discovered that the software issue that caused the error has existed since April 2014. It has impacted other real-time intervals for which NYISO's price correction deadlines have passed, and thus, no price corrections were made. The extent of this issue impacts real-time intervals only when both of the following conditions are present:

- 15-minute scheduling is disabled at the HQ Interface only
- The RTC15 execution was subject to a NYCA Ramp, HQ Ramp, or HQ Total TTC constraint.

During these times, the correct External Interface Congestion was properly added to the HQ Import Proxy Bus prices. Prices for the HQ Wheel Proxy Bus, however, did not include the correct External Interface Congestion.

The NYISO identified the following impacts of the software issue:

- Incorrect HQ Wheel Proxy Bus LBMP across 348 real-time intervals over 19 different days since April 2014.
- Only wheel-thru transactions at the HQ Wheel Bus that were subjected to balancing market LBMPs during these intervals were affected.
- Financial impact to those transactions is less than \$20,000.

On February 26<sup>th</sup>, the NYISO informed Market Participants of this issue at the Market Issues Working Group meeting.

To prevent recurrence of this pricing error, the NYISO has implemented a procedural change when disabling 15-minute scheduling to ensure that the Special Pricing rules for Proxy Buses are applied correctly. A software solution is also in development.

Additionally, there are software solutions planned for fall 2015 deployment to address issues noted with publishing and posting prices when Daylight Savings Time begins and ends.

## **April – June 2015**

In the second quarter of 2015, there were 3 days with real-time price corrections, affecting 7 real-time intervals across 3 different hours.

- The one real-time price correction for 4/2 was due to a software error that resulted in erroneous Lake Erie Circulation values being used by RTD which resulted in a statewide price spike. All internal and external zones were impacted.
- The four real-time price corrections for 6/12 resulted from an operator error related to the deletion of a generator out-of-merit record. This error caused prices to decrease during these intervals. All internal and external zones were impacted.
- The two real-time price corrections for 6/30 were due to a software error that resulted in an incorrect DNI value for the OH interface being considered by RTD which resulted in a statewide price decrease. All internal and external zones were impacted.

Measures taken in the 2<sup>nd</sup> quarter to mitigate pricing errors include:

- Software deployment to ensure that the Special Proxy Pricing rules are applied correctly to both the HQ Import Proxy Bus and HQ Wheel Proxy Bus when 15 minute scheduling is disabled. (This issue was identified during the 1<sup>st</sup> quarter).
- Continued enhancements to the Intelligent Source Selector (ISS) software to reduce telemetry errors.

## **July – September 2015**

In the third quarter of 2015, there were 2 days with real-time price corrections, affecting 6 real-time intervals across 3 different hours.

- Two real-time price corrections for 8/3 resulted from a data error that caused erroneous load values to influence the load forecasts, resulting in a statewide price spike. All internal and external zones were impacted.
- Three real-time price corrections for 8/3 resulted from a data error in RTD that impacted the load forecast, impacting statewide prices. All internal and external zones were impacted.
- The one real-time price correction for 9/13 was due to incorrect load forecaster data used by RTD that impacted statewide prices. All internal and external zones were impacted.

Measures taken in the 3<sup>rd</sup> quarter to mitigate pricing errors include:

- Continued enhancements to the Intelligent Source Selector (ISS) software to reduce telemetry errors.
- Additionally, the NYISO continuously examines its load forecasting software and models to determine if there are parameters or model variables which contribute to data errors.

## **October – December 2015\***

In the fourth quarter of 2015, there were 3 days with real-time price corrections, affecting 11 real-time intervals across 5 different hours.

- The seven real-time price corrections for 10/28 resulted when prices posted to OASIS for the N.E. Gen Sandy Pond and HQ Gen Cedars proxies did not reflect special proxy bus pricing. This issue occurred during a system outage while software was being upgraded. Only prices for N.E. Gen Sandy Pond (for 4 of the intervals) and HQ Gen Cedars (for 6 of the intervals) were impacted.
- The one real-time price correction for 11/20 resulted from an operator error related to a generator out-of-merit record. This error caused prices to decrease during these intervals. All internal and external zones were impacted. Prices for Regulation Capacity and Regulation Movement were also impacted.
- One real-time price correction for 11/26 resulted from a software error that caused an erroneous external constraint to form in RTD. Only prices for HQ Import Export and HQ Wheel were impacted.
- Two real-time price corrections for 11/26 resulted from an issue related to a generator out-of-merit record. This error caused prices to decrease during these intervals. All internal and external zones were impacted. Prices for 10 Spin in the East and SENY reserve areas were also impacted.

Measures taken in the 4<sup>th</sup> quarter to mitigate pricing errors include:

- Continued enhancements to the Intelligent Source Selector (ISS) software to reduce telemetry errors.
- Software fix implemented to address the issue that resulted in the 11/26 price correction.

\*Details on Ancillary Service Price Corrections are included in the Q4 2015 report going forward.

### **January – March 2016**

In the first quarter of 2016, there were 16 real-time intervals corrected across four days.



- The three real-time price corrections for 1/28 were due to computer system issues that resulted in incorrect application of external congestion to the Sandy Pond Proxy prices. Only prices for the Sandy Pond Proxy were impacted.
- The two real-time price corrections for 1/29 resulted from incorrect load forecaster data used by RTD that impacted statewide energy prices. All internal and external zones were impacted.
- The nine real-time price corrections for 2/24 resulted from an issue related to special external proxy bus pricing logic following a software deployment.
  - For the 1<sup>st</sup> quarter hour of HB13, incorrect external congestion was applied to the HQ Wheel and HQ Import Export proxy RTD prices.
  - For the 2<sup>nd</sup> quarter hour, prices posted to OASIS for the HQ Wheel and HQ Import Export proxies did not reflect special proxy bus pricing
  - For the 3<sup>rd</sup> quarter hour, incorrect external congestion was applied to the OH Bruce proxy RTD prices.
- The two real-time price corrections for 2/25 were due to computer system issues that resulted in incorrect Lake Erie Circulation values seen by RTD. All internal and external zones were impacted. Additionally, prices for NYCA Regulation, NYCA Regulation Movement, and 10 Spin in all East zones were also impacted.

