NEW YORK INDEPENDENT SYSTEM OPERATOR
10 Krey Boulevard ♦ Rensselaer, NY 12144

February 28, 2011

Submitted Electronically

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Re: New York Independent System Operator, Inc.'s Compliance Filing in Docket Nos. ER08-1281-005 and ER08-1281-006

Dear Ms. Bose:

In compliance with paragraph 25 and ordering paragraph "B" of the Federal Energy Regulatory Commission's ("Commission's") December 30, 2010 *Order on Rehearing and Compliance* that was issued in Docket No. ER08-1281-000, *et al*. ("December Order")[1] and the *Notice of Extension of Time* that the Commission issued in the above dockets on January 28, 2011, the New York Independent System Operator, Inc. ("NYISO") hereby submits additional loop flow-related analysis and data supporting studies previously provided to the Commission in the NYISO's July 21, 2008 exigent circumstances filing ("Exigent Circumstances Filing") and its August 16, 2010 responses to questions posed by the Commission in this proceeding ("August 2010 Filing")[2]. The December 30, 2010 Order instructed the NYISO to submit a compliance filing "provid[ing] copies of all the studies it has done regarding loop flow issues and various possible solutions to such issues."[3]

I. LIST OF DOCUMENTS SUBMITTED

The NYISO submits the following documents:

1. this filing letter;

2. a narrative explaining the Real Time Commitment market simulations that the NYISO's Operations Department performed for selected hours supporting the Operations Department studies described on pages 16 – 19 of the NYISO's

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[1] *New York Independent System Operator, Inc.*, 133 FERC ¶ 61,276 (2010) ("December 2010 Order").

[2] A supplemental response was also provided to the Commission on October 14, 2010 ("October 2010 Filing").

[3] December 2010 Order, at ordering paragraph "B".

Exigent Circumstances Filing, including a link to a posting on the NYISO's web site of screen prints of the studies that the Operations Department performed ("Attachment I");

3. a narrative explanation of data that was used by the NYISO's Market Mitigation and Analysis Department ("MMA") to perform the correlation study that is described on pages 14 – 16 of the NYISO's Exigent Circumstances Filing, along with a link to a location on the NYISO's web site where the described data is posted. In the study MMA identified a correlation between Lake Erie circulation and the scheduling of transactions via a circuitous contract path from the NYISO's western border to the Independent Electricity System Operator of Ontario ("IESO"), then to the Midwest Independent Transmission System Operator ("Midwest ISO") and sinking in PJM Interconnection, LLC ("PJM") ("Attachment II");

4. a Memorandum dated October 23, 2008 supporting and explaining the NYISO Market Advisor's study results that were provided on pages 19 – 22 of the NYISO's Exigent Circumstances Filing, along with a link to a location on the NYISO's web site where the underlying data is posted ("Attachment III");

5. a narrative explanation of the study performed by the NYISO's Market Monitoring Unit ("MMU") Potomac Economics to quantifying the expected benefits of the Buy-Through of Congestion and Market-to-Market Coordination Broader Regional Markets solutions. The attachment also contains a link to a location on the NYISO's web site where data supporting this component of the MMU study is posted ("Attachment IV"); and

6. a detailed narrative explaining the methods the NYISO's MMU used to produce its 2010 study estimating the benefits of the Enhanced Interregional Transaction Coordination Broader Regional Market solution. The narrative also describes the hourly results that have been posted on the NYISO's web site for review ("Attachment V").

II. COPIES OF CORRESPONDENCE

Correspondence concerning this filing should be served on:

Robert E. Fernandez, General Counsel
Raymond Stalter, Director of Regulatory Affairs
*Alex M. Schnell
*Kristin A. Bluvas, Attorney
New York Independent System Operator, Inc.
10 Krey Boulevard
Rensselaer, NY 12144
Tel: (518) 356-8707
Fax: (518) 356-7678
aschnell@nyiso.com
kbluvas@nyiso.com

* Persons designated for receipt of service

III. BACKGROUND

In its July 15, 2010 Order[4] ("July 2010 Order"), the Commission instructed the NYISO to submit several categories of studies that had been preformed by or for the NYISO. The NYISO filed a response to comply with the July 2010 Order on August 16, 2010, and a supplemental response on October 14, 2010. The December 2010 Order found that the NYISO failed to identify and produce all the loop flow-related studies it was directed to produce in the July 2010 Order, but did not specifically identify the studies that the NYISO failed to provide. The NYISO believed it had provided the documents that were responsive to the Commission's July 2010 Order in its August and October responses. In an effort to comply with the Commission's December ruling, the NYISO submits additional explanations of the studies that were submitted on August 16, 2010 and of the studies that were described in the NYISO's July 21, 2008 Exigent Circumstances Filing (which studies had little to do with the Broader Regional Market solutions to Lake Erie loop flow), along with data supporting the studies it performed. Because the supporting data might, in some instances, exceed the limits on the size of the files that can be e-filed, the data is, instead, being made publicly available on the NYISO's web site.[5] Links to the location(s) where data is being posted on the NYISO's web site are included in the Attachments to this filing letter.

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[4] *New York Independent System Operator, Inc.*, 132 FERC ¶ 61,031 (2010).

[5] The public posting of data on the NYISO's web site is consistent with the Commissions direction that the NYISO submit these studies in its compliance filing or, in the alternative, post the studies on its website and reference the relevant postings in its compliance filing. *See* December 2010 Order at P 25.

The attachments to this filing include both explanatory narratives and data to provide additional granularity. The first three attachments to this filing address studies that were described on pages 14 – 22 of the NYISO's 2008 Exigent Circumstances Filing. The following two attachments address the MMU's efforts to estimate the expected benefits of some of the proposed Broader Regional Market solutions to Lake Erie loop flow.

IV. DESCRIPTIONS OF THE DOCUMENTS SUBMITTED

A. NYISO 2008 Operations Department Studies

The analysis the NYISO's Operations Department performed to produce the Operations Department Studies described on pages 16 – 19 of the NYISO's Exigent Circumstances filing is explained in greater detail in Attachment I to this filing letter. The link included in Attachment I provides access to screen shot .pdfs of the various market simulations that the NYISO's Operations Department performed. The narrative response identifies key assumptions underlying the studies that the NYISO produced, explains why particular assumptions were made, and explains why two of the cases studied were not used to support the NYISO's Exigent Circumstances filing.

B. NYISO 2008 MMA Analysis

The analysis the NYISO's MMA performed to produce the study described on pages 14 – 16 of the NYISO's Exigent Circumstances Filing is described in Attachment II to this filing letter. Attachment II also includes a link to an excel spreadsheet (located on the NYISO's web site) that contains supporting data. The MMA analysis determined that a significant degree of correlation exists between the scheduling of circuitous External Transactions around Lake Erie from the NYISO's IESO Proxy Generator Bus for delivery to the PJM Control Area and Lake Erie circulation power flows in a "clockwise" direction. The narrative also explains the data provided in each column of the spreadsheet.

C. Market Advisor 2008 Study

Attachment III to this compliance filing is a Memorandum titled *Estimating the Congestion and Loss Charges Not Borne by Circuitous Transactions* that explains the assumptions underlying the Market Advisor's 2008 study that was described on pages 19 through 22 of the NYISO's Exigent Circumstances filing. Attachment III also includes a link to an excel spreadsheet (located on the NYISO's website) that contains data supporting this study. In some hours no data is provided because there were no relevant Path 1 or Path 5 transactions. For the 24 hour period starting on June 30, 2008 HB12 through July 1, 2008 HB11, no data is provided because data was not available from the source that the NYISO's Market Advisor used to obtain its data. This is the only gap in data that the NYISO is aware of.

