

ISSUE 22: PRICING PHYSICAL CONSTRAINTS

Date Raised

Initially raised in 1997 by Ontario's Market Design Committee, and later considered in 2003 as part of the Market Evolution Program's analysis of historical nodal prices.

Description

Electricity in Ontario is currently priced on the basis of what is called a "uniform market clearing price", which is determined using a set of unconstrained supply offers and demand bids. The unconstrained algorithm underlying the "uniform market clearing price" ignores the physical capabilities and limitations of the power system and, instead, fictitiously assumes a single-point load and a single-point generator at the exact same location. The price determined in the unconstrained schedule for a given interval is applied to all electricity within the province for that same interval, and is thus termed "uniform".

However, in reality, there are thermal constraints on how much electricity can be moved through a given section of transmission line. Additionally, maintaining power quality and the stability of the transmission grid imposes additional constraints on how much electricity can move through various sections of the grid at various times.

Though prices in Ontario are determined through an unconstrained algorithm, the actual dispatch (set of instructions issued to dispatchable facilities) is based on a security constrained algorithm which fully respects the physical characteristics of Ontario's power system. Stated differently, prices in Ontario are currently computed in an unconstrained market algorithm, whereas dispatch instructions are issued according to a security constrained algorithm. Consequently, additional costs are incurred in Ontario's "uniform pricing" system when the actual security constrained dispatch of resources required to satisfy load at a given interval differs from the purely economic solution produced by the unconstrained algorithm.

Transmission congestion refers to the situation where flows on some part of the transmission system have reached an allowable limit. As a result, additional flow that would otherwise be economically efficient is restricted. Because of congestion, generation within Ontario may from time to time require 're-balancing' in order to ensure that electricity can get to where it is needed. This would be done by constraining off the grid some generators who have indicated that they are willing to produce, when their output cannot flow to where it is

needed, and constraining other generators on to the grid even though their offers indicated that they were not willing to produce at the market price¹.

In other words, as a result of transmission and other reliability constraints, facilities may not be dispatched in strict economic order. In Ontario's "uniform pricing" system, any facility experiencing a deviation from the unconstrained schedule in its actual production or consumption receives a congestion management settlement credit, also known as a CMSC payment. For example, generators may have offered output and have been accepted in the unconstrained schedule but may be "bottled" because of transmission constraints that prevent them from getting the output they have offered to where the demand is. In such circumstances they will be directed not to produce and will receive constrained off payments equivalent to the difference between the "uniform market clearing price" and their accepted offer. Conversely, other generators or importers that were not selected because their bids were too high may find themselves dispatched (i.e. constrained on) in the constrained schedule in order to compensate for the energy that has been constrained off because it could not flow to the appropriate geographic market. In this case, such generators will also be compensated through a constrained on payment equivalent to the difference between their offer and the "uniform market clearing price"².

The uniform hourly Ontario price does not accurately reflect the demand-supply balance. Namely, the unconstrained calculation has access to a larger resource stack than the constrained calculation (for instance, operating reserve in North West Ontario that is available but cannot be delivered, full capability of quick-start units and partially dispatched units that can't be delivered due to transmission constraints). In contrast, the constrained calculation determines the schedule of resources that can be delivered while considering constraints of the transmission system. As such, prices based on the constrained calculation would more properly reflect demand-supply balances.

Background

This (uniform) pricing approach was adopted by Ontario's Market Design Committee and subsequently implemented at a time when alternative approaches were not sufficiently widespread or mature enough to represent suitable examples or case studies.

¹ MSP Report May- August 2002.