Measures taken in the 1<sup>st</sup> quarter to mitigate pricing errors include:

- Continued enhancements to the Intelligent Source Selector (ISS) software to reduce telemetry errors.

## **April – June 2016**

In the second quarter of 2016, there were 24 real-time intervals corrected across ten days.

- The real-time price correction for 4/6 resulted from an incorrect generator out-of-merit-record. All internal and external zones were impacted.
- There were eight real-time price corrections that resulted from incorrect load forecast data used by RTD that impact statewide energy prices.
  - The 4/15 price correction impacted prices for all internal and external zones, prices for 10 Spin in all NYCA zones, and the price for NYCA Regulation Capacity.
  - The 4/22, 6/11, and 6/12 price corrections impacted prices for all internal and external zones.
  - The 5/9 and 6/7 price corrections impacted prices for all internal and external zones and prices for NYCA Regulation Capacity and NYCA Regulation Movement.
  - The 6/2 price correction impacted prices for all internal and external zones and prices for 10 SPIN in all East zones.
- The real-time price correction for 6/8 was due to a software issue that caused the posting of an incorrect NYCA Regulation Movement price.
- Fourteen real-time price corrections for 6/20 resulted from the system outages during a planned software upgrade.
  - Four real-time price corrections resulted from incorrect DNI being used by RTD.
    - One correction to the 21:30 interval impacted prices for all internal

- and external zones and prices for NYCA Regulation Capacity and NYCA Regulation Movement.
  - Two corrections to the 21:55 and at 21:56:41 intervals impacted prices for all internal and external zones and prices for NYCA Regulation Capacity and NYCA Regulation Movement.
  - One correction to the 22:50 interval impacted prices for all internal and external zones.
- Seven real-time price corrections resulted from erroneous external congestion.
  - Four corrections to the 22:00, 22:05, 22:10, and 22:15 intervals impacted prices for the HQ Import Export, HQ Wheel, NPX Sandy Pond, and 4 PJM proxy buses.
  - Three corrections to the 23:05, 23:10, and 23:15 intervals impacted prices for all NE and PJM proxy buses, as well as the OH proxy bus and HQ Cedars proxy bus.
- Three real-time price corrections to the 22:19:11, 22:20, and 22:22:11 intervals occurred for two reasons. First, incorrect DNI was used by RTD, and second, erroneous external congestion was included. All internal and external zones were impacted.

Measures taken in the 2<sup>nd</sup> quarter to mitigate pricing errors include:

- Software fix was implemented to address the issue that resulted in the 4/15 and 4/22 price corrections.
- Improvements to the load forecast software and parameters that address issues contributing to price corrections in the 2<sup>nd</sup> quarter.
- Software fix was implemented to improve handling of the data transition after an Out of Merit is released.
- Software fix was implemented to address issues posting external congestion to RTD LBMPs during system outages.
- A software fix is in development to address the Regulation Movement posting issue that resulted in the 6/8 price correction.

## **July – September 2016**

In the third quarter of 2016, there were seven real-time intervals corrected across two days.

- The two real-time price corrections for 9/13 resulted from an incorrect generator out-of merit-record. LBMPs in all internal and external zones were impacted. Ancillary Service Prices for 10 Minute Spinning Reserve for all East zones were also impacted for one of the intervals.
- The five real-time price corrections for 9/16 were due to a computer system issue which resulted in erroneous external congestion. The corrections impacted the LBMP for the NPX Sandy Pond proxy bus.

### Note about LBMPs during Ramapo PAR Modeling Issue

On June 28<sup>th</sup>, following a fire that destroyed Ramapo PAR 3500, the NYISO updated the percentage value of PJM Keystone interchange modeled over the remaining in-service Ramapo PAR 4500 from 30.5% to 46% for its June 29<sup>th</sup> Day-Ahead Energy Market. However, the corresponding change was not made for the NYISO's Real-Time

Energy Market. Instead, the percentage of interchange modeled over the single in-service Ramapo PAR 4500 remained at 30.5% in the Real-Time Market from June 29<sup>th</sup> until August 5<sup>th</sup>, when the issue was identified by the NYISO and corrected. At the time the error was detected, real-time prices that had been established but not finalized (i.e., prices for 8/4/16 and part of 8/5/16) were reviewed and deemed not to require correction per the procedures described in Attachment E. Prices for June 29<sup>th</sup> through August 3<sup>rd</sup> had already been reviewed and finalized per Attachment E procedures before NYISO was aware of the issue.

This did not affect the Day-Ahead Market.

On August 12<sup>th</sup>, 2016, the NYISO informed Market Participants of this issue.

To prevent recurrence of this issue, the NYISO implemented procedural changes associated with the modification of these PAR modeling values.

#### Note about Graduated Transmission Demand Curve Issue

On October 6<sup>th</sup>, 2016, the NYISO informed Market Participants of an inconsistency between its software implementation of the graduated transmission demand curve pricing and the tariff. NYISO is planning to seek a waiver from FERC dating back to the implementation of the graduated transmission demand curve on February 11, 2016, and is working with stakeholders on a path forward to reconcile the software implementation and the tariff.

### **October – December 2016**

In the fourth quarter of 2016, there was one real-time interval corrected.