The data posted on the NYISO's web site separates the costs that were incurred into four categories for each hour: DAM congestion, DAM losses, RTM congestion, and RTM losses. These four categories correspond to the four categories of charges identified on page 3 of the Market Advisor's memorandum. In each hour, positive values (shown in black) indicate net charges to the NYISO, while negative values (shown in parentheses and in red) indicate net credits to the NYISO. The total estimated cost to the market reflected in the provided data is $94.8 million, not $96 million. The NYISO separately rounded each of the four categories (DAM congestion, DAM losses, RTM congestion, RTM losses) to the nearest million dollars before it summed them together to arrive at the $96 million estimated impact.

D. NYISO 2010 Market Structures Department Analyses

The presentation materials provided to the Commission in Attachments C and D of the NYISO's August 16, 2010 filing were developed to review with NYISO stakeholders the interaction of transaction scheduling strategies, settlement provisions and loop flow impacts. The primary purpose of the first of these presentations (dated December 16, 2008) was to review and establish a thorough understanding of the indirect transaction scheduling practices that caused the NYISO to submit its Exigent Circumstances filing in July of 2008. This presentation contrasted the expected loop flow impact of circuitous scheduling without effective controls in place to conform actual to scheduled power flows, with the expected loop flow outcomes of the same scheduling practices if phase angle regulators are able to successfully conform actual power flows to scheduled power flows.

The second presentation (dated February 6, 2009) considered the scheduling outcomes, loop flow impacts and risk exposures under a hypothetical contract sink settlement practice. In the hypothetical scenario addressed in the presentation, the locational price utilized for settlement purposes is determined based upon the tag defined ultimate source or sink destination of a transaction without regard to the bid submitted, or contract path proposed for and used in the evaluation and scheduling of the transaction.

In both of the presentations described above, the information is presented as a series of hypothetical scenarios that describe what would occur under various potential scheduling practices, based upon an assumed distribution of power flows, given the transaction source and sink areas identified in each scenario. The assumptions made with regard to power distribution around Lake Erie are stated in each presentation.

The purpose of the presentation material included in Attachment E to the August 16, 2010 filing was to provide NYISO stakeholders with a status and schedule briefing on the development of Broader Regional Market solutions to address Lake Erie loop flow. The material was delivered to stakeholders on July 8, 2009 in preparation for subsequent more detailed discussions of potential market-based solutions. The presentation recapped prior efforts to develop solutions and introduced the concept of Buy-Through of Congestion—the allocation to, and recovery of, constraint management costs from the parties responsible for scheduling transactions that cause transmission in control areas that are not part of the contract path over which a transaction was scheduled (parallel path flows). No study results or conclusions were presented in this material.

The presentation materials provided to the Commission in Attachments F, G, H and I to the August 16, 2010 filing were developed to review with NYISO stakeholders efforts to evolve the NYISO's pricing logic in response to the Commission directives in this proceeding. The material was developed and reviewed with stakeholders over the first six months of 2010, culminating in a conceptual approval by the NYISO's Business Issues Committee on June 2, 2010. No study results or conclusions were represented in this material. The NYISO is currently undertaking software development efforts to complete the implementation of its proposed Interface Pricing revisions.

There are no attachments to this filing that relate to the Market Structures Department presentations.

E. MMU 2010 Studies

Attachments IV and V to this filing were produced by the NYISO’s MMU. The documents in these attachments provide a more granular explanation of studies performed by the NYISO’s MMU, that were presented at the September 27, 2010 Broader Regional Markets technical conference, and provided to the Commission in an update to the NYISO’s August 16, 2010 responses. Attachment IV includes a narrative explanation of the study performed by the MMU to quantifying the expected benefits of the Buy-Through of Congestion and Market-to-Market Coordination Broader Regional Markets solutions. The attachment also contains a link to a location on the NYISO’s web site where data supporting this component of the MMU study is posted.

Attachment V contains a detailed narrative explaining the methods the NYISO’s MMU used to produce its 2010 study estimating the benefits of the Enhanced Interregional Transaction Coordination Broader Regional Market solution. The narrative also describes the supporting hourly data that has been posted on the NYISO’s web site for review.

V. CONCLUSION

WHEREFORE, for the foregoing reasons, the NYISO respectfully requests that the Commission accept this filing and the NYISO’s posting of documents on its web site as fulfilling its obligation to comply with paragraph 25 and ordering paragraph B of the December 30, 2010 Order.

Respectfully submitted,

/s/ Kristin A. Bluvas
Alex M. Schnell
Kristin A. Bluvas, Attorney
New York Independent System Operator, Inc.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding in accordance with the requirements of Rule 2010 of the Commission Rules of Practice and Procedure, 18 C.F.R. § 385.2010.

Dated at Rensselaer, New York this 28th day of February, 2011.

/s/ *Kristin A. Bluvas*

Kristin A. Bluvas
New York Independent System Operator, Inc.
10 Krey Boulevard
Rensselaer, NY 12144
Tel: (518) 356-8540
Fax: (518) 356-7678
E-mail: kbluvas@nyiso.com

ATTACHMENT I

NYISO Operation's Studies Estimating Impacts of Circuitously Scheduled Transactions

Prepared By: Allen Hargrave, Manager, Energy Market Operations

[Due to the size of the files associated with some of the Attachments, the NYISO has posted the underlying data for this study on its website at http://www.nyiso.com/public/webdocs/documents/regulatory/filings/2011/02/Attachment_I_OperationsStudy2008.zip]

The analysis the NYISO's Operations Department performed to produce the Operations Department Studies described on pages 16 through 19 of the NYISO's July 21, 2008 Exigent Circumstances filing in FERC Docket No. ER08-1281 is described below, and in the screen shot .pdfs that are provided with this response. This response identifies the assumptions underlying the studies that the NYISO produced, explains why particular assumptions were made, and explains why two of the cases studied were not used to support the NYISO's Exigent Circumstances filing.

The analysis conducted by Operations consisted of performing Real Time Commitment (RTC) market simulations for selected hours. The RTC software is a market evaluation that runs every 15 minutes to produce a commitment and dispatch that is co-optimized for load and ancillary services. The RTC evaluation covers a 2 ½ hour time window in 15 minute intervals with an objective function to minimize the total production cost of the solution. The RTC function produces the external transaction schedules and their corresponding LBMPs, and is able to commit Gas Turbines (GTs) and other fast starting units (<= 30 minutes) within the New York Control Area.

The simulations were conducted on an offline server with software that was identical to the NYISO production system. The starting point was a savecase, which is a collection of database tables containing the input data and results produced during the production RTC evaluation for the selected date and time. Starting with the retrieved savecase data, certain data modifications were made and the RTC evaluation was re-run.

The Lake Erie circulation is calculated in the NYISO Energy Management System (EMS) every 6 seconds. During each Production run of RTC, the circulation value is obtained from the EMS at the time the process initiates and used for the 2 ½ hour evaluation window. The RTC runs that were selected for simulation, were the runs that perform the hourly transaction scheduling to determine the interchanges with the neighboring Control Areas. The run that produced the HB20 transaction schedules began its processing at 19:00 and the results were posted at 19:15 to allow time for confirmation (check-out) with the neighboring Control Areas.

The first simulation that was run was to vary the Lake Erie circulation value. In this simulation the NYISO made a simplifying assumption that the identified amount of circuitous transactions was increasing the circulation observed and making it larger than it should have been on a MW for MW basis. The circulation input was reduced by roughly the amount of the circuitously scheduled transactions. The circulation input in the RTC simulation was adjusted and the program was re-run to determine the change in the total production cost.

The second simulation built on the first simulation. In addition to the change made in the first simulation, the NYISO also adjusted the Ramapo PAR to reflect the MWs that were estimated to have flowed over the New York/PJM interface. The Ramapo PAR is typically operated to follow the PJM to NYISO hourly net interchange. The circuitous transactions were not scheduled through the PJM-NYISO interface and therefore did not affect the Ramapo PAR scheduling. The alternative included changing the circulation value and the Ramapo PAR schedule for the rerun to determine the change in the total production cost. The increased schedule on the Ramapo PAR injects power into the eastern portion of the New York Control Area thus allowing more expensive eastern NY generation to be backed down and result in lower production costs.

