Preliminary Results of Analysis of the Broader Regional Markets Initiatives

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Introduction

- This presentation summarizes our assessment of the potential benefits of some of the Broader Regional Market ("BRM") initiatives.
- 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); and
  - ✓ Improving the utilization of New York's external interfaces, as well as the interfaces between MISO, PJM and Ontario.
- We report production cost savings because it is the most accurate measure of the improvement in economic efficiency.
  - ✓ In most cases, the short-term consumer savings would be substantially higher (which is based on the price effects of the initiatives).

Inefficient Pricing of Loop Flows

- To estimate the benefits of better coordination of flows around Lake Erie, we first estimate:
  - ✓ The quantity of loop flows across each of the ISOs' flowgates; and
  - ✓ The inefficient pricing of the estimated loop flows;
    - – The inefficiency is reflected in the difference between the value of the flowgate capability 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 this analysis, we analyzed November 2008 through October 2009.
- The value of flowgate capability used by the loop flows depends on the marginal cost of re-dispatch for the monitoring ISO (the ISO on whose system the flowgate is on).
  - ✓ 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.

Inefficient Pricing of Loop Flows

- Transmission Line Loading Relief ("TLR") is often called when loop flows are contributing to congestion on the flowgate.
  - ✓ However, inefficiencies exist whether or not a TLR is called and the broader regional market initiatives will address these inefficiencies.
- 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).
  - ✓ 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.
  - ✓ Minimize the redispatch costs of the monitoring and non-monitoring ISOs.

Estimating the Quantity of Loop Flows

- We estimated forward and reverse loop flows resulting from:
  - ✓ Inter-control area transactions where the monitoring ISO is not on the contract path; and
  - ✓ Native generation-to-load impacts from the other three ISOs.
- We first used Powerworld software to estimate distribution factors relative to the key flowgates on each ISO's system based on NERC planning cases.
- Loop flow impacts were calculated for each inter-control area transaction:
  - ✓ For each transaction, the Transmission Distribution Factor ("TDF") was calculated based on the source and sink of the transaction.
- Native generation-to-load impacts were calculated for each generator:
  - ✓ 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 calculated the market flows across each flowgate.

Estimating the Pricing Inefficiencies

- To identify pricing inefficiencies for the loop flows, the difference between the value of the flowgate and the costs incurred by the source of the loop flows is estimated.
- 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:

1. 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.
2. 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.

- The following tables show these pricing inefficiencies. They report the difference between the value of flowgate capability in the monitoring ISO and the charges (or payments) to sources of the loop flows.

Inefficient Pricing when Loop Flows are Under-Priced

Direction/Source of Loop Flows		Monitoring ISO (in $millions): NYISO	ONT	MISO	PJM
Forward	**NYISO GTL**		$4	$1	$17
	ONT GTL	$7		$16	$16
	MISO GTL	$7	$13		
	PJM GTL	$57	$35		
	ONT - NYISO			$1	$4
	MISO - ONT	$6			
	PJM - MISO	$2	$2		
	NYISO - PJM		$3		
	Total	**$79**	**$57**	**$19**	**$37**
Reverse	**NYISO GTL**		$7	$2	$15
	ONT GTL	$9		$16	$14
	MISO GTL	$9	$14		
	PJM GTL	$40	$32		
	ONT - NYISO			$1	$3
	MISO - ONT	$1			
	PJM - MISO	$2	$1		
	NYISO - PJM		$6		
	Total	**$61**	**$60**	**$19**	**$33**

Inefficient Pricing when Loop Flows are Over-Priced

Direction/Source of Loop Flows		Monitoring ISO: ONT
Forward	**MISO GTL**	$20
	PJM - MISO	$1
Reverse	**MISO GTL**	$23
	PJM - MISO	$4

Conclusions of Loop Flow Analysis

- Forward and reverse loop flows are significant through each of the four ISOs.
  - ✓ The total gross value of the over-priced and under-priced loop flows is $413 million.
  - ✓ The BRM initiatives would capture some portion of this value by providing efficient incentives to schedule transactions and dispatch resources internally to minimize costs throughout the four ISOs' systems.
    - – The portion of the value that would be captured by the BRM is very difficult to estimate. It is based on the ability of other ISOs or schedulers to relieve the monitoring ISO's constraints at a lower cost than the ISO's real-time dispatch.
    - – We believe a reasonable range for this portion is 10 to 20 percent.
- These result may be understated for the following reasons:
  - ✓ Fuel prices were very low during the period studied, which reduces the value of congestion.
  - ✓ We did not have data on TLR-based curtailments and, therefore, have not identified cases where transactions were curtailed whose value exceed the value of the flowgate.
  - ✓ It does not identify the potential efficiency gains of scheduling transactions to relieve a constraint that was not scheduled under current rules.

Analysis of External Interface Utilization

- In addition to the benefits of better coordination of transactions and internal dispatch to lower the costs of managing congestion in the region, the BRM addresses improving scheduling between ISO markets.
- Improved scheduling would more fully utilize the transmission interfaces between the markets and generate significant benefits.
  - ✓ These benefits are best measured as reduced production costs.
  - ✓ Production costs are reduced as lower-cost resources in one market displace higher-cost resources in the adjacent market.
  - ✓ The result of this process is improved price convergence between the markets.
- We performed an econometric analysis to estimate the benefits that are available from optimal scheduling of the interfaces between the markets.
- The portion of the savings that are ultimately realized depend on the actions taken by the ISOs.
  - ✓ Real-time coordination of the net scheduled interchange ("NSI") (or intra-hour scheduling) would likely capture most of the savings.
  - ✓ Simply shortening the scheduling timeframes for participants would capture a much smaller share of the potential benefits.