- The real-time price corrections for 12/25 resulted from incorrect load forecast data used by RTD that impacted statewide energy prices. Ancillary Service Price for Regulation Capacity was also impacted for this interval.

Measures taken in the 4<sup>th</sup> quarter to mitigate pricing errors include:

- Software improvement to prevent price posting errors following software deployments.

#### Note about Graduated Transmission Demand Curve Issue

On October 6, 2016, the NYISO informed Market Participants of an inconsistency between its software implementation of the graduated transmission demand curve pricing and the tariff. On January 6, 2017, the NYISO requested certain tariff waivers to continue applying the transmission constraint pricing methodology that is currently coded in its software. The NYISO requested that the waivers remain in place until tariff revisions and software modifications to resolve the current inconsistency are approved by FERC and implemented.

### **January – March 2017**

In the first quarter of 2017, there were seven real-time intervals corrected.

- The one real-time price correction for 1/4 resulted from a price posting issue that caused incorrect energy prices for six internal zones and six external proxy buses.

- There was no impact to Ancillary Service Prices for this interval.
- The four real-time price corrections for 1/9 resulted from a price posting issue that caused incorrect energy prices for all internal and external zones. There was no impact to Ancillary Service Prices for these intervals.
  - The two real-time price corrections for 3/24 resulted from the handling of the deletion of a generator out-of-merit record. Energy prices for all internal and external zones were impacted. Regulation Capacity price was also impacted.

Measures taken in the 1<sup>st</sup> quarter to mitigate pricing errors include:

- Software fix was implemented to improve data handling during a deployment.
- Software fix was implemented to address the issue that resulted in the 1/4 and 1/9 price corrections.

#### Note about Graduated Transmission Demand Curve Issue

On October 6, 2016, the NYISO informed Market Participants of an inconsistency between its software implementation of the graduated transmission demand curve pricing and the tariff. On January 6, 2017, the NYISO requested certain tariff waivers to continue applying the transmission constraint pricing methodology that is currently coded in its software. The NYISO requested that the waivers remain in place until tariff revisions and software modifications to resolve the current inconsistency are approved by FERC and implemented.

### **April – June 2017**

In the second quarter of 2017, there were twelve real-time intervals corrected.

- The one real-time price correction for 5/13 resulted from a metering error which impacted the load forecast. This caused incorrect energy prices for all internal zones and external proxy buses. There was no impact to Ancillary Service Prices for this interval.
- The three real-time price corrections for 5/18 resulted from a software issue related to handling of a generator out of merit record. This caused incorrect energy prices for all internal zones and external proxy buses. Regulation Capacity and Regulation Movement prices were also impacted.
- The seven real-time price corrections for 5/19 resulted from an incorrect Operator input entry of a constraint limit. There was no impact to Ancillary Service Prices for the 5/19 corrected intervals.
- The one real-time correction for 5/29 resulted from a price posting issue that caused incorrect Regulation Capacity and Regulation Movement prices to be posted. There was no impact to reserves prices or energy prices.

To mitigate price corrections, the NYISO is currently working with its IT department on the price posting issue which contributed to price corrections in the 2<sup>nd</sup> quarter.

#### Note about Graduated Transmission Demand Curve Issue

On April 21, 2017 the NYISO submitted proposed tariff revisions to clarify and enhance transmission constraint pricing. This filing was accepted by FERC on June 14, 2017. Changes became effective and were implemented on June 20, 2017.

## July – September 2017

In the third quarter of 2017, there were ten real-time intervals corrected.

- The one real-time price correction for 8/29 resulted from an outage record that was removed in error following a software deployment. This caused incorrect energy prices for all internal zones and external proxy buses. The Regulation Movement price was also impacted.
- The one real-time price correction for 9/10 was due to an erroneous load forecast used by RTD that resulted from a software issue. This caused incorrect energy prices for all internal zones and external proxy buses. Regulation Capacity and Regulation Movement prices were also impacted.
- The three real-time price corrections for 9/17 resulted from incorrect data received from an external RTO. Only NE Sandy Pond proxy bus prices were impacted.
- The four real-time corrections for 9/18 were due to an incorrect generator status resulting from a data error. This caused incorrect energy prices for all internal zones and external proxy buses. 10 Minute Spinning Reserve prices in all NYCA zones and Regulation Capacity prices were also impacted, and Regulation Movement prices were impacted for three of the intervals.
- The one real-time correction for 9/21 resulted from an input error with an interface limit. This caused incorrect energy prices for all internal zones and external proxy buses. Regulation Capacity and Regulation Movement prices were also impacted.

Measures taken in the 3<sup>rd</sup> quarter to mitigate pricing errors include:

- Reviewed generator data and confirmed that the data error that occurred on 9/18, which resulted in four real-time price corrections, was an isolated incident.

### Note about one pricing error discovered in the 3<sup>rd</sup> quarter after our price correction deadline:

While conducting a routine review of pricing outcomes, it was discovered that the NYISO's market software could inadvertently fail to reduce the target level for SENY 30-minute reserves to zero MW during a Thunderstorm Alert (TSA) under certain circumstances. A subsequent review of past TSAs identified a single five-minute interval in real-time (i.e., the five-minute interval ending at 18:30 on August 11, 2016) during which such an inadvertent failure occurred and, as a result, the NYISO's Real-Time Dispatch (RTD) software erroneously established a separate price for SENY 30-minute reserves. As a result of the inadvertent failure to reduce the target level for SENY 30-minute reserves to zero MW during the five-minute interval ending at 18:30 on August 11, 2016 – an interval when a TSA was treated as being in effect by the NYISO's real-time market software – RTD produced a SENY 30-minute reserve price of \$19.82 per MWh for the affected interval. As this software issue and pricing impact was discovered after NYISO's price correction deadline had passed, no price corrections were made. A software fix has been implemented to ensure appropriate reserve requirements during a Thunderstorm Alert.