The third simulation retained the Lake Erie circulation and Ramapo PAR assumptions described above, and added transaction bid changes in the hour being evaluated. The transaction changes included decreasing the MW amount of transactions being offered from NYISO to IESO and increasing the MW amount of transactions being offered from NYISO to PJM. This assumption modeled the circuitous transactions as if they had instead been scheduled via the direct transmission path, instead of being scheduled circuitously around Lake Erie. The transaction amounts that were redirected were, again, roughly the amount of the circuitous transactions. The circulation input and the transaction offers in the RTC simulation were adjusted and the program was re-run to determine the change in the OH and PJM Proxy Generator Bus LBMPs, as well as the change in total production cost for New York. After reviewing the results of the first two Cases it ran, the NYISO determined that this simulation was more informative than simulations 1 and 2 that are described above.

CASE #1: 05/26/2008 HB13 [post @12:15]

Original Production run
Circulation @ -2096 MWs
Circuitous transactions ~ 2100 MWs
Total Production Cost = -$31,820,808.00 [*05262008_HB13_original_TPC.PDF*]
LBMPs
OHAC $55.01
PJAC $57.97

Simulation #1 change circulation from -2096 MWs to 0 MWs (~ -2096 MWs + 2100 MWs)
Total Production Cost = -$31,910,338.00 [*05262008_HB13_circ_adj_TPC.PDF*]
TPC Savings = -$31,910,338.00 – (-$31,820,808.00) = -$89,530 /2.5 hrs = -$35.8K/hr

Simulation #2, in addition to the change made in Simulation #1, the Ramapo PAR is moved from 500 into PJM to 500 into NY
Total Production Cost = -$31,985,866.00 [*05262008_HB13_circ_Ram_adj_TPC.PDF*]
TPC Savings = -$31,985,866.00 – (-$31,820,808.00) = -$165,058 /2.5 hrs = -$66.0K/hr

Simulation #3 includes all of the changes made in Simulation #1 and #2. In addition, 2100 MWs of circuitously scheduled transactions were redirected from exiting New York at the NYISO’s interface with IESO to exiting New York at the NYISO’s interface with PJM

Total Production Cost = -$40,634,784.00
[*05262008_HB13_circ_Ram_trans_adj_TPC.PDF*]
TPC Savings = -$40,634,784.00 – (-$31,820,808.00) = -$8,813,976 /2.5 hrs = -$3.53M/hr
LBMPs
OHAC $5.52
PJAC $59.97

Case #1 was affected by internal NYCA constraints. Due to the presence of internal constraints, it was determined that this case did not allow the isolation of cost to circuitous transactions as cleanly as Case #2, below.

CASE #2: 05/26/2008 HB20 [post @19:15]

Original Production run
Circulation @ -1880 MWs
Circuitous transactions ~ 2095 MWs
Total Production Cost = -$34,747,715.00 [*05262008_HB20_original_TPC.pdf*]
LBMPs
OHAC $19.99
PJAC $79.82

Simulation #1 change circulation from -1880 MWs to 200 MWs (~ -1880 MWs + 2095 MWs)

Total Production Cost = -$34,831,127.00 [*05262008_HB20_circ_adj_TPC.pdf*]
TPC Savings = -$34,831,127.00 – (-$34,747,715.00) = -$83,412 /2.5 hrs = -$33.4K/hr

Simulation #2, in addition to the change made in Simulation #1, the Ramapo PAR is moved from 400 into PJM to 600 into NY

Total Production Cost = -$34,877,960.00 [*05262008_HB20_circ_Ram_adj_TPC.pdf*]
TPC Savings = -$34,877,960.00 – (-$34,747,715.00) = -$130,245 /2.5 hrs = -$52.1K/hr

Simulation #3 includes all of the changes made in Simulation #1 and #2. In addition, 2095 MWs of circuitously scheduled transactions were redirected from exiting New York at the NYISO’s interface with IESO to exiting New York at the NYISO’s interface with PJM

Total Production Cost = -$41,029,198.00
[*05262008_HB20_circ_Ram_trans_adj_TPC.pdf*]
TPC Savings = -$41,029,198.00 – (-$34,747,715.00) = -$6,281,483 /2.5 hrs = -$2.5M/hr
LBMPs
OHAC -$17.33
PJAC $100.00

CASE #3: 05/26/2008 HB21 [post @20:15]

Original Production run
Circulation @ -1719 MWs
Circuitous transactions ~ 2274 MWs
Total Production Cost = -$32,996,237.00 [*05262008_HB21_original_TPC.PDF*]
LBMPs
OHAC $61.00
PJAC $87.56

Simulation #1 change circulation from -1719 MWs to 550 MWs (~ -1719 MWs + 2274 MWs)

Total Production Cost = -$31,119,584.00 [*05262008_HB21_circ_Ram_adj_TPC.PDF*]
TPC Savings = -$31,119,584.00 – (-$32,996,237.00) = $1,876,653 /2.5 hrs = $0.75M/hr

Simulation #2 was not performed for Case #3. By the time the NYISO was running Case #3 it had already determined from its evaluation of the previous cases that Simulation #3 was the better modeling method, so Simulation #2 was omitted.

Simulation #3 includes all of the changes made in Simulation #1, along with the changes that would have been made to produce Simulation #2. In addition, 2274 MWs of circuitously scheduled transactions were redirected from exiting New York at the NYISO's interface with IESO to exiting New York at the NYISO's interface with PJM

Total Production Cost = -$37,430,771.00
[*05262008_HB21_circ_Ram_trans_adj_TPC.PDF*]
TPC Savings = -$37,430,771.00 – (-$32,996,237.00) = -$4,434,534 /2.5 hrs = -$1.77M/hr
LBMPs
OHAC -$999.70
PJAC $999.70

Case #3 was not used in the NYISO's Exigent Circumstances filing because the LBMPs determined in Case #3 represented the default real-time offers that the NYISO used to prioritize transactions that received Day Ahead awards to give these transactions a high economic priority. The transactions that were redirected from exiting New York at the NYISO's interface with IESO to exiting New York at the NYISO's interface with PJM were all initially scheduled as Day Ahead transactions. With the injection of these additional transactions at the NYISO's interface with PJM there were not enough real-time counter-offers to bring the New York/PJM interface back within permissible scheduling limits, so the inter-hour ramping limitations became binding. The LBMP pricing in this case would not be representative of what would have been expected because the NYISO's interface limits would never have permitted the full amount of transactions to be scheduled.

In addition to the explanation of the NYISO's study method that is provided above, .pdfs of screen prints that the NYISO made to document its analysis are also provided. The alternative study scenarios that the NYISO performed are no longer available (the NYISO believes they were stored on a server that has since been decommissioned).

ATTACHMENT II

NYISO MMA 2008 Analysis of Circuitously Scheduled Transactions

Prepared By: Joshua Boles, Supervisor MMA Analysis & Reporting

[Due to the size of the files associated with some of the Attachments, the NYISO has posted the underlying data for this study on its website at http://www.nyiso.com/public/webdocs/documents/regulatory/filings/2011/02/Attachment_II_MMAStudy2008.xls]

The excel spreadsheet labeled 2152011_FERC_1281_Support.xls contains the data used to support the analysis that appears in Section V.A. (pages 14 – 16) of the NYISO's July 21, 2008 Exigent Circumstances Filing letter in Docket No. ER08-1281. The identified analysis determined a significant degree of correlation exists between the scheduling of External Transactions around Lake Erie from the NYISO's IESO Proxy Generator Bus for delivery to the PJM Control Area and Lake Erie circulation power flows in a "clockwise" direction.

