

Introduction

This issue of **Quick Takes** explains the impact of intertie-related scheduling limits on intertie zone prices and interchange schedules.

Background

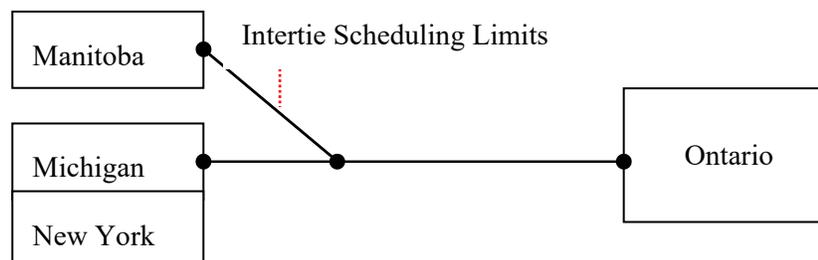
Scheduling Across the Interties

The pre-dispatch run of the unconstrained algorithm determines the market schedules (quantities) of interchange, i.e. imports and exports, and calculates projected prices for Ontario and the intertie zones. Intertie congestion prices (ICPs) are calculated based on these projected prices. A participant's actual interchange schedule is produced by the pre-dispatch constrained algorithm, which considers the effects of constraints within the IESO-controlled grid.

There are two types of limits specific to scheduling across the interties: the intertie scheduling limit and the net interchange schedule limit:

- The *intertie scheduling limits* consider the physical capacity of the tielines to transfer energy between each intertie zone and Ontario. They are specific to each intertie zone and may be different for import versus export. For example, imports from Michigan could be limited to 1300 MW while exports are limited to 1500 MW.
- The *net interchange schedule limit*, also referred to as the inter-hour ramp limit, restricts the hour-to-hour change in net schedules between Ontario and other jurisdictions. It is a global limit that looks at the net effect of changes in all schedules across all the interties from hour to hour. This limit ensures that the change in flows from one hour to the next respects the physical capabilities of resources within Ontario to respond. See *Quick Take 2: Net Interchange Schedule Limit* for more information.

The dispatch algorithm looks at both limits when it determines the quantity of offers and bids that it can use from each intertie zone. The figure below illustrates this concept (only three intertie zones are shown). For example, offers from the Michigan intertie zone can only be scheduled if the quantity respects both the Michigan intertie limit for imports and the net interchange schedule limit.



Both limits must be respected in determining the allowable quantities scheduled to or from each intertie zone, but prices are only affected if the intertie scheduling limit is binding (limiting). In

other words, the projected price for a given hour is only affected if there is congestion on the intertie, i.e. intertie scheduling limits are causing a restriction. Prices are not affected if schedules are restricted only to respect the net interchange schedule limit.

Impact on Congestion Management Settlement Credits (CMSC)

Both the constrained and unconstrained algorithms are bound by the intertie scheduling limit and the net interchange schedule limit, and these limits are applied in the same way to both algorithms. However, the starting conditions for the constrained and unconstrained algorithms may differ, typically because of transmission congestion within Ontario. And, if the starting conditions differ, the outcomes will differ. In some circumstances, this difference may result in CMSC payments.

(See our *Ontario Energy Trading* course for additional information on the constrained and unconstrained algorithms and CMSC payments.)

Scheduling and Prices

The projected price of energy in an intertie zone is equal to the Ontario price minus the cost of congestion. As the examples will show, the cost of congestion is calculated by relaxing the limit by a nominal amount and determining the economic impact on the market; i.e. the algorithm considers the price of the next MW that would be available if the limit were not restrictive. In cases where only the intertie limit is restrictive, that next MW will come from the Ontario bid/offer stack. When both the intertie limit and the net interchange schedule limit are simultaneously restrictive, the next MW will come from another intertie zone.

Recall that intertie zone settlement prices are based on the Ontario prices calculated in real-time and any Intertie Congestion Price (ICP) calculated during the hour-ahead pre-dispatch run. The following descriptions illustrate the process of determining the pre-dispatch projected prices used to calculate ICPs.