## October – December 2017

In the fourth quarter of 2017, there were two real-time intervals corrected.

- The two real-time price corrections for 10/10 resulted from a metering issue. A

unit's metered output, which was used by RTD, was significantly higher than the unit's actual output. This resulted in erroneous constraints. Energy prices for all internal zones and external proxy buses were corrected. There was no impact to Reserve or Regulation prices.

### **January – March 2018**

In the first quarter of 2018, there were no price corrections.

### **April – June 2018**

In the second quarter of 2018, there were twenty-two real-time intervals corrected.

- The twelve real-time price corrections for 4/2 resulted from a software posting issue that prevented correctly-calculated prices from being posted successfully to the OASIS. Prices for all internal and external zones, as well as ancillary services were corrected.
- The four real-time price corrections for 4/29 were due to software issues that resulted in incorrect application of external congestion. The Sandy Pond Proxy prices were corrected for four intervals and the OH Bruce Proxy price was corrected for one interval. No corrections were made to internal zone prices or ancillary services prices.
- The four real-time price corrections for 5/1 were due to incorrect line limits that caused erroneous congestion. The Mohawk Valley and North internal zone prices as well as the HQ Cedars Proxy price were corrected. There were no corrections to ancillary services prices.
- The one real-time price correction for 5/15 resulted from a software issue related to handling of a generator out of merit record. All internal and external zone prices as well as Regulation Capacity prices were corrected.
- The one real-time price correction for 5/29 was due to an incorrectly entered outage record. All internal and external zone prices were corrected. There were no corrections made to ancillary services prices.

Measures taken in the 2<sup>nd</sup> quarter to mitigate pricing errors include:

- Software fix was implemented to resolve the 4/2 issue that prevented correctly-calculated prices from being posted.

### **July – September 2018**

In the third quarter of 2018, there were seven real-time intervals corrected.

- One of the real-time price corrections for 8/8 resulted from an Operator input error which caused an erroneous constraint. All internal and external zonal prices as well as Regulation Capacity and Regulation Movement prices were corrected.
- Four of the real-time price corrections for 8/8 were due to a software issue related to the handling of a limit override entry which resulted in erroneous constraints. All internal and external zonal prices as well as Regulation Capacity and Regulation Movement prices were corrected.
- The two real-time price corrections for 9/18 resulted from an incorrect generator

out of merit record. All internal and external zonal prices, 10-Minute Spin prices in all NYCA zones, and Regulation Capacity prices were corrected.

Note about one pricing error discovered in the 3<sup>rd</sup> quarter after our price correction deadline:

While conducting a routine review of market outcomes, it was discovered that on August 4, 2018, an incorrect limit override was applied, impacting one binding real-time interval. Two constraints developed incorrectly which impacted prices at 15:52:

Pricing Interval	Limiting Facility	Facility PTID	Contingency	Constraint Cost(\$)
8/4/18 15:52	GOETHALS 345 LINDN_CG 345 1	26000	GOETHALS-LINDN_CG_345_G23M	\$ (1,175.00)
8/4/18 15:52	GOETHALS 345 LINDN_CG 345 2	325203	GOETHALS-LINDN_CG_345_G23L	\$ (1,175.00)

As the error and pricing impact was discovered after NYISO’s price correction deadline had passed, no price corrections were made.

### October – December 2018

In the fourth quarter of 2018, there were no price corrections.

### January – March 2019

In the first quarter of 2019, there were 5 real-time intervals corrected.

- The two real-time price corrections for 1/20 resulted from an Operator input error of a line limit which caused a constraint to no longer bind. All internal and external zonal prices were corrected.
- The three real-time price corrections for 2/8 resulted from an erroneous deletion of a generator out of merit record. All internal and external zonal prices were corrected.

Measures taken in the 1<sup>st</sup> quarter to mitigate pricing errors include:

- Software fix to improve the ramping of DNI values coming out of DNI Override.

### April – June 2019

In the second quarter of 2019, there were 12 real-time intervals corrected.

- The three real-time price corrections for 5/8 resulted from an incorrect generator out of merit record. All internal and external zonal prices were corrected. Ancillary service prices for 10 Minute Spinning Reserves for zones in the East were also corrected.
- The two real-time price corrections for 5/21 resulted from a load calculation error. The data source used for part of the load forecast calculation became corrupt.

Energy prices for all internal zones and external proxy buses were corrected. There was no impact to ancillary service prices for these intervals.

- The six real-time price corrections for 6/16 resulted from a database issue that prevented correctly-calculated prices from being posted successfully to the OASIS. Reposting the correct prices updated the LBMPs for all internal and external zones in four of the six intervals, and for a subset of the zones for the other two intervals. Prices for ancillary services were updated in four of the six intervals.
- The one real-time price correction for 6/18 resulted from a metering issue. A unit appeared to be offline when it was actually generating. Energy prices for all internal zones and external proxy buses were corrected. Ancillary service prices for 10 Minute Spinning Reserves for zones in the East were also corrected.

Measures taken in the 2<sup>nd</sup> quarter to mitigate pricing errors include:

- Replaced corrupt data source that resulted in the 5/21 price correction with a more reliable source.

## **July – September 2019**

In the third quarter of 2019, there were 9 real-time intervals corrected.