Consistent with the description in Section V.A. of the Exigent Circumstances Filing, the four columns labeled in the excel spreadsheet represent the following information;

Z_NYISO__IMO-NYISO_CIRC_MW________________AV - the amount of unscheduled flows around Lake Erie as measured at the NY border with IESO. It represents a measure of the average hourly difference between the scheduled and actual megawatts at its border with the IESO. A positive value represents clockwise unscheduled flows and a negative value represents counter-clockwise unscheduled flows. The data used to perform the study was acquired through NYISO's internal metering ("PI") software.

RT Sch MWh NY-ON-MISO-PJM – hourly volume of transactions scheduled along the path from NY-IESO-MISO-PJM. These transactions were scheduled to exit the NYISO at the OH_LOAD_BRUCE proxy bus and sink in a Receiving Control Area ("RCA") identified as PJM.

Date_Hr – a time series in hours spanning October 1, 2007 hour beginning 00 and May 31, 2008 hour beginning 23.

Correlation – a value which indicates whether a significant linear association between the two sets of data exists. Two sets of data that are perfectly correlated would have a correlation coefficient of 1.

The posted excel spreadsheet correlation value of .711 differs by .006 from the correlation value of .717 listed in the filing. The cause of this slight discrepancy appears to be a clerical error.

The study was run for NYISO to IESO to MISO to PJM transactions based on an assumption that these so-called "Path 1" transactions would significantly contribute to clockwise circulating power flows because the vast majority of the power that was scheduled to flow over a circuitous "contract path" would instead flow directly from sources in New York, over the NYISO/PJM interface to serve load in PJM.

ATTACHMENT III

NYISO Market Advisor Estimate of the Congestion and Loss Charges Not Borne by Circuitous Transactions

Prepared By: Dr. David Patton and Pallas Lee VanSchaick, Potomac Economics

[Due to the size of the files associated with some of the Attachments, the NYISO has posted the underlying data for this study on its website at http://www.nyiso.com/public/webdocs/documents/regulatory/filings/2011/02/Attachment_III_LakeErieHourly.xls]

MEMORANDUM

TO: Nicole Bouchez

FROM: David B. Patton
Pallas LeeVanSchaick

DATE: October 23, 2008

RE: Estimating the Congestion and Loss Charges Not Borne by Circuitous Transactions

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When transactions are scheduled from one RTO area to another via circuitous contract paths, physical flows occur that are not consistent with the scheduled contract paths. These inconsistencies are generally known as "loop flows". Since settlements are based on the contract path, not the physical flow, the settlements for a transaction scheduled on a circuitous path can be significantly different from the settlements for a transaction with the same source and sink scheduled on a direct path (i.e., the path most consistent with the physical flow of power between the source control area and sink control areas). Hence, the participant scheduling the circuitous transaction may not bear the full costs of the congestion and losses caused by its transaction. To the extent that loop flows contribute to congestion and losses, these costs must be recovered from NYISO customers through uplift charges.

The purpose of this memo is to present our estimates of the congestion and loss charges that were not borne by participants engaged in circuitous transactions in 2008. This memo discusses:

- The estimated loss and congestion charges that were not borne by the circuitous transactions and how these charges are estimated from Location-Based Marginal Prices ("LBMPs"); and
- The estimated allocation of these charges between the Day-Ahead and the Real-Time markets.

We have not estimated the *market impact* of the circuitous transactions because estimating *market impact* would require calculating a hypothetical market solution based on an alternate set of assumptions. This would require determining what transactions would have been scheduled each day if only direct paths had been available, developing assumptions regarding how other market participants would have changed their behavior, determining how the NYISO's operations and modeling would have changed, and simulating new day-ahead and real-time market outcomes. Such simulations would be highly speculative and are outside the scope of the analysis described in this memo.

Estimating the Charges Not Borne by Circuitous Transactions

On July 21, the NYISO submitted an exigent circumstances filing to the FERC in order to prohibit scheduling on eight circuitous paths around Lake Erie. We identified two types of circuitous transactions (known as "Path 1" and "Path 5" transactions in the filing) that actually flowed between January 1 and July 22, 2008. [1] [2] The methodology for estimating the charges not borne by these transactions is as follows.

Path 1 – Transactions sourcing in the NYISO, wheeling through Ontario and the MISO, and sinking in PJM.

These transactions accounted for 92 percent of all circuitous transactions during the period. These transactions were charged to export from New York at the Ontario interface, although the power flowed primarily from the NYISO to PJM. Since Path 1 transactions were charged for exporting at the Ontario interface rather than the PJM interface, we estimated the charges not borne by Path 1 transactions as the difference between the LBMP at the PJM proxy bus and the LBMP at the Ontario proxy bus.[3]

Path 5 – Transactions sourcing in PJM, wheeling through the NYISO and Ontario, and sinking in the MISO.

These transactions accounted for only 8 percent of the circuitous transactions during the period. These transactions caused power to flow from PJM to the MISO as if they were scheduled directly from PJM to the MISO. However, these transactions were settled by the NYISO as a wheel from the PJM proxy bus to the Ontario proxy bus. When the LBMP at the Ontario proxy bus was lower than the LBMP at the PJM proxy bus, the settlement for the transaction was a payment to the participant. The payments to these transactions (which were funded by uplift charges to NYISO customers) were equal to the difference between the LBMP at the PJM proxy bus and the LBMP at the Ontario proxy bus.[4]

Since LBMPs have multiple components, it is straightforward to separate the estimated charges not borne by Path 1 and Path 5 transactions into congestion, loss, and energy components. Since the energy components of LBMPs are the same at all locations in the NYISO, the energy charges not borne by these transactions was $0.

Day-Ahead versus Real-Time Charges

When transactions are scheduled on circuitous paths, it results in substantially larger amounts of loop flows than when transactions are scheduled on direct paths. Loop flows through the NYISO cause inconsistencies between the actual transfer capability of the NYISO and the transmission capability that is available to the NYISO market. These inconsistencies result in residual charges (or revenues) to NYISO customers in the real-time market because loop flows use the NYISO transmission system without paying for congestion or losses.

To the extent that the NYISO is able to forecast loop flows prior to the Day-Ahead Market, the NYISO can adjust the amount of loop flow assumed in the Day-Ahead Market. Such adjustments reduce inconsistencies between available real-time transfer capability (i.e., capability not utilized by loop flows) and the transmission capability scheduled in the Day-Ahead Market. Hence, such adjustments reduce real-time uplift charges by shifting a portion of the effects of the loop flows into the Day-Ahead Market, thereby reducing the amount of day-ahead congestion and loss revenues collected by the NYISO for a given set of LBMPs.

The reduction in day-ahead congestion revenues results in uplift, because the NYISO's obligations to Transmission Congestion Contract ("TCC") holders are funded by day-ahead congestion revenues. Reduced day-ahead loss revenues also increase uplift charges because day-ahead loss revenue is normally used to defray uplift charges.

When the NYISO began to adjust its assumptions in the day-ahead market to account for higher loop flows from circuitous transactions, it reduced the amount of day-ahead congestion and loss revenue collected by the NYISO. For our estimate of the charges not borne by circuitous transactions, we assumed the day-ahead revenue reduction was equal to the size of the adjustment (in megawatts) times the difference between the LBMP at the PJM proxy bus and the LBMP at the Ontario proxy bus.[5] Correspondingly, we assumed the real-time congestion and loss uplift charges were reduced according to the size of the adjustment times the LBMP difference between the proxy buses.[6]

We estimated that a total of $96 million in charges were not borne by circuitous transactions scheduled from January 1 to July 22, 2008. The allocation of these charges between the Day-Ahead Market and the Real-Time Market and between congestion and losses is as follows:

- $25 million of Day-Ahead Congestion Revenue,
- $19 million of Day-Ahead Loss Revenue,
- $41 million of Balancing (i.e., Real-Time) Congestion Charges, and
- $11 million of Balancing (i.e., Real-Time) Loss Charges.