² MSP CMSC in the IMO-administered market, February 2003

Why a Pricing Issue

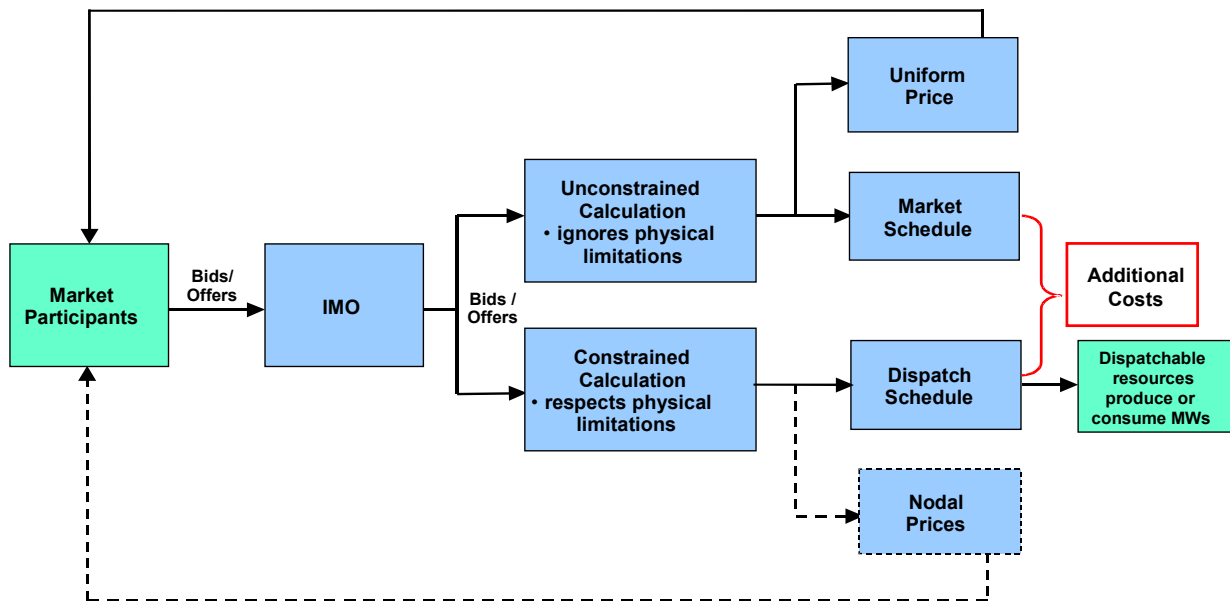
Ontario’s current pricing method is based on a set of computations that:

- (a) Do not reflect geographically varied physical characteristics of the transmission system; and
- (b) generate prices that do not reflect the actual costs of delivering energy to different locations on the transmission system.

This pricing method unrealistically treats the transmission system as if it were a copper plate. In reality, under any given set of circumstances, different locations on the power grid face different capabilities, requirements, and constraints. In the absence of transmission constraints and losses, the cost of delivering energy to each location on the grid would be the same. However, because of transmission constraints and losses, the cost of delivering energy to different locations on the grid varies. This salient fact is ignored in Ontario’s current pricing method, and is merely accounted for “after the fact” through a set side-payments such as constrained-on and constrained-off Congestion Management Settlement Credits.

The relationship between the unconstrained market schedule, constrained dispatch, and additional costs resulting from differences between the two is schematized in figure 1.

Figure 1. Determining Ontario’s “Uniform” Price



Impacts of Issue

Market Impact

As observed in the IMO's analysis of historic nodal prices, this issue contributes to the differences between shadow nodal prices and energy prices as determined under the current uniform pricing system. In that analysis, an upward bias was observed with respect to average congestion (nodal) prices relative to average Hourly Ontario Energy Prices.

Second, current spot prices in Ontario do not fully reflect the costs of delivering energy to specific locations on the transmission system to meet geographically varied supply and demand conditions while respecting physical constraints. Uplift charges are introduced to reflect the costs of redispatching the system in order to respect such balances and constraints. This process reduces overall price transparency and blunts efficient market signaling.

Participant Impact

[To be developed]

IMO Processes and Procedures Impact

Related Issues

- 002: Publishing Nodal Price Data
- 004: Use of 12-times Ramp Rate in the Dispatch Unconstrained Algorithm
- 016: Historical Analysis of Nodal Prices
- 018: Pricing and Allocation of Line Losses
- 023: Elimination of Constrained-off Payments
- 027: Timing Differences between Unconstrained and Constrained Real-Time Sequences

Options Considered

[To be developed]

Selected References

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