- The six real-time price corrections for 9/25 resulted from a posting issue that prevented the complete and successful posting of generator prices to the OASIS. The correctly-calculated prices were reposted to the Real-Time LBMP Generator “All” file on OASIS for all six intervals. There were no changes to Ancillary service prices.
- The three real-time price correction for 9/30 resulted from an outage modeling issue that resulted in large discrepancies between actual and modeled flows. Energy prices for all internal zones and external proxy buses were corrected. Ancillary service prices for NYCA Regulation Capacity and Regulation Movement were also corrected.

### Note about software issue that impacted market evaluation during the 3<sup>rd</sup> quarter:

On July 2<sup>nd</sup> and July 3<sup>rd</sup> 2019, the NYISO experienced software issues that impacted the market evaluation of transaction bids at the Neptune, Hudson Transmission Partners (HTP), and Linden VFT Scheduled Lines. Additional details of the issue were described in a ‘Notice of Potential Market Problem’ email to Market Participants sent on July 3<sup>rd</sup>, 2019.

The NYISO and its Independent Market Monitor, Potomac Economics, have concluded an assessment of the potential Market Problem and determined that the reported concern did not have a material effect on the ISO-administered markets or transmission service. Therefore, it was not a Market Problem.



## October – December 2019

In the fourth quarter of 2019, there were 17 real-time intervals corrected.

- The three real-time price corrections for 10/23 resulted from an erroneous limit at the NE Sandy Pond proxy which caused an external constraint to bind. NE Sandy Pond proxy bus prices were corrected by removing this erroneous external congestion from them.
- The one real-time price correction for 11/28 resulted from an error which prevented the correctly-calculated prices from being successfully posted to OASIS. Reposting the correct prices updated the LBMPs for all internal zones and external proxy buses, as well as Regulation Capacity prices.
- The one real-time price correction for 12/9 resulted from an error which prevented the correctly-calculated prices from being successfully posted to OASIS. Reposting the correct prices updated the LBMPs for all internal zones and external proxy buses, as well as NYCA Regulation Capacity and Regulation Movement prices, 10 Minute Spinning Reserves prices for zones in the East, and 10 Minute Non-Synchronous Reserves prices in NYC.
- The twelve real-time price corrections for 12/12 resulted from software issues due to database errors during a software deployment.
  - One correction to the 12:30 interval resulted from incorrect application of the pricing rules for external proxy buses. Only the NE Sandy Pond bus price was impacted and was re-calculated to include the applicable external congestion.
  - Two corrections to the 13:10 and 13:15 intervals resulted from incorrect DNI schedules. All internal zone and external proxy bus energy prices were corrected as well as Regulation Capacity and Regulation Movement prices.
  - Six corrections to the 13:20, 13:25, 13:30, 13:35, 13:40, and 13:45 intervals resulted from the incorrect application of the pricing rules for external proxy buses. Prices were corrected at HQ Import Export, HQ Wheel, NE Sandy Pond, and 4 PJM proxy buses.
  - Two corrections to the 16:30 and 16:40 intervals resulted from incorrect application of the pricing rules for external proxy buses. Only the NE Sandy Pond proxy bus price was impacted and was re-calculated to remove the erroneous external congestion.
  - One correction to the 16:45 interval resulted from incorrect DNI schedules. All internal zone and external proxy bus energy prices were corrected as well as 10 Minute Spinning Reserve in the NYCA, Regulation Capacity, and Regulation Movement prices.

## January – March 2020

In the first quarter of 2020, there were 33 real-time intervals corrected.

- The one real-time price correction for 1/29 resulted from an erroneous line limit sent by a T.O. that caused erroneous congestion. All internal zones and external proxy bus energy prices were corrected. Regulation Capacity and Regulation Movement prices were corrected as well.
- The thirty-two real-time price corrections for 2/21 resulted from a data corruption issue. This led to incorrect DNI schedules and erroneous application of RTC external congestion to the RTD proxy bus prices.
  - The following intervals were impacted by incorrect DNI schedules:
    - For 14:20, 14:21:49, 14:23:31, 14:25, 14:30, 14:35, 14:40, 14:45, 14:50, 14:55, 15:00, 15:05, 15:10, 15:15, 15:20, 15:25, 15:30, 15:35, and 15:40, all internal zones and external proxy bus energy prices were corrected.
    - For 14:23:31, 10 Minute Spinning Reserve prices in all East zones were corrected.
    - For 14:35, 14:40, 14:45, 14:50, 14:55, 15:00, 15:05, 15:10, 15:15, 15:20, 15:25, 15:30, 15:35, and 15:40, Regulation Capacity prices were corrected.
    - For 14:40, 14:45, 14:50, 15:00, 15:05, 15:10, 15:15, 15:20, 15:25, 15:30, 15:35, and 15:40, Regulation Movement prices were corrected.
    - For 14:50 and 14:55, 10 Minute Spinning Reserve and 10 Minute Non-Synchronous Reserve prices in NYC were corrected.
    - For 15:00, 15:05, 15:10, and 15:15, 10 Minute Spinning Reserve prices and 10 Minute Non-Synchronous Reserve prices in all NYCA zones were corrected.
    - For 15:20, 15:25, 15:30, 15:35, and 15:40, 10 Minute Spinning Reserve prices and 10 Minute Non-Synchronous Reserve prices were corrected in all East zones.
    - For 15:00, 15:05, 15:10, 15:15, 15:20, 15:25, 15:30, 15:35, and 15:40, external congestion at HQ Import/Export, HQ Wheel, and all PJM proxy buses was removed.
  - The following intervals had only erroneous external congestion removed:
    - For 15:45, 15:50, 15:55, and 16:00, erroneous external congestion was removed at HQ Import/Export, HQ Wheel, and all PJM proxy buses.

- For 16:05, 16:10, 16:15, 16:50, 16:55, 17:00, 17:05, 17:10, and 17:15, erroneous external congestion was removed at all external proxy buses.