Only the $52 million that we estimate was associated with the Real-Time Market was collected through balancing residuals. Hence, the estimated charges not borne by circuitous transactions account for a relatively small share of the NYISO's balancing residuals during this period.

POTOMAC ECONOMICS

End Notes

[1] In order to identify circuitous transactions, we screened the NYISO transaction data (which includes NERC tag information about the sending and receiving control areas) for transactions that were scheduled with all four control areas adjacent to Lake Erie: the NYISO, PJM, the MISO, and IESO. Specifically, we screened for transactions that (i) sourced/sinked in the NYISO, flowed out-to/in-from IESO, and sinked/sourced in PJM; (ii) sourced/sinked in the NYISO, flowed out-to/in-from PJM, and sinked/sourced in IESO; or (iii) wheeled through the NYISO and where the source and sink control areas were either PJM and the MISO or the MISO and IESO.

[2] A portion of the Path 1 and Path 5 transactions were not included in our estimate. This included instances when a particular entity scheduled a counterflow transaction in the same hour as a Path 1 or Path 5 transaction, resulting in no net interchange with the NYISO.

For example, if an entity scheduled a transaction sourcing in the MISO, wheeling through Ontario, and sinking in the NYISO and a Path 1 transaction in a particular hour, the transaction sinking in the NYISO would be paid the LBMP at the Ontario proxy bus and the Path 1 transaction would pay the LBMP at the Ontario proxy bus, resulting in no net interchange for energy, losses, and congestion with the NYISO. In this example, the power flows resulting from the pair of transactions is equivalent to a direct path transaction sourcing in the MISO and sinking in PJM. Since the direct path transaction would not have any settlement with the NYISO and the pair of transactions had no net interchange with the NYISO, we excluded from our estimates Path 1 transactions when they were paired with counterflow transactions. In a similar manner, we excluded Path 5 transactions that were paired with counterflow transactions.

[3] The charges not borne by Path 1 transactions are calculated as follows:

$$\begin{aligned}\text{Path 1 Charges} &= MW * (LBMP_{PJMproxy} - LBMP_{OHproxy}) \\ &= MW * (ENERGY + LOSS_{PJMproxy} + CONGEST_{PJMproxy} \\ &\qquad - \{ENERGY + LOSS_{OHproxy} + CONGEST_{OHproxy}\}) \\ &= MW * (LOSS_{PJMproxy} - LOSS_{OHproxy}) \\ &\quad + MW * (CONGEST_{PJMproxy} - CONGEST_{OHproxy}) \\ &\quad + MW * (ENERGY - ENERGY)\end{aligned}$$

The charges not borne by Path 1 transactions can be broken into:

$$\text{Path 1 Congestion Charges} = MW * (CONGEST_{PJMproxy} - CONGEST_{OHproxy})$$

$$\text{Path 1 Loss Charges} = MW * (LOSS_{PJMproxy} - LOSS_{OHproxy})$$

$$\text{Path 1 Energy Charges} = \$0$$

The energy charges not borne by Path 1 transactions are $0, because the energy components of the LBMPs are the same at all locations in the NYISO.

4 The wheeling charges to Path 5 transactions were generally negative (i.e., the wheel received a payment). As a result, these charges are funded by uplift to NYISO customers. These are calculated as follows:

$$\text{Path 5 Wheel Charges} = MW * (LBMP_{OHproxy} - LBMP_{PJMproxy})$$
$$= MW * (ENERGY + LOSS_{OHproxy} + CONGEST_{OHproxy} - \{ENERGY + LOSS_{PJMproxy} + CONGEST_{PJMproxy}\})$$
$$= MW * (LOSS_{OHproxy} - LOSS_{PJMproxy}) + MW * (CONGEST_{OHproxy} - CONGEST_{PJMproxy}) + MW * (ENERGY - ENERGY)$$

The wheel charges are uplifted to NYISO customers. These can be broken into:

$$\text{Path 5 Congestion Charges} = MW * (CONGEST_{PJMproxy} - CONGEST_{OHproxy})$$
$$\text{Path 5 Loss Charges} = MW * (LOSS_{PJMproxy} - LOSS_{OHproxy})$$
$$\text{Path 5 Energy Charges} = \$0$$

The energy charges not borne by Path 5 transactions are $0, because the energy components of the LBMPs are the same at all locations in the NYISO.

5 This assumes that the distribution of loop flows modeled across the power system in the day-ahead is the same as the actual distribution of loop flows across the system. However, in practice, the day-ahead pattern and the actual pattern are not identical.

6 Where "Reduction_MW" is the adjustment to loop flow estimate in the Day-Ahead Market, the value of impacted transmission capability at day-ahead market prices is equal to:

$$\text{DA Congestion Revenue Reduction} = Reduction\_MW * (CONG_{PJMproxyDA} - CONG_{OHproxyDA})$$
$$\text{DA Loss Revenue Reduction} = Reduction\_MW * (LOSS_{PJMproxyDA} - LOSS_{OHproxyDA})$$

The adjustments in day-ahead loop flow estimate reduced the congestion and loss charges uplifted to NYISO customers in the balancing (i.e., real-time) market as follows:

$$\text{Balancing (RT) Congestion Charges} = (Transaction\_MW - Reduction\_MW) * (CONG_{PJMproxyRT} - CONG_{OHproxyRT})$$
$$\text{Balancing (RT) Loss Charges} = (Transaction\_MW - Reduction\_MW) * (LOSS_{PJMproxyRT} - LOSS_{OHproxyRT})$$

ATTACHMENT IV

NYISO MMU 2010 Study Estimating the Benefits of Certain Broader Regional Markets Initiatives

Prepared By: Dr. David Patton and Pallas Lee VanSchaick

[Due to the size of the files associated with some of the Attachments, the NYISO has posted the underlying data for this study on its website at http://www.nyiso.com/public/webdocs/documents/regulatory/filings/2011/02/Attachment_IV_HourlyData_PJM_Cnstrnts.zip]

A. Introduction

This document provides a detailed description of a study performed by Potomac Economics to estimate the magnitude of the benefits that might be expected to result from certain Broader Regional Markets initiatives. In particular, this study is referred to in Slide 2 of Dr. Patton's September 27, 2010 presentation to stakeholders as follows:

- *In particular, we estimate the production cost savings that may be achieved by:*
  - ✓ *Coordinating flows around Lake Erie through:*
    - – *Coordinated congestion management between RTOs; and*
    - – *The "buy-through congestion" initiative for transaction scheduling);*

Slides 3 to 9 of Dr. Patton's presentation discuss the method used to perform the study, and the final summary results of the study are shown in Slide 13 under the heading "Coordinated Congestion Management."

The summary tables in the power point were calculated by summing across the hourly data from this study, which is provided in four Excel files entitled: "LOOPFLOW_VALUE_PJM.xlsx," "LOOPFLOW_VALUE_ONT.xlsx," "LOOPFLOW_VALUE_MISO.xlsx," and "LOOPFLOW_VALUE_NYISO.xlsx."

This study estimates the quantity and value of loop flows on flowgates in each of the four Lake Erie ISOs (PJM, MISO, Ontario, and NYISO) that are caused by generation, loads, and transactions scheduled between the Lake Erie ISOs. The data used in the study is from seasonal NERC planning cases and other public data sources.

B. Overview of Study

This study to quantify the benefits of better coordination of flows around Lake Erie has two components:

- Estimating the quantity of loop flows across each of the ISOs' flowgates that is caused by the other three ISOs. This is described in the section below entitled: "Estimating the Quantity of Loop Flows."

- Estimating the degree to which the estimated loop flows are priced inefficiently. This is reflected in the difference between the value of the flowgate capability, which is equal to the shadow price of the flowgate in the real-time market of the monitoring ISO, and the charges to transactions that cause the loop flows. This difference provides insight about the potential efficiencies from coordinated congestion management and buy-through congestion provisions. This is described in the section below entitled: "Inefficient Pricing of Loop Flows."

