Niagara Generation Modeling Update

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Background

- At the January 22, 2016 MIWG, NYISO informed Market Participants that it was exploring a modeling improvement of the Niagara Power Project in the Real-Time and Day-Ahead Markets. The modeling improvement is intended to better align the market model used for scheduling and pricing with the market model used for assessing constraint flows.
- The purpose of this presentation is to inform Market Participants of the NYISO's progress, and to discuss the implementation timing.
- For additional background, please see the 1/22/2016 MIWG Presentation (also included in Appendix): http://www.nyiso.com/public/webdocs/markets_operations/committees/bic_miwg/meeting_materials/2016-01-22/Niagara_Modeling%20Improvements_MIWG_22-JAN-2016vFINAL.pdf

Niagara plant configuration
(recap of 1/22/2016 MIWG)

- **The Niagara Power Plant is comprised of 25 individual generating units, divided into three distinct points of injection onto the bulk power system:**
  - ***Niagara 230 kV Bus***
  - ***Niagara 115 kV East Bus***
  - ***Niagara 115 kV West Bus***
- **In the NYISO Energy Markets, the plant is modeled in a distributed fashion to assess constraint flows for transmission security (i.e., security analysis). However, it is represented at a single point of injection for scheduling and pricing purposes (i.e., commitment and dispatch). This point of injection is modeled at the 230kV bus.**
  - ***The TCC Market employs a distributed plant model for Niagara in both the power flow and scheduling algorithms.***

Impacts on transmission constraints

(recap of 1/22/2016 MIWG)

- **There are several key constraints for which Niagara generation impacts differ between the 230kV and 115kV station units:**
  - ***Packard-Sawyer 230kV for l/o Packard-Sawyer 230kV***
  - ***Niagara-Packard 230kV #61 for TWR:PACKARD 62 & BP76***
  - ***Niagara-Packard 230kV #62 for TWR:NIAGARA 61 & 64***
- **Increasing output from the Niagara units on the 115kV busses tend to relieve these constraints, while increasing output from units on the 230kV bus aggravates them.**
- **NYISO has historically managed these constraints by requesting 115kV bus production be maximized to meet the plant's schedule when it would be optimal to do so.**

Modeling Improvement

- **NYISO is planning a modeling improvement that will better reflect the distributed impacts of Niagara.**
- **The improvement allows the market software to recognize the current distribution* of the plant output for scheduling and pricing in the same manner in which it currently does for security analysis.**
  - ***This change will better align the market model used for scheduling and pricing with the market model used for security analysis.***
  - ***This change will also better align the Energy Market with the TCC Market.***

*Plant distribution for the Real-Time Market is based on actual telemetered output from the individual units observed at the time each RTD/RTC execution initializes. Plant distribution for the Day-Ahead Market is generally a single static value applied to all hours based on the previous like day observations (e.g., weekday to previous weekday, weekend to previous weekend day).

Modeling Improvement - Example

- **Constraint:**

Time Stamp	Limiting Facility	Contingency	Shadow Price
3/16/2016 8:20	NIAGARA 230 PACKARD 230 1	TWR:PACKARD 62 & BP76	$48.20

- **LBMPs:**

Time Stamp	Name	PTID	LBMP	Losses	Congestion
3/16/2016 8:20	NIAGARA_115E_LBMP	323715	$27.67	-$0.87	-$9.15
3/16/2016 8:20	NIAGARA_115W_LBMP	323714	$26.05	-$0.81	-$7.47
3/16/2016 8:20	NIAGARA_230_LBMP	323716	$9.00	-$0.66	$9.73
3/16/2016 8:20	NIAGARA____	23760	$9.00	-$0.66	$9.73

- **Once the distribution logic is enabled in the dispatch, the Niagara price (at PTID 23760) will reflect the weighted distribution of each injection point to develop the overall Niagara schedule and price.**
  - ***If Niagara output is distributed in a manner that relieves the active constraints, the 23760 LBMP will increase. If it is distributed in a manner that aggravates the constraints, the 23760 LBMP will decrease.***

			Current Model	Distributed Scheduling and Pricing Model *			
Time Stamp	Name	PTID	Original LBMP	Output MW Example 1	LBMP Example 1	Output MW Example 2	LBMP Example 2
3/16/2016 8:20	NIAGARA_115E_LBMP	323715	$27.67	400	$27.67	600	$27.67
3/16/2016 8:20	NIAGARA_115W_LBMP	323714	$26.05	400	$26.05	600	$26.05
3/16/2016 8:20	NIAGARA_230_LBMP	323716	$9.00	1600	$9.00	400	$9.00
3/16/2016 8:20	NIAGARA____	23760	$9.00	2400	$14.95	1600	$22.40

* Example is illustrative only and should not be taken as an exact construction of a shift-factor weighted distributed LBMP