Measures taken in the 1<sup>st</sup> quarter to mitigate pricing errors include:

- Software fix to RTD to ensure correct ramping of interchange during certain Operator override modes.
- Software fix to prevent the data corruption issues that caused the 2/21 corrections.
- Development of additional communication/risk assessment protocols as it relates to software deployments.

### **April – June 2020**

In the second quarter of 2020, there were 8 real-time intervals corrected.

- The two real-time price corrections for 4/20 resulted from an incorrect line limit that caused erroneous congestion. All internal zones and external proxy bus energy prices were corrected. There was no impact to prices for ancillary services.
- The one real-time price correction for 4/21 resulted from software issues during a deployment that led to incorrect application of the external proxy bus pricing logic. Specifically, RTC external congestion that should have been applied to the real-time prices for the N.E. Gen Sandy Pond bus was not applied. Only the N.E. Gen Sandy Pond bus energy price was impacted by the issue and corrected.
- The two real-time price corrections for 5/11 resulted from a generator out of merit record that was deleted in error. All internal zones and external proxy bus energy prices were corrected. There was no impact to prices for ancillary services.
- The three real-time price corrections for 6/30 resulted from a data issue in the load forecast used by RTC in advisory intervals. To correct prices, erroneous RTC external congestion was removed from the real-time energy prices for HQ Gen Cedars, NPX Gen 1385, NPX Gen Cross Sound Cable, and OH Gen proxy buses. There was no impact to prices for ancillary services.

Measures taken in the 2<sup>nd</sup> quarter to mitigate pricing errors include:

- Software fix to ancillary services pricing during particular scarcity events. This issue was identified during testing and never resulted in a pricing error.
- The NYISO is currently working with our vendor on improvements to prevent a re-occurrence of the data issue which resulted in the 6/30 price errors.

### **July – September 2020**

In the third quarter of 2020, there were 5 real-time intervals corrected.

- The one real-time price correction for 7/23 resulted from a data issue in the Load Forecaster whereby actual load data feeding the forecast had an erroneous downward spike that caused an erroneous load forecast to be used by RTD. All internal zones and external proxy bus energy prices were corrected. There was no impact to prices for ancillary services.
- The three real-time price corrections for 8/3 resulted from an erroneous NE supply curve price at the NE Sandy Pond proxy which caused an external constraint to bind in RTC. The corresponding real-time NE Sandy Pond proxy bus prices were corrected by removing this erroneous external congestion from them. Only the N.E. Gen Sandy Pond bus energy price was impacted by the issue and corrected.
- The one real-time price correction for 8/4 resulted from generator out of merit records that were entered in error. All internal zones and external proxy bus energy prices were corrected. Additionally, NYC 10-minute Spin and NYC 10-minute Non-Spin reserves prices were also corrected.

### **October – December 2020**

In the fourth quarter of 2020, there were 5 real-time intervals corrected.

- The two real-time price correction for 10/8 resulted from an issue related to the deletion of an outage record. All internal zones and external proxy bus energy prices were corrected. Additionally 10-minute Spin prices for all zones in NYCA were corrected, as were the Regulation Capacity and Regulation Movement prices.
- The three real-time price correction for 10/20 resulted from an incorrect outage record. All internal zones and external proxy bus energy prices were corrected. Additionally 10-minute Spin prices for all zones in NYCA were corrected, as were the Regulation Capacity and Regulation Movement prices.

### **January – March 2021**

In the first quarter of 2021, there were 3 real-time intervals corrected.

- Two real-time price corrections for 2/9 were due to a software error during a software deployment that resulted in incorrect Lake Erie circulation values seen by RTD. All internal zones and external proxy bus energy prices were corrected. The 10-minute Spin prices for all zones in the East were also corrected.
- One real-time price correction for 2/9 resulted from a software error following a software deployment which impacted an outage record. All internal zones and external proxy bus energy prices were corrected. There was no impact to prices for ancillary services.

## April – June 2021

In the second quarter of 2021, there were 4 real-time intervals corrected.

- The two real-time price corrections for 4/3 resulted from a metering issue which impacted the load forecast. All internal zones and external proxy bus energy prices were corrected. Regulation Capacity and Regulation Movement prices were also corrected.
- The one real-time price correction for 4/20 was due to the transmission demand curve mechanism being applied to both the first and second most limiting elements of related line segments, as further described in slides 4 - 6 of the September 10, 2019 MIWG [presentation](#). All internal zones and external proxy bus energy prices were corrected. Regulation Capacity and Regulation Movement prices were also corrected.
- The one real-time price correction for 5/5 resulted from a metering issue which impacted the load forecast. All internal zones and external proxy bus energy prices were corrected. There was no impact to prices for ancillary services.

## July – September 2021

In the third quarter of 2021, there were 56 real-time intervals corrected.

- The 11 real-time price corrections for 7/7 resulted from a metering issue which impacted the load forecast.
  - For 8 of the corrections, all internal zones and external proxy bus LBMPs were corrected. 10-minute Spin, 10-minute Non-Spin, and 30-minute operating reserve prices were also corrected for all zones in the NYCA. For 7 of these intervals, the Regulation Capacity price was corrected as well.
  - For 3 of the corrections, external congestion was removed from the real-time LBMPs for HQ Import Export, HQ Wheel, NE Sandy Pond, and the 4 PJM proxy buses. No corrections were made to internal zone LBMPs or ancillary services prices.
- The 41 real-time price corrections for 8/6 resulted from a software error that resulted in erroneous external congestion.
  - For 15 of the corrections, external congestion was removed from the real-time LBMPs for HQ Import Export, HQ Wheel, NE Sandy Pond, and the 4 PJM proxy buses.
  - For 3 of the corrections, external congestion was removed from the real-time LBMPs for HQ Import Export, HQ Wheel, NE Sandy Pond, NPX Gen 1385, and the 4 PJM proxy buses.
  - For 23 of the corrections, external congestion was removed from the real-time LBMPs for NE Sandy Pond.
- The three real-time price corrections for 8/20 resulted from an erroneous NE supply curve price at the NE Sandy Pond proxy which caused an external constraint to

bind in RTC. The corresponding real-time NE Sandy Pond proxy bus LBMPs were corrected by removing this erroneous external congestion from them. Only the N.E. Gen Sandy Pond bus LBMP was impacted by the issue and corrected.