The time period used for this analysis was November 2008 through October 2009.

C. Estimating the Quantity of Loop Flows

First, we identified flowgates in each ISO footprint that were likely to be significantly affected by loop flows from generation, load, and external transactions scheduled in the other three ISOs. We included flowgates defined in the NERC 09/10 winter planning case. We also consulted with operations personnel for each ISO to identify additional constraints from the period that were likely affected by loop flows from the other three ISOs. The lists of flowgates evaluated in this study are as follows:

- In NYISO:
  - 91 ATHENS PLEASANT VALLEY TSA CASE
  - CENTRAL EAST TIES
  - DYSINGER
  - Loss of 91 Athens Pleasant Valley on 92 Leeds Pleasant Valley
  - NIAGARA PACKARD ROBINSON xTWR1
  - WEST CENTRAL TIES
- In IESO:
  - ADIRONDACK - ONT
  - BLIP-(Buchanan Longwood Input)
  - MP-ONT_N
  - NYIS-ONT
  - ONT - FRONTIER
  - ONTARIO-ITC
  - ONT-NYIS
  - QFW-(Queenston Flow West)
  - For IESO, the existence of constraints was in some cases inferred from the nodal congestion prices as described later.

- In MISO:
  - Adams-Rochester 161kV flo Byron 345/161 kV XFMR
  - Adams-Rochester 161kV flo Byron-Pleasant Valley 345kV
  - Adams-Rochester 161kV flo Byron-PVS-Adams + Adams 345/161 XFMR
  - Bondurant-BooneJct 161 for Lehigh-Webster 345
  - Breed-Wheatland 345 kV line l/o Rockport-Jefferson 765 kV line
  - Bunsonville-Eugene 345kV flo Casey-Breed 345kV
  - Burr Oak 345/138 XFMR (flo) Burr Oak - Leesburg 345
  - Byron-Maple Leaf 161 flo Byron-Pleasant Valley 345
  - COOPER_S
  - Crete-St Johns Tap 345 kV l/o Dumont-Wilton Center 765 kV line
  - Dundee-Hazleton 161 (flo) Arnold-Hazleton 345 #14976
  - Dune Acres-Michigan City 138 1 (flo) Wilton Center-Dumont 765
  - Dune Acres-Michigan City 138 1&2 (flo) Wilton Center-Dumont 765
  - Ellington-Hintz 138 for N.Appleton-Werner West 345
  - Fox Lake-Rutland 161kV flo Lakefield-Fieldon-Wilmarth 345 kV line + SPS
  - Gallagher-Paddys West 138 (flo) Trimble Co.-Clifty Creek 345
  - GENTLMN3 345 REDWILO3 345 1
  - GREENFIELD-LAKEVIEW 138 flo BEAVER-DAVIS BESSE 345
  - Hazleton T21 345/161kV flo Hazleton T22 345/161kV
  - Hazleton-Black Hawk 161 FLO Hazleton-Washburn 161
  - Indian Lake Xfmr T2 (flo) Indian Lake Xfmr T1
  - Lakefield-Fox lake 161 (flo) Lakefield-Fieldon-Wilmarth 345 kV line + SPS

- Lanesville 345/138 xfmr (flo) Kincaid-Latham-Blue Mound 345 & Kincaid-Pawnee 345
- MWEX
- Newtonville 138/161 Xfm T3 flo Newtonville 138/161 Xfm T5
- Northeast Ohio Interface
- Oak Grove-Galesburg 161 flo Nelson-Electric Jct 345
- ONTARIO-ITC
- Paddock-Townline 138 (flo) Paddock-Blackhawk 138
- Pana 345/138 xfmr (flo) Coffeen - Coffeen North 345 + Coffeen UN2 SPS
- Pleasant Prairie-Zion 345 flo Cherry Valley-Silver Lake 345 R
- Pleasant Prairie-Zion 345 flo Zion-Arcadian 345
- PRI-BYN
- Rising 345/138 Xfmr1 (flo) Clinton - Brokaw 345
- Rivermines-N Farmington 138kv (flo) St Francois-Lutesville 345kv
- S1226-Tekamah 161kV flo S3451-Raun 345kV
- Seneca-Krendale 138 flo Wylie Ridge-Cabot 500
- St Francois - Lutesville 345
- St. Francois-Lutesville 345 (flo) E. W Frankfort-Shawnee 345
- State Line-Roxanna 138 kV l/o Wilton Center-Dumont 765 kV
- State Line-Wolf Lake 138 flo Burnham-Sheffield 345
- Stillwell - Dumont 345kV (flo) Wilton Center - Dumont 765kV
- Sub 56(Davnprt)-E.Calamus161 for Quad-RockCr345
- Sub K/Tiffin-Arnold 345kV
- Werner West-Werner 138kV (flo) Werner West-North Appleton 345kV

- In PJM:
  - 155 Nelson-111 Electric Junction (15502) 345 kV l/o Cherry Valley-Silver Lake (15616) 345 kV
  - 15616 Cher-Silv for 15502 Nels-EJ
  - AEP-DOM l/o Baker-Broadford 765 kV
  - AP South Interface
  - Burnham-Munster 345 flo Dumont-Wilton Center 765
  - Cherry Valley-Silver Lake 345 kV (15616 line)
  - CLOVERDALE-LEXINGTON 500
  - Cloverdale-Lexington 500 kV l/o Mt. Storm-Valley 500 kV
  - Cloverdale-Lexington 500 kV l/o Pruntytown-Mt. Storm 500 kV
  - Cordova-Nelson 345 kV (15503 line)
  - Cordova-Nelson 345 kV (15503) l/o H471-Nelson 345 kV (15504)
  - Kammer #200 765/500 kV xfmr l/o Belmont-Harrison 500
  - Kammer #200 765/500 kV xfmr l/o Kammer-South Canton 765 kV
  - Kammer #200 765/500-kV xfmr l/o Belmont 765/500-kV xfmr
  - Kammer .100 345/138kV xfmr l/o Tidd-WestBellair-Kammer 345kV
  - Lanesville 345/138 (flo) Kincaid - Pawnee 345 + 2106 SPS
  - ONT-NYIS
  - Paddock-Town Line 138 (flo) Wempletown-Rockdale 345
  - Pana 345/138 Xfmr 2 (flo) Kincaid 2101 + 2102 + UN2 + 2106 (Kincaid SPS table 2 w/ 2101 or 2102 o/s
  - Pana 345/138 xfmr l/o Kincaid-Pawnee 345
  - Pierce-Foster 345kV (flo) Kyger Creek-Sporn 345kV
  - PJM Central Interface
  - PJM Eastern Interface

- PJM ID 11
- PJM ID 12
- PJM ID 13
- PJM ID 15
- PJM ID 16
- PJM ID 18
- PJM ID 19
- PJM ID 20
- PJM ID 23
- PJM ID 24
- PJM ID 26
- PJM ID 27
- PJM ID 29
- PJM ID 3
- PJM ID 30
- PJM ID 31
- PJM ID 32
- PJM ID 4
- PJM ID 5
- PJM ID 6
- PJM ID 8
- PJM ID 9
- PJM Western Interface
- Roseland-Cedar Grove F 230 kV l/o Roseland-Cedar Grove B
- Sammis-Wylie Ridge 345 kV line l/o Belmont-Harrison 500 kV

- Sammis-Wylie Ridge 345KV
- State Line-Wolf Lake 138 flo Wilton Center-Dumont 765

The flowgates with the name of "PJM ID X" are PJM constraints that are not defined in the NERC planning case. The definition of these constraints (i.e., the mapping of these constraints from PJM EMS to NERC planning case) is included in the file "PJM_Constraints_Mapped.xls" [available on the NYISO's web site]

For each flowgate, we estimated forward and reverse loop flows resulting from:

- Inter-control area transactions where the monitoring ISO is not on the contract path. Each hourly Excel data file contains a sheet entitled "Transaction" containing the calculations related to inter-control area transactions.