Analysis of External Interface Utilization

- The largest source of benefits we estimated derives from improving the utilization of the interfaces between markets. The analysis is described below.

Ontario, MISO, and PJM Interfaces

- We first estimated how prices in each ISO respond to changes in the scheduled interchange ("NSI") over the interface, recognizing that this price response varies as prices increase or when there is congestion leading to the interface.
  - ✓ Our model also controls for changes in the NSI over other interfaces.
  - ✓ We did not have the congestion component of PJM's real-time prices so the element was not included for the PJM interfaces.
  - ✓ We then used the estimates to simultaneously optimize the interchange over each of the four inter-ISO interfaces around Lake Erie, given the interface limits.

New England Interface

- For the New England interface, our analysis uses the actual generator offers in both markets, and recognizes the binding constraints leading to the interface, to estimate the optimal interchange each 5-minutes.

HQ Interface

- We have not estimated the benefits from dynamic dispatching the HQ interface.
- However, the BRM would likely reduce or eliminate uplift costs currently incurred when the NYISO lacks the flexibility necessary to manage flows over the interface.

Analysis of External Interface Utilization

- Having calculated the optimal interchange on a five-minute basis for each interface, we then estimated the production costs savings achieved by the NSI adjustments.
  - ✓ Production cost savings result when relatively high-cost resources in one region are displaced by lower cost resources in the adjacent region.
  - ✓ Production cost reductions are the most accurate reflection of increased efficiency.
- The following table shows the estimated production costs savings by interface:

Coordination of Scheduled Interchange	Estimated Benefits
New York - Ontario	$61
New York - PJM	$70
New York - New England	$10
Ontario - MISO	$57
MISO - PJM	$43

- The savings for New England are lower in 2009 than estimated in prior years.
  - ✓ In 2006 to 2008, the production cost savings ranged from $17 to $21 million.
  - ✓ Also, coordination over the New England interface may have a larger effect on prices and reliability as it supplies east New York where shortages are more frequent.
- For the HQ interface, the NYISO estimated the following savings:
  - ✓ $8 million less balancing congestion from mitigating the negative prices in west NY.
  - ✓ $11 million in reduced uplift that was paid to HQ to manage flows on the interface.

Summary of Estimated BRM Production Cost Savings

- The potential savings we estimate address two aspects of the BRM initiations.
- Both show significant potential economic efficiencies, although the benefits of improved utilization of the external interfaces is larger.
- The following table summarizes the estimated annual benefits in the two areas, which totals:
  - ✓ $174 million in savings for the NYISO interfaces and constraints; and
  - ✓ $302 million in savings on all interfaces and constraints.
- In total, the benefits may be understated due to:
  - ✓ The low load and high surplus capacity that prevailed in 2009; and
  - ✓ The relatively low fuel prices in 2009.
- The low fuel prices in 2009 can be addressed by adjusting the benefits to correspond to a more typical natural gas price.
  - ✓ The benefits should be highly correlated to natural gas prices because gas-fired units are on the margin in most periods in New York and the adjacent markets.
  - ✓ The table shows that at a $6 per MMBTU gas price, the benefits would rise to:
    - – $211 million on the NYISO interfaces and constraints;
    - – $368 million for all interfaces and constraints.

Summary of Estimated BRM Production Cost Savings

Coordination of Scheduled Interchange	Estimated Benefits	Fuel-Price Adj. Benefits*
New York - Ontario	$61	$76
New York - PJM	$70	$86
New York - New England	$10	$12
Ontario - MISO	$57	$70
MISO - PJM	$43	$54
New York - HQ (Balancing Congestion Reduction)	$8	$8
New York - HQ (Uplift Reduction)	$11	$11
	$261	**$317**

Coordinated Congestion Management	Total	Assumed Savings	Estimated Benefits	Fuel-Price Adj. Benefits*
Under-priced Congestion				
NYISO Forward Loop Flows	$79	10%	$8	$10
NYISO Reverse Loop Flows	$61	10%	$6	$8
PJM Forward Loop Flows	$37	10%	$4	$5
PJM Reverse Loop Flows	$33	10%	$3	$4
MISO Forward Loop Flows	$19	10%	$2	$2
MISO Reverse Loop Flows	$19	10%	$2	$2
Ontario Forward Loop Flows	$57	10%	$6	$7
Ontario Reverse Loop Flows	$60	10%	$6	$7
Over-Priced Congestion				
Ontario Forward Loop Flows	$21	10%	$2	$3
Ontario Reverse Loop Flows	$27	10%	$3	$3
	$413		**$41**	**$51**
Total Estimated Savings - NYISO Interfaces/Constraints			**$174**	**$211**
Total Estimated Savings - All Interfaces/Constraints			**$302**	**$368**

* Adjusted to a $6 per MMBTU Natural Gas Price