- The one real-time price correction for 8/26 was due to a software error that caused incorrect reserve demand curve logic to be applied during an EDRP/SCR activation. All internal zones and external proxy bus LBMPs were corrected. Additionally, 10-minute Spin, 10-minute Non-Spin, and 30-minute operating reserve prices for all NYCA zones were corrected, as were the Regulation Capacity prices.

Note about one pricing error discovered in the 3<sup>rd</sup> quarter after our price correction deadline:

After our price correction deadline for market day September 23<sup>rd</sup>, it was discovered that an issue with two outage records resulted in incorrectly developed constraints which impacted prices at 15:40 and 15:42:26.

Pricing Interval	Limiting Facility	Facility PTID	Contingency	Constraint Cost(\$)
09/23/21 15:40	ELM_ST 230 HUNTLEY 230 1	25855	TWR:GARDENVLLE 79 & 80	\$ (1,175.00)
09/23/21 15:40	ELM_ST 230 SENECA 230 1	26426	BUS:GARDNVLLE 72 & 79 & TR 4	\$ 1,175.00
09/23/21 15:40	ELM_ST 230 SENECA 230 1	26427	SCB:GARDNV(R755):71&73&80&TR	\$ 1,175.00
09/23/21 15:40	GARDNVLB 230 SENECA 230 1	25856	BUS:GARDNVLLE 72 & 79 & TR 4	\$ (1,175.00)
09/23/21 15:40	GARDNVLB 230 SENECA 230 1	25857	SCB:GARDNV(R755):71&73&80&TR	\$ (1,175.00)
09/23/21 15:42:26	ELM_ST 230 SENECA 230 1	26426	BUS:GARDNVLLE 72 & 79 & TR 4	\$ 1,175.00
09/23/21 15:42:26	ELM_ST 230 SENECA 230 1	26427	SCB:GARDNV(R755):71&73&80&TR	\$ 1,175.00
09/23/21 15:42:26	GARDNVLB 230 SENECA 230 1	25856	BUS:GARDNVLLE 72 & 79 & TR 4	\$ (1,175.00)
09/23/21 15:42:26	GARDNVLB 230 SENECA 230 1	25857	SCB:GARDNV(R755):71&73&80&TR	\$ (1,175.00)

As the error and pricing impact was discovered after NYISO’s price correction deadline had passed, no price corrections were made.

Measures taken in the 3<sup>rd</sup> quarter to mitigate pricing errors include:

- A software fix is in development to address the incorrect application of the reserve demand curve logic during an EDRP/SCR activation.

### October – December 2021

In the fourth quarter of 2021, there was 1 real-time interval corrected.

- The one real-time price correction for 11/17 resulted from a telemetry error affecting a PAR schedule. All internal zones and external proxy bus LBMPs were corrected. There was no impact to prices for ancillary services.

Note about one pricing error discovered in the 3<sup>rd</sup> quarter after our price correction deadline:

During Special Case Resource (SCR) program and/or the Emergency Demand Response Program (EDRP) activations, the NYISO utilizes special pricing rules (referred to as

“scarcity pricing” rules). These rules alter the otherwise applicable reserve requirements and reserve demand curves in real-time for the locational reserve regions impacted by an SCR/EDRP activation. On August 26, 2021, the NYISO activated SCRs and EDRP resources located on Long Island from 1:00 p.m. until 8:00 p.m. The activation was timely and properly entered into the NYISO’s demand response information system (DRIS) in order to provide notice of the activation to the affected resources and the marketplace. Due to an inadvertent error, however, the activation was not timely transferred to NYISO’s market software in order to trigger the application of the scarcity pricing logic for all real-time intervals encompassed by the activation. As a result, the market software did not apply the scarcity pricing logic for the first 90 minutes of the event. NYISO grid operators discovered the issue and rectified it such that the scarcity pricing logic was applied beginning with the five-minute interval ending at 2:35 p.m.

As the error and pricing impacts were discovered after the applicable correction deadline, no price corrections were made.

The NYISO conducted an after-the-fact, assessment to identify a conservative, upper bound on the potential impacts for the 90-minute period at issue. For the 90-minute period at issue, real-time energy prices averaged approximately \$104/MWh statewide. During the affected period, the average real-time settlement price for 10-minute reserve products (spinning reserves and 10-minute total reserves) across all reserve regions was approximately \$10/MWh, while the average real-time settlement price for 30-minute reserves was approximately \$6/MWh. The results of the NYISO’s analysis indicated a minimal potential impact for the affected period. Per our assessment, if the scarcity pricing logic had been applied for the affected period, the upper bound on the potential impact to real-time energy prices would have been an increase by no more than approximately \$7/MWh to the average statewide real-time energy price over this period. The assessment identified a similar upper bound on the potential impact to real-time reserve settlement prices.

Measures taken in the 4<sup>th</sup> quarter to mitigate pricing errors include:

- A software fix to address the incorrect application of the reserve demand curve logic during an EDRP/SCR activation that resulted in the 8/26 price corrections, as further explained in the July to September 2021 section above.
- The NYISO has implemented additional, internal process improvements to help mitigate the potential for a scarcity event failing to get transferred into the market software for evaluation.