Additional Information

- **NYISO re-ran recent Day-Ahead executions using the Niagara distribution logic. This resulted in the following schedule and LBMP changes at PTID 23760, as compared to the production results:**

	Hours w/ Western Constraints		Hours w/ no Western Constraints	
	Avg Schedule Delta	Avg LBMP Delta	Avg Schedule Delta	Avg LBMP Delta
Day 1	+68.5 MW	+$1.10	0 MW	-$0.54
Day 2	+244.7 MW	+$3.52	0 MW	-$0.02

- **This modeling change does not alter the Niagara bidding or settlement PTID (23760). The plant will continue to provide a single bid, receive a single schedule, and settle at the LBMP for PTID 23760. However, as a result of this modeling change, the way in which the plant's output is distributed at the plant will impact its schedule and price.**

TCC Market

- The TCC Market currently employs a distributed Niagara model for both its power flow as well as its scheduling and pricing routines. Therefore, there are no changes anticipated to the TCC Market models.
- Existing TCCs involving PTID 23760 will continue to settle at that PTID.
- The NYISO does not anticipate adding new bid points to the TCC market as a result of this Energy Market change.

Activation

- **NYISO expects to activate this modeling improvement in the Scheduling and Pricing algorithms of SCUC, RTC, and RTD on Wednesday, May 4, 2016.**
  - ***Allows Market Participants to make investment decisions regarding their TCC holdings in time for the Spring 2016 Centralized TCC Auction (final round) and the May 2016 Reconfiguration TCC Auction.***

Appendix

January 22, 2016 MIWG Presentation Materials

Purpose

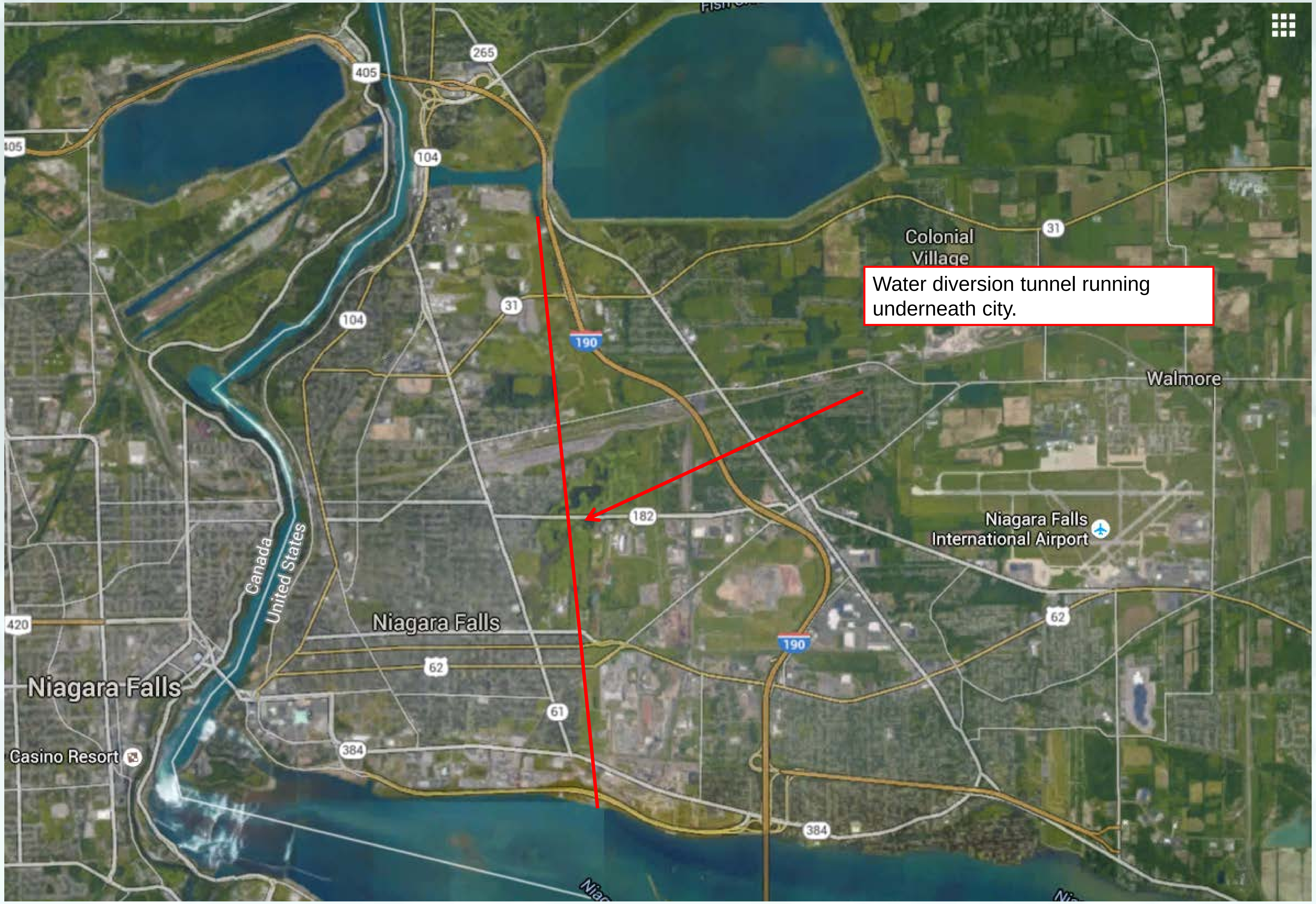
- **The purpose of this presentation is to begin a discussion with Market Participants on the modeling of the Niagara Power project. Specifically: a) its configuration, b) its impacts on Western NY congestion, c) how it is modeled in the NYISO Markets, and d) ideas to improve the transparency and modeling of the plant.**