- Native generation-to-load impacts from the other three ISOs. Each hourly Excel data file contains a sheet entitled "GTL" containing the calculations related to generation and load.

For each constrained flowgate, all shift factors and distribution factors were calculated using PowerWorld simulator and the NERC 09/10 winter planning case. All PowerWorld cases assumed that the PAR-controlled lines between PJM and NYISO (i.e., the 5018, JK, and ABC lines) would be fully controlled (i.e., open). Other PAR-controlled lines including the four IESO-Michigan lines were assumed to be free-flowing.

Inter-Control Area Transactions:

For each inter-control area transaction, the Transmission Distribution Factor ("TDF") was calculated based on the source control area and sink control area of the transaction.

In the hourly data, the following information is reported:

- One column contains the date and hour.

- Two columns contain the NERC flowgate ID and the flowgate name.

- Four columns contain the distribution factor of a particular transaction path on the flowgate. For example, Column E "MISO_to_PJM" contains the TDF of a MISO to PJM transaction on the flowgate. They are directional area-to-area PTDFs from PowerWorld simulator. The TDF of a multi-leg transaction is the sum of the TDFs of the component legs. For example, a MISO to NYISO transaction has a TDF equal to the TDFs of MISO to PJM and PJM to NYISO.

- Two columns contain the source control area and the sink control area of a particular transaction.

- One column contains the MW scheduled by the transaction.

Native Generation-to-Load Impacts:

Native generation-to-load impacts were calculated for each generator on each flowgate. For each generator, the Generation-to-Load Distribution Factor ("GLDF") was calculated as the difference between the generator's Generation Shift Factor ("GSF") and the ISO's load-weighted average Load Shift Factor ("LSF"). These GLDFs were used to calculate the market flows across each flowgate.

In the hourly data, the following information is reported:

- One column contains the date and hour.
- Two columns contain the NERC flowgate name and the flowgate [ID].
- Eight columns, labeled NY_FGTL, NY_RGTL, ONT_FGTL, ONT_RGTL, MISO_FGTL, MISO_RGTL, PJM_FGTL, and PJM_RGTL, represent Forward or Reverse Gen To Load (FGTL or RGTL) impacts of a non-monitoring area to a modeled constraint in the monitoring area. For example, a column NY_FGTL in a MISO file indicates the forward loop flow impact of NY generation serving its native load on MISO constraints.
- There are additional eight columns related to GTL impact calculation, NY_FRATIO, NY_RRATIO, ONT_FRATIO, ONT_RRATIO, MISO_FRATIO, MISO_RRATIO, PJM_FRATIO, and PJM_RRATIO. These columns represent the percent of generation in a non-monitoring area that has forward or reverse impact on a monitored constraint (FRATIO or RRATIO). For example, if 40 percent of NY generation has forward impact on a MISO constraint and the remaining 60 percent has reverse impact, NY_FRATIO and NY_RRATIO will be 40% and 60% for that constraint in the MISO file.

The following steps were used to calculate these values for each flowgate:

1) Compute shift factors for every generator node and load node in the non-monitoring area on the modeled constraint in the monitoring area, labeled as GSF and LSF.

2) Calculate weighted load shift factors, WLSF = sum of (Load MW*LSF) / total Load MW, this is done over all load nodes in the non-monitoring area;

3) For each generator node, if GSF > WLSF then categorize as a FGTL node, else if GSF < WLSF then categorize as a RGTL node.

4) FGTL = sum of (Generation MW*(GSF-WLSF)) /total Generation MW, this is done over all FGTL nodes.

5) RGTL follows the same calculation but over all RGTL nodes.

6) FRATIO = sum of (Generation MW over all FGTL nodes)/total Generation MW over all nodes.

7) RRATIO = sum of (Generation MW over all RGTL nodes)/total Generation MW over all nodes.

All Generation MW and Load MW are from the NERC planning case.

D. Inefficient Pricing of Loop Flows

The inefficient pricing of loop flows is reflected in the difference between the value of the flowgate capability (i.e., the shadow price in the monitoring ISO) and the charges to transactions that cause the loop flows. This difference provides insight about the potential efficiencies from coordinated congestion management and buy-through congestion provisions. For example, if a flowgate is constrained with a $200/MWh shadow price and 150 MW of flowgate capability is used by loop flows in the forward direction, the economic value of capability used by the loop flows is $30,000/hour. This is equal to the congestion charges that would be collected if the 150 MW of flow resulted from transactions scheduled internally. Therefore, the assessment quantifies pricing inefficiencies by estimating the difference between the value of the flowgate and the costs incurred by the sources of the loop flows.

The value of flowgate depends on the marginal redispatch cost to manage the congestion on the flowgate by the monitoring ISO. For the MISO, NYISO, and PJM, this is the flowgate's real-time shadow price. For IESO, this is implied by the real-time nodal prices that are produced by its real-time security-constrained dispatch software.

The pricing inefficiencies can be placed in two categories:

- Under-priced Congestion: this occurs when transactions are not charged for their loop flows, or where the value of the flowgate exceeds the costs incurred by non-monitoring ISOs to help manage it.

- Over-priced Congestion: this occurs when transactions that are more valuable than the flowgate capability are curtailed (not estimated due to lack of data), or when non-monitoring ISOs incur higher redispatch costs to help manage the congestion than the value of the flowgate.

Transmission Line Loading Relief ("TLR") is often called when loop flows are contributing to congestion on the flowgate. When no TLR is called, loop flows are not charged (or paid) for their use of the flowgate. In this case, the BRM initiatives will enhance efficiency by: providing efficient scheduling incentives for transactions by charging transactions that cause forward loop flows (contribute to congestion), and by paying transactions that cause negative loop flows (relieve congestion), and by reducing re-dispatch costs in the monitoring ISO.

When a TLR is called, the costs incurred by transactions and the non-monitoring ISOs may be substantially higher (or lower) than the marginal re-dispatch cost in the monitoring ISO. In this case, the BRM will ensure that transactions that cause loop flows are charged (or paid) consistent with the cost of re-dispatch in the monitoring ISO, and minimize the redispatch costs of the monitoring and non-monitoring ISOs.

Inefficiency of Non-TLR Constraints

Calculation of loop flow values for transactions for non-TLR constraints are categorized as "UNDER PRICED" in our study. For these, the loop flows associated with a transaction are valued as follows:

- Forward value = Transaction MW*Distribution Factor*Constraint Shadow Price, if distribution factor > 0;

- Reverse value = Transaction MW*Distribution Factor*Constraint Shadow Price, if distribution factor < 0;

Calculation of loop flow values for GTL for non-TLR constraints are categorized as "UNDER PRICED" inefficiency in our study. We define Net Native Load (NNL) in each area as the minimum of total Generation from internal resources and area Load. There are four columns in the files, labeled MISO_NNL, PJM_NNL, ONT_NNL, and NY_NNL, representing NNL for each hour in each area.

- Forward value = NNL*FRATIO*FGTL*Constraint Shadow Price

- Reverse value = NNL*RRATIO*RGTL*Constraint Shadow Price

We do not have constraint-specific shadow prices from Ontario. Hence, we are not able to measure loop flow values on a per-constraint basis. Instead, we estimate loop flow impact in the Ontario system at a more aggregated level. We calculate a proxy shadow price, labeled PROXYCONG, to represent the congestion cost flowing through Ontario. This proxy is computed as the difference between the West zone LMP congestion component and the Niagara Zone LMP congestion component. The quantity of loop flows through Ontario is measured as the loop flows across the four lines between Michigan and IESO.

Inefficiency of TLR Constraints

We measure two pricing inefficiencies during a TLR event: when loop flows are over-priced and when loop flows are under-priced.

