

## **ISSUE 10: SYSTEMIC OVER-FORECASTING OF PRE-DISPATCH DEMAND**

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### **Date Raised**

First raised by the Market Surveillance Panel (MSP) in its October 7, 2002 report and noted in each subsequent MSP report.

### **Description**

The Market Surveillance Panel (MSP), in all of its periodic reports, noted that the one-hour ahead pre-dispatch demand is persistently higher than the real-time peak demand. In its latest report, the MSP has further noted that this upward bias in demand forecasting is most prevalent in certain key hours, namely hours 23 and 24. The MSP has identified this persistent over-forecast of demand as a problem for the following reasons. First, the persistent over-forecast of the real-time peak-demand in pre-dispatch results in a persistent positive difference between the pre-dispatch price and the real-time prices (HOEP or even peak MCP). This provides market participants with an inaccurate market signal from which to plan their operations. Second, the persistent over-forecast of demand means that too many imports (too few exports) may be scheduled in pre-dispatch than what are required (efficient) in real-time. Similarly, the over-forecast of demand may affect the start (shut-down) decision of fossil units with the units either starting sooner or shutting down later than is efficient given their start-up costs and speed-no load costs. Finally, persistent and predictable differences in the pre-dispatch demand may induce off-setting flows of imports and exports that do not contribute towards the efficient operation of the market and result in unnecessary Intertie Offer Guarantee payments.<sup>1</sup>

In its last report, the MSP noted that a factor contributing to the over-forecast of the real-time peak demand is the algorithm used by the IMO to select the peak demand in pre-dispatch. In particular, the algorithm biases the forecast of the peak demand in the hours 23 and 24, with the bias being an over-forecast of demand.

### **Background**

The Market Rules (Chapter 7, Section 5) mandates the IMO to “determine pre-dispatch schedules in order to provide itself and market participants with advance information and projections necessary to plan the physical operation of the electricity system.” The rule describes the information that the IMO needs and the algorithm that the IMO should use in the pre-dispatch sequence. However, it does not explicitly require the IMO to use the forecast peak demand. In consideration of system reliability, the IMO uses its forecast peak demand for

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<sup>1</sup> The MSP Report on June 14, 2004, pp71.

## **ISSUE 10: SYSTEMIC OVER-FORECASTING OF PRE-DISPATCH DEMAND**

each delivery hour to ensure that sufficient resources are available (i.e. “pre-scheduled”) to meet the demand in the real time dispatch sequence.

The pre-dispatch sequence for a given dispatch day is initially determined before noon on the day before the dispatch day. Every hour thereafter, the IMO updates the pre-dispatch schedule for each remaining hour in the current day, and each hour in the pre-dispatch day.

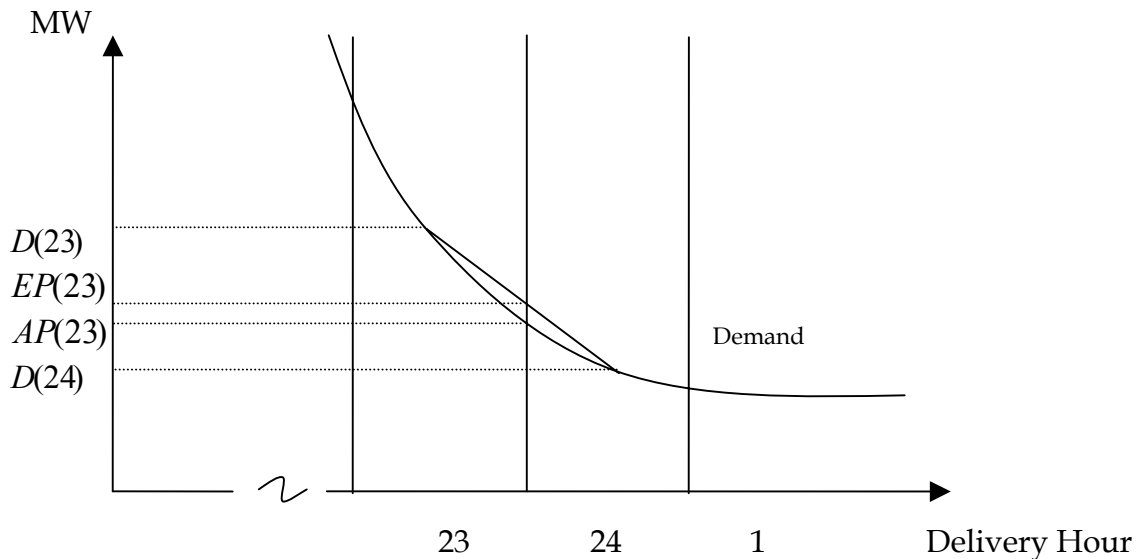
Prior to running the pre-dispatch sequences, the IMO forecasts average Ontario primary demand for a given hour. The IMO then adjusts this hourly average demand to approximate what the peak demand will be within the delivery hour. The IMO uses this peak demand value in the Dispatch Scheduling Optimizer (DSO) to determine the pre-dispatch schedules and price.

The approach to approximating the peak demand within an hour is relatively simple: in general, the estimated peak demand is the average of forecast demands in two adjacent delivery hours. In particular, during periods of increasing demand (e.g. morning pickup), the estimated peak demand for a given delivery hour would be the average of the demand in that hour and that in the next hour. In contrast