Niagara plant configuration

- **The Niagara Power Plant is comprised of 25 individual generating units, divided into three distinct points of injection onto the bulk power system:**
  - ***Niagara 230kV Bus:***
    - **12 Lewiston Pump Generating units (480MW total)**
    - **6 Main Generating units (1290MW total)**
  - ***Niagara 115kV East Bus***
    - **4 Main Generating units (860MW total)**
  - ***Niagara 115kV West Bus***
    - **3 Main Generating units (645MW total)**
- **In the NYISO Energy Markets, the plant is modeled in a distributed fashion to assess constraint flows for transmission security. However, it is represented at a single point of injection for scheduling and pricing purposes. This point of injection is modeled at the 230kV bus. The plant has been operated and scheduled as a single aggregate generator since 1969.**
  - ***The TCC Market employs a distributed plant model for Niagara in both the power flow and scheduling algorithms.***

Niagara Plant – A bird's eye view

Niagara Plant – A bird's eye view



Plant operating constraints

- **The individual units are subject to strict physical and environmental operating constraints:**
  - ***The Lewiston units (230kV) cannot be operated without the Main Niagara units (115kV & 230kV) in operation. This is because the Lewiston units' hydraulic output must flow through the other units. As a result, the Lewiston units are hydraulically, and therefore electrically coupled to the Main units.***
  - ***An additional plant constraint is that NYPA must meet requirements governed under an International Treaty that dictates the allowable water diversion for power production.***
  - ***As a result of the hydraulic coupling of the 115kV and 230kV units, there is no ability to establish two unique sets of generating offers for the 115kV and 230kV units that would meet the simultaneous objectives to (a) meet the total plant schedule and, (b) meet the run-of-river requirements of the International Treaty for allowable water diversion.***

Impacts on transmission constraints

- **There are several key constraints for which Niagara generation impacts differ between the 230kV and 115kV station units:**
  - ***Packard-Sawyer 230kV for I/o Packard-Sawyer 230kV***
  - ***Niagara-Packard 230kV #61 for TWR:PACKARD 62 & BP76***
  - ***Niagara-Packard 230kV #62 for TWR:NIAGARA 61 & 64***
- **Increasing output from the Niagara units on the 115kV system tend to relieve these constraints, while increasing output from units on the 230kV system aggravate them.**
- **NYISO has historically managed these constraints by maximizing production at the 115kV yards to meet the plant's schedule when it would be optimal to do so.**

Discussion – Improved modeling

- **NYISO is exploring a modeling change that would better reflect the distributed impacts of Niagara.**
- **The change involves recognizing the current distribution of the plant output for scheduling and pricing. This change would better align the market model used for scheduling and pricing with the market model used for assessing constraint flows.**
  - ***This change would also better align the Energy Market with the TCC Market.***
- **The purpose of discussing this now with Market Participants is to initiate the dialogue early in this process.**
- **As we progress through our analysis of this change, we will come back to Market Participants to share results and timelines.**

Discussion – Additional pricing points

- **In order to improve transparency to the Market surrounding the relative impacts each of the Niagara points of injection have on the system, NYISO will begin developing and publishing LBMPs representing the plant's points of injection at the 115kV East and West bus and the 230kV bus. These LBMPs are informational only, and will not replace, nor impact, the existing aggregate Niagara 23760 PTID LBMP that is currently produced.**

  - ***The three new LBMP points will be:***
    - ***NIAGARA_115W_LBMP (323714)***
    - ***NIAGARA_115E_LBMP (323715)***
    - ***NIAGARA_230_LBMP (323716)***

- **The intention of the three new LBMP points is to more accurately depict the value of energy at each of the Niagara points of injection.**

Next Steps

- **NYISO will continue researching refinements to the way in which Niagara is modeled in the energy markets and will return to a future MIWG with additional information once it becomes available.**

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- ***Operating open, fair and competitive wholesale electricity markets***
- ***Planning the power system for the future***
- ***Providing factual information to policy makers, stakeholders and investors in the power system***

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