If a non-monitoring ISO does redispatch for this TLR constraint and produces a higher shadow price than in the monitoring ISO, we categorize the inefficiency as "OVER PRICED". For an "OVER PRICED" TLR constraint:

- Forward GTL over-priced value = NNL*FRATIO*FGTL*(SP in non-monitoring ISO - SP in monitoring ISO)

- Reverse GTL over-priced value = NNL*RRATIO*RGTL*(SP in non-monitoring ISO - SP in monitoring ISO)

- Forward inter-control area transaction over-priced value = Transaction MW*distribution factor*(max(SP in sourcing ISO, SP in sinking ISO) - SP in monitoring ISO), if distribution factor > 0

- Reverse inter-control area transaction over-priced value = Transaction MW*distribution factor*(max(SP in sourcing ISO, SP in sinking ISO) - SP in monitoring ISO), if distribution factor < 0

If a non-monitoring ISO does redispatch for this TLR constraint and produces a lower shadow price than in the monitoring ISO or does not do redispatch for this TLR constraint, we categorize the inefficiency as “UNDER PRICED”. For an “UNDER PRICED” TLR constraint:

- Forward GTL under-priced value = NNL*FRATIO*FGTL*(SP in monitoring ISO – SP in non-monitoring ISO)

- Reverse GTL under-priced value = NNL*RRATIO*RGTL*(SP in monitoring ISO – SP in non-monitoring ISO)

- Forward inter-control area transaction under-priced value = Transaction MW*distribution factor*(SP in monitoring ISO - max(SP in sourcing ISO, SP in sinking ISO)), if distribution factor > 0

- Reverse inter-control area transaction under-priced value = Transaction MW*distribution factor*(SP in monitoring ISO - max(SP in sourcing ISO, SP in sinking ISO)), if distribution factor < 0

ATTACHMENT V

NYISO MMU 2010 Interface Utilization Study

Prepared By: Dr. David Patton and Pallas Lee VanSchaick

[Due to the size of the files associated with some of the Attachments, the NYISO has posted the underlying data for this study on its website at http://www.nyiso.com/public/webdocs/documents/regulatory/filings/2011/02/Attachment_V_Hrly_Bnfts_by_Intrfc_2009.xls]

MEMORANDUM

TO: Alex Schnell

FROM: David B. Patton

DATE: February 21, 2011

RE: Interface Utilization Study

As part of our assessment of the potential benefits of the Broader Regional Market ("BRM") initiatives, we estimated the production cost savings that may be achieved by improving the utilization of interfaces among the control areas on the Lake Erie "loop": MISO, PJM, NYISO, and Ontario. The final study was presented to market participants on September 27, 2010. This memo provides additional information regarding our analytic approach and assumptions, as well as a more detailed set of results of our study.

Using hourly data from all of 2009, we employed an econometric regression model to estimate the benefits that are available from optimal scheduling of the interfaces between these RTOs. The general approach to the analysis is straightforward: controlling for particular supply conditions, we first estimate how the hourly price at an interface responds to variation in net interchange. We then use these estimates to calculate efficiency-enhancing interface adjustments for each of the four interfaces and calculate the reduction in the total production costs.

To calculate the estimates, we hypothesize that the price change on a particular interface from one hour to the next is explained by three main variables:

(1) the hourly change in flows at the interface;

(2) the hourly change in flows on the other neighboring interfaces around Lake Erie, (for example, in examining the Midwest ISO-to-PJM interface, the neighboring Lake Erie interface is the Midwest ISO-to-Ontario interface); and

(3) The hourly total net interchange in the control area (NSI), which will include all interfaces.

The supply conditions that we control for are (1) fuel costs; (2) the slope of the supply curve; and (3) congestion. Controlling for these factors is appropriate because they are likely to affect the hypothesized relationship between prices and interchange. To control for fuel costs, the prices at the border are expressed as heat rates by dividing the LMP by the cost of natural gas (the implicit assumption being that natural gas units are on the margin).

To control for differences in supply curve slope and for congestion, we allow the model to estimate different rates of price responsiveness depending on the prevailing locational price and the congestion costs leading to or from the interface. In particular, we assume the slope of the supply curve increases at heat rates above 8,000 (a typical heat rate of a natural gas combined cycle unit) or when congestion cost exceed $20/MWh. Hence, the estimated responsiveness of price to interchange flows will depend on the level of price and congestion. To produce estimates that vary with congestion and overall price levels, we utilize standard econometric techniques.[1]

We also tested for and found serial correlation in the data. This means that some of the data was correlated with itself from a prior period. When this occurs, the statistical results may erroneously indicate a relationship between two variables. Hence, we utilize procedures to correct the data to remove the serial correlation.[2] Our tests for serial correlation indicated that these corrections effectively addressed the serial correlation.

We estimate the price relationship in both directions. Hence, for example, the price relationship on the Midwest ISO-to-PJM interface is estimated as well as the price relationship on the PJM-to-Midwest ISO interface. This means we estimate eight

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[1] We transform the underlying data by making the regressors a conditional function of price levels and congestion.

[2] We utilized Maximum Likelihood Estimation to correct for autocorrelation.

separate equations for the four "Lake Erie RTOs".

The econometric model provides estimated parameters that represent the estimated marginal price effects from the changing interface flows. These estimates are made for the effects of changing flows on the interface being evaluated and for the effect of changing flows on the other neighboring Lake Erie RTO. These estimated parameters are then used to estimate the benefits of an optimized interchange among the four Lake Erie RTOs.

We estimate the optimal interchange beginning with actual historical prices, actual interchange quantities, and actual transmission limits at each interface for 2009. The first identifies the interface where a marginal exchange (25 MW) creates the highest production-cost benefit. Using the estimated price impacts for this marginal exchange, new price is set at both sides of the interface and a new price is set at the other interface with the neighboring Lake Erie RTO. Hence, if the highest initial marginal value exchange is on the PJM-to-NYISO interface, the PJM price at the NYISO border is adjusted, the NYISO price at the PJM border is adjusted, and the PJM price at the Midwest ISO border price is adjusted. This creates a marginal benefit. Using these adjusted prices, we again identify the interface where a 25 MW marginal exchange creates the highest production-cost benefit (respecting the interface limit). The impact of the exchange is calculated and the marginal benefit is added to the marginal benefit of the exchange in the previous step. The prices are again adjusted and the process continues until marginal exchanges can create no additional value (pieces at the interfaces are equalized or transmission limits are reached). The marginal benefit from each iteration is summed together to establish the estimated benefit from optimized dispatch. Using this process, the Table 1 shows the monthly redispatch benefits for each interface and the annual total.

Table 1: Summary of Estimated Interface Optimization Net Production Cost Savings

2009 ($Millions)

Month (2009)	Ontario and Midwest ISO	Midwest ISO and PJM	PJM and New York ISO	New York ISO and Ontario	All
January	$3.97	$4.90	$6.03	$5.33	$20.22
February	$2.13	$2.86	$2.40	$2.53	$9.92
March	$6.81	$4.41	$3.29	$6.71	$21.22
April	$8.28	$4.19	$3.19	$7.09	$22.75
May	$5.90	$4.91	$3.89	$5.94	$20.63
June	$6.14	$4.44	$4.00	$8.52	$23.10
July	$5.13	$3.39	$2.92	$8.46	$19.90
August	$5.79	$3.80	$2.60	$3.70	$15.89
September	$4.49	$2.72	$1.84	$2.31	$11.36
October	$4.52	$2.59	$3.69	$4.58	$15.38
November	$5.30	$3.60	$2.73	$6.09	$17.72
December	$3.95	$4.29	$6.15	$5.45	$19.84

As the table shows, significant net savings are achieved over each interface in every month. Due to the relatively low load and low natural gas prices during 2009, the prices at the interfaces were lower and less volatile than usual and, hence, the total production cost savings are likely to be understated. To provide additional information that may be useful to the Commission and market participants, we provide hourly production cost savings results for each of the interfaces in Appendix A [which is posted on the NYISO's web site].

Please feel free to contact me with any questions.

DBP