

ISSUE #027: DIFFERENCES IN INPUTS USED IN THE UNCONSTRAINED AND CONSTRAINED REAL-TIME SEQUENCES

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Description

There are several differences between the inputs used to solve the constrained sequence and the unconstrained sequence. These differences contribute to differences in the prices determined in the two sequences; the nodal prices in the constrained sequence and the uniform Ontario price in the unconstrained sequence. Some of the differences are associated with timing differences between the start of the constrained sequence and of the unconstrained sequence. At times the difference in the magnitude of these inputs can be large and these differences cause a divergence between nodal prices and the uniform Ontario prices.

This issue impacts the principle of market transparency; dispatch (along with the corresponding nodal prices) and settlement pricing are determined on separate bases from the uniform Ontario prices that are not easily understood or discerned by market participants.

Background

The Real-time dispatch algorithm consists of an unconstrained sequence and a constrained sequence as described in Chapter 7 of the IMO Market Rules. The unconstrained sequence is used to determine market schedules and the uniform prices (i.e., energy and operating reserve prices), whereas the constrained sequence is used to determine physical schedules by which facilities are actually dispatched. The constrained sequence also determines nodal prices.

In addition to the formulation differences between the constrained and the unconstrained sequences, there are also differences in inputs that relate to differences in the timing of the two sequences. There is roughly a ten-minute time difference between the start of the unconstrained sequence and the constrained sequence with the constrained sequence starting first. This timing difference is illustrated in figure 1. Figure 1 presents the timing of the start of the constrained sequence and unconstrained sequence for interval 3 of delivery hour X. The constrained sequence for interval 3 starts about 5 minutes before the start of interval 3 (at X:05). This is to ensure that there is sufficient time to compute the schedules/prices, check the results and send them to the unit operators before the start of the interval (at X:10). As a result, forecast values for some

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inputs (demand, reserve requirements and unit availability) need to be used. In contrast, the unconstrained sequence is started after the end of interval 3. At this time, inputs such as those for demand, reserve requirements or unit availability are based on actual market conditions realized in the interval; these inputs can differ from the forecasted values used in the constrained sequence.

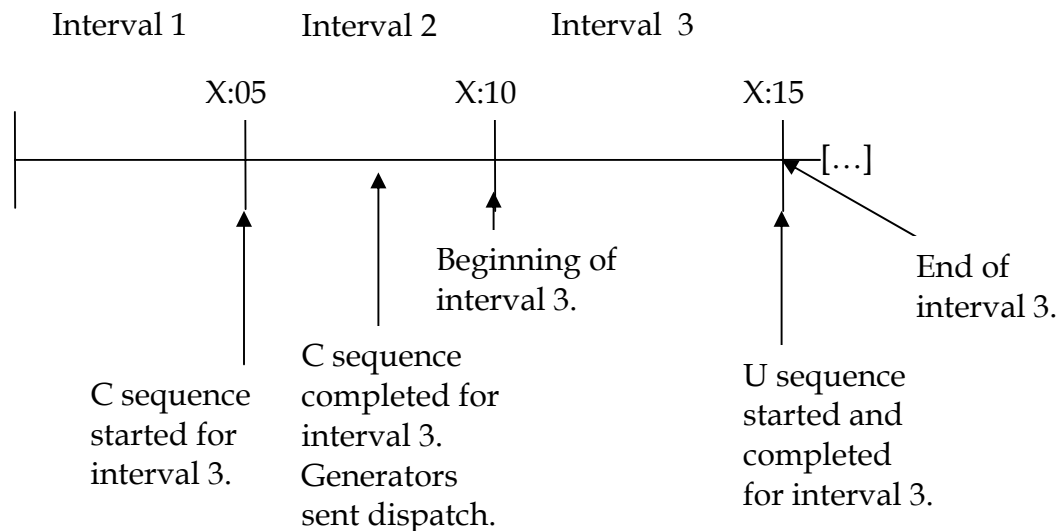
Under the initial market design as proposed by the Market Design Committee (MDC), the MDC anticipated that the real-time nodal and uniform prices could be affected by a variety of potential input issues; these prices are determined based on estimations of real-time events rather than the actual events. To address this, the MDC recommended three price determinations: provisional prices, preliminary prices and final prices. The current nodal and uniform prices corresponded to the provisional prices. These prices provided participants with a signal of the real-time market conditions. The intent of the preliminary and final prices was to correct the prices for differences between estimated and actual input values to ensure a high level of settlement accuracy. The preliminary prices would be published 2 business days after the dispatch day while the final prices would be published 6 days after.