We will look at the impact of the intertie scheduling limit and the net interchange schedule limit using the New York and Michigan intertie zones:

Case 1 - Not restricted by the net interchange schedule change limit, with:

- No congestion - Michigan
- Congestion, i.e. restricted by intertie limit – New York

Case 2 - Restricted by the net interchange schedule change limit, with:

- No congestion - Michigan
- Congestion, i.e. restricted by intertie limit – New York

Figures 1 and 2 show offers available to the algorithm including: Ontario resources (white), offers from the Michigan intertie zone (light grey) and offers from the New York intertie zone (dark grey). In our examples, only offers are used, however the principle holds true for bids or for combinations of bid and offer in the intertie zones.

Case 1 (See Figure 1)

In this example, the Michigan offers total 1250 MW, with an intertie limit of 1300 MW. The net schedule change from the previous hour is 600 MW, which is less than the net interchange schedule limit of 700 MW. Therefore, the algorithm is able to use all the Michigan offers in the Ontario stack. The Michigan intertie zone price is the same as the Ontario price and the Intertie Congestion Price (ICP) is calculated to be zero:

Michigan to Ontario schedule = 1250 MW

Ontario price = \$500

Michigan intertie zone price = \$500

Michigan Intertie Congestion Price (ICP) = 0

For the New York zone, the net schedule change limit is similarly not a problem (600 MW vs. a 700 MW limit). However, offers total 2000 MW, with an intertie limit of 1600 MW. There is congestion; all the offers from the New York zone are economic, but the intertie limit prevents them from being used.

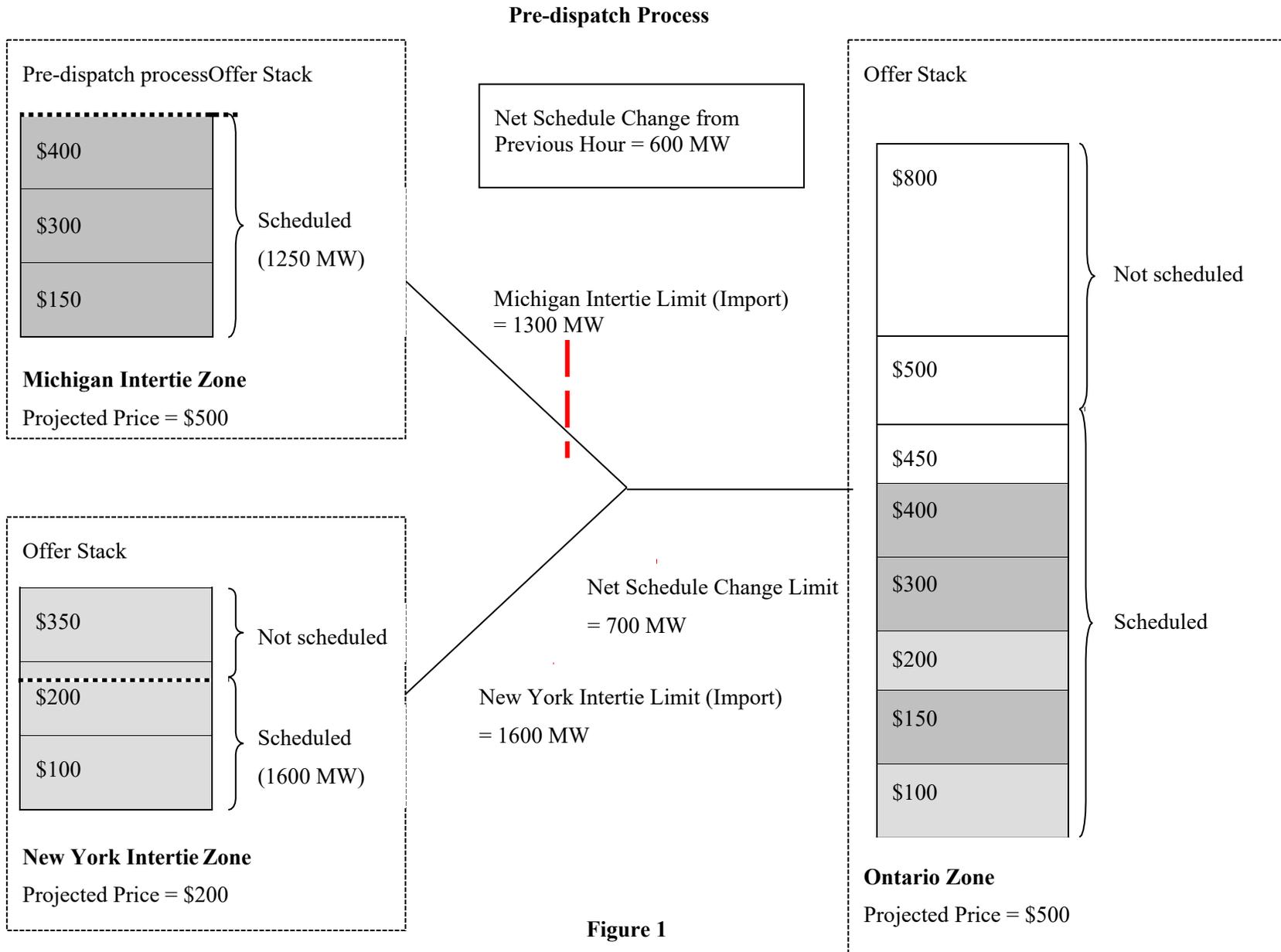
In cases where the intertie is congested, the algorithm determines the price in the intertie zone by relaxing the limit by a nominal amount and determining the economic effect on the solution. The impact of relaxing the New York intertie limit by one MW, i.e., increasing the limit from 1600 to 1601, is to allow 1 MW of \$200 energy to displace an Ontario resource priced at \$500 MW. This results in a New York intertie zone price of \$200. The cost of the congestion is \$300, which is equal to the net savings to the market if the congestion had not been present. The outcome is as follows:

New York to Ontario schedule = 1600 MW

Ontario price = \$500

New York intertie zone price = \$200

New York Intertie Congestion Price (ICP) = -\$300



Case 2 (See Figure 2)

In this example, although all the offers from Michigan and New York are economic, the algorithm cannot utilize them while still respecting the global net interchange schedule limit and the New York intertie limit.

For the New York intertie, both congestion and the net interchange schedule limit are restricting our ability to transfer energy. Once again, we have to look at the effect of relaxing the New York intertie limit by one MW, i.e., increasing the limit from 1600 to 1601. At the same time, we have to consider how relaxing the New York intertie limit will impact the net interchange schedule limit and hence the other intertie zones. In other words, if we want to utilize the 1 MW we get from relaxing the New York intertie limit we have to reduce 1 MW coming from another intertie zone. In order to use one more \$200 MW from the New York intertie zone we would have to reduce one \$300 MW from the Michigan intertie zone. Therefore the cost of the congestion on the New York intertie is \$100, which is equal to the net savings to the market if the congestion had not been present. The New York intertie zone price of \$700 reflects the Ontario price (\$800) modified by the cost of congestion (\$100).

New York to Ontario schedule = 1600 MW

Ontario price = \$800

New York intertie zone price = \$700

New York Intertie Congestion Price (ICP) = -\$100

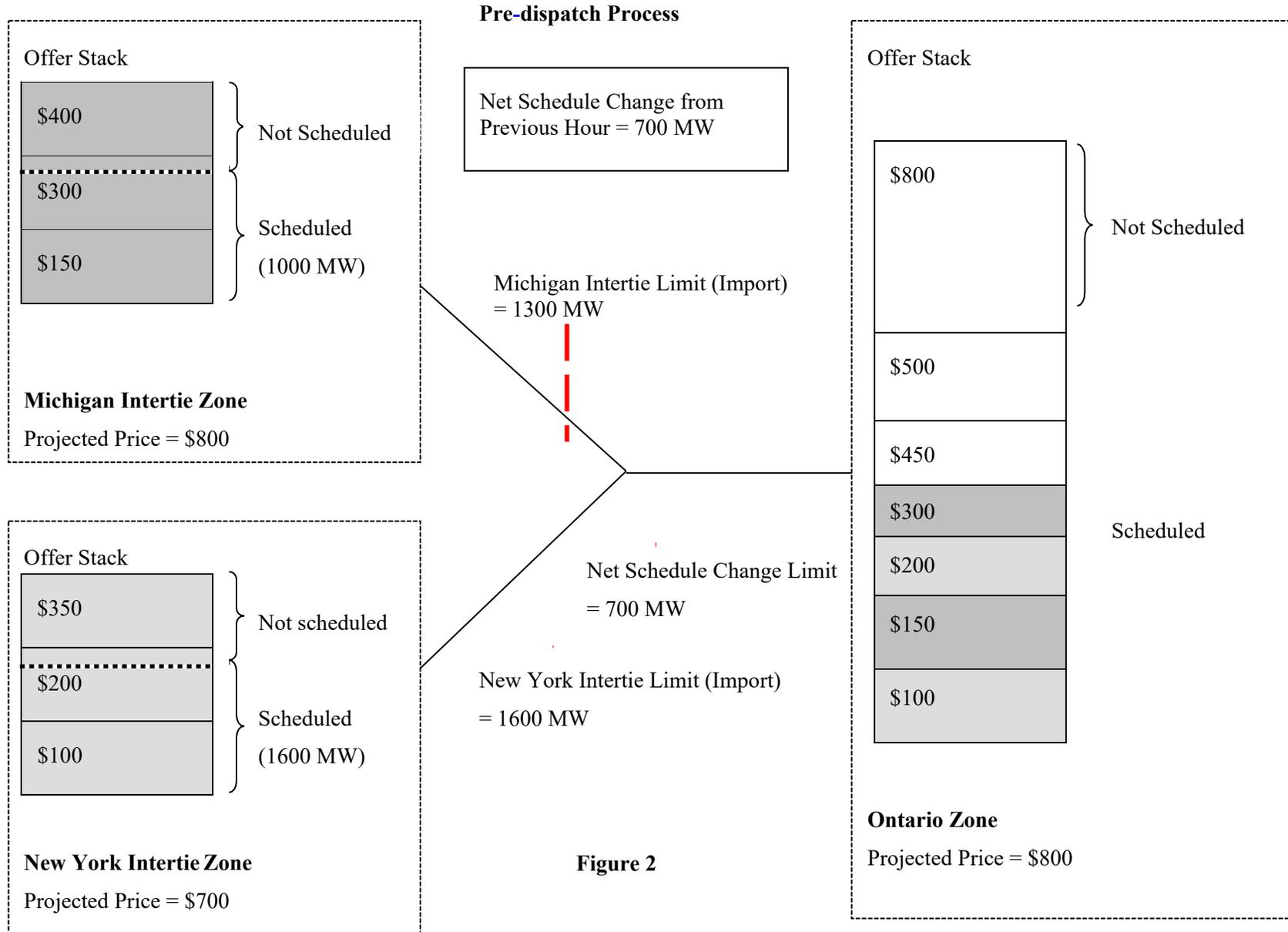