## **January – March 2022**

In the first quarter of 2022, there were 16 real-time intervals corrected.

- The two real-time price corrections for 1/16 were due to an Operator input error that resulted in incorrect DNI values for the NE Sandy Pond interface in RTD. All internal zones and external proxy bus LBMPs were corrected for both intervals. For one of the intervals, Spin, 10-Minute Non-Spin, 30-Minute Reserve, Regulation Capacity, and Regulation Movement prices were also corrected. For the other interval, Regulation Capacity price only was corrected in addition to LBMPs.

- The 6 real-time price corrections for 2/15 resulted from a software error that resulted in the erroneous application of external congestion.
  - For 3 of the corrections, the incorrect external congestion was removed from, and the correct external congestion was applied to, the real-time LBMPs for the PJM Gen Keystone proxy bus.
  - For 3 of the corrections, external congestion was removed from the real-time LBMPs for OH Gen Proxy and HQ Gen Cedars Proxy.
- The 7 real-time price corrections for 3/1 resulted from a data error related to a scheduled transmission outage. All internal zones and external proxy bus LBMPs were corrected. Regulation Capacity and Regulation Movement prices were also corrected.
- The one real-time price correction for 3/13 resulted from Operator input that caused redundant adjustments to be applied to the load forecasts. All internal zones and external proxy bus LBMPs were corrected. Ancillary Services prices were not impacted.

### **April – June 2022**

In the second quarter of 2022, there were 24 real-time intervals corrected.

- Three real-time price corrections for 4/19 were due to a software error following issues with a software deployment that resulted in incorrect DNI values in RTD. All internal zones and external proxy bus LBMPs were corrected. 10-minute Spin, 10-Minute Non-Spin, and 30-Minute Operating Reserve prices were corrected for all zones in the NYCA, as were Regulation Capacity and Regulation Movement prices.
- Twenty real-time price corrections for 4/19 resulted from a software error following issues with a software deployment that led to erroneous application of RTC external congestion to the RTD external proxy bus LBMPs.
  - For 10 of the corrections, external congestion was removed from the real-time LBMPs for HQ Gen Import, HQ Gen Wheel, NE Gen Sandy Pond, and the 4 PJM proxy buses.
  - For 4 of the corrections, external congestion was removed from the real-time LBMPs for PJM Gen Keystone proxy bus.
  - For 6 of the corrections, external congestion was removed from the real-time LBMPs for NE Gen Sandy Pond proxy bus.
- The one real-time price correction for 5/5 resulted from an Operator input error of limits for CENTRAL EAST - VC and SCH - PJ – NY which caused erroneous constraints to bind. All internal zones and external proxy bus LBMPs were corrected. Regulation Capacity and Regulation Movement prices were also corrected.

### **July -September 2022**

In the third quarter of 2022, there were 48 real-time intervals corrected.

- Twelve real-time price corrections for 7/20 occurred during a Special Case Resource (SCR) program and Emergency Demand Response Program (EDRP) activation. Although timely and properly entered into the NYISO's demand



response information system (DRIS) in order to provide notice of the activation to affected resources and the marketplace, the activation was not timely transferred to NYISO's market software and, therefore, did not trigger the application of the scarcity pricing logic for some of the real-time intervals encompassed by the activation. All internal zones and external proxy bus LBMPs were corrected for the twelve impacted intervals. 10-minute Spin, 10-Minute Non-Spin, and 30-Minute Operating Reserve prices were also corrected for all zones in the NYCA, as were Regulation Capacity prices. Regulation Movement prices were corrected in eight of the twelve intervals.

- Ten real-time price corrections for 7/30 resulted from a database issue that prevented correctly calculated prices from being posted successfully to the OASIS. Reposting the correct prices updated the LBMPs for all internal zones and external proxy buses. Prices for ancillary services were updated in six of the ten intervals.
- The one real-time price correction for 7/31 resulted from a metering issue. All internal zones and external proxy bus LBMPs were corrected. Regulation Capacity and Regulation Movement prices were also corrected.
- Eight real-time price corrections for 8/9 resulted from a metering issue which impacted the load forecast.
  - For 4 of the corrections, all internal zones and external proxy bus LBMPs were corrected. Regulation Capacity and Regulation Movement prices were corrected as well.
  - For 1 of the corrections, all internal zones and external proxy bus LBMPs were corrected. Regulation Capacity price was corrected as well.
  - For 3 of the corrections, erroneous external congestion was removed from the real-time LBMPs for the NE Sandy Pond proxy bus. No corrections were made to internal zone LBMPs or ancillary services prices.
- Three real-time price corrections for 8/10 resulted from a metering issue. All internal and external proxy bus LBMPs were corrected. Regulation Capacity and Regulation Movement prices were also corrected for two of the intervals.
- The three real-time price corrections for 8/15 resulted from an erroneous limit at the NE Sandy Pond proxy which caused an external constraint to bind. NE Sandy Pond proxy bus prices were corrected by removing this erroneous external congestion from them.
- Eleven real-time price corrections for 8/31 resulted from a metering issue. All internal and external proxy bus LBMPs were corrected. No corrections were made to ancillary services prices.

Measures taken in the 3<sup>rd</sup> quarter to mitigate pricing errors include:

- The NYISO has developed incremental enhancements to existing procedures to further support timely transfer of EDRP/SCR activations into the NYISO's market software.
- A software change planned for October 2022 deployment to improve load pattern development to prevent a re-occurrence of the issue which resulted in the 8/31 price errors.
- Improvements to the Integrated Source Selection (ISS) to reduce the potential for certain metering issues.