Prior to market opening, the IMO and the IMO Board amended the market rules to remove the provisions requiring the IMO to calculate preliminary and final market price to amend the Market Rules accordingly (reference MR-00208). The rationale for this amendment(s) were:

- Replacing provisional prices with preliminary and final prices would not necessarily assure more accurate prices given the timelines and processes associated with revenue metering;
- It would almost certainly result in all prices changing two days and six days after the fact, leading to confusion among market participants and the broader public;
- It would delay the benefit of price certainty, which would likely complicate the activities of market participants (e.g. hedging arrangements); and
- It would be complex and expensive to implement.

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Figure 1. Time discrepancy between the start of the constrained and unconstrained sequences.



Why a Pricing issue?

Differences in inputs in the two sequences can cause differences in the nodal prices and uniform Ontario prices. These differences are not easily understood or discerned by market participants.

More specifically, input differences that are associated with the sequence timing differences includes the following. First, since the constrained sequence is started 5 minutes prior to the start of the interval it is based on a forecast of demand (a forecast for what demand will be at X:15) whereas the unconstrained sequence is completed using the actual demand that occurred in the interval. Higher demand forecasts in the constrained sequence relative to the actual demand used in the unconstrained sequence may cause higher nodal prices relative to the Ontario uniform price. The degree to which such prices are higher (or lower in the event of an under-forecast) depends in part on where the market is situated on the supply curve at a given interval. The divergence between prices caused by demand difference will exist in essentially every interval.

Second, changes in the operating reserve requirements that occur after the completion of the constrained sequence but before the completion of the unconstrained sequence will not be reflected in the constrained sequence but will be reflected in the unconstrained sequence. These changes may occur due to a need to activate reserve in response to a contingency. They may also occur as a manual control action, where the IMO identifies a potential shortage of reserve in the constrained sequence and lowers the reserve requirement to reflect its use of

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'out-of-market' sources of reserve. Given the joint optimization of energy and reserve, differences in the requirement can cause a divergence between the nodal prices relative to the Ontario zonal prices with the Ontario zonal price falling relative to nodal prices. The relative divergence in prices will persist for at most two intervals before the reserve requirement will be similarly reflected in the two sequences.

Third, outages or derates to units that occur between the completion time of the constrained and unconstrained sequences will not be captured in the constrained sequence but will be reflected in the unconstrained sequences. These differences cause the Ontario price to increase relative to nodal prices although the price increase may be dampened if reserve is activated (discussed above). The relative divergence in prices will persist for at most two intervals before the reserve requirement will be similarly reflected in the two sequences.

Impacts of Issue

The input differences between the two sequences has contributed to the divergence between congestion (i.e. nodal) prices determined by the constrained sequence and uniform prices determined by the unconstrained sequence. Market participants have raised a concern regarding the lack of transparency regarding the reason or causes for the differences in these prices; dispatch (along with the corresponding nodal prices) and settlement pricing are determined on separate bases from the uniform Ontario prices that are not easily understood or discerned by market participants.

Related Issues

- 002: Publishing Nodal Price Data
- 004: Use of 12-times Ramp Rate in the Dispatch Unconstrained Algorithm
- 013: Impact of Out of Market Resources on the Market
- 016: Historical Analysis of Nodal Prices
- 018: Pricing Line Losses
- 022: Pricing Physical Constraints
- 023: Elimination of Constrained-off Payments

Selected References

IMO Market Rules. Chapter 7: System Operations and Physical Markets
<http://www.theimo.com/imoweb/manuals/marketdocs.asp>