For the Michigan intertie, there is no congestion, only the net interchange schedule limit is restrictive. In the absence of congestion, the intertie zone price equals the Ontario price. The amount scheduled still has to respect the net interchange schedule limit, however this is not reflected in the intertie zone price.

Michigan to Ontario schedule = 1000 MW

Ontario price = \$800

Michigan intertie zone price = \$800

Michigan Intertie Congestion Price (ICP) = 0



Summary

The net interchange schedule limit may cause what appears to be an economic offer or bid not to be scheduled, even though there is no congestion on the intertie and the intertie zone price is above the offer price or below the bid price.

The cost of congestion reflects the savings to the market that would have otherwise been realized if the intertie limit had not been restrictive.

When an intertie is congested, i.e. the intertie scheduling limit is restrictive, but the net interchange schedule limit is not restrictive, the cost of congestion will reflect the price difference between the marginal resource in the intertie zone and the marginal resource available in Ontario.

When an intertie is both congested and restricted by the net interchange schedule limit the cost of congestion will reflect the difference between the marginal resource in the congested zone and the marginal resource in another intertie zone.

Additional Information

For additional information on importing and exporting please refer to our *Interjurisdictional Energy Trading* Capability course. From time to time, we also offer a face-to-face training session on *Interjurisdictional Energy Trading* (See the [Marketplace Training](#) home page for details on course offerings.)

For additional information, please contact the IESO at:

Toll Free: 1-888-448-7777

Tel: (905) 403-6900

Fax: (905) 403-6921

Email: customer.relations@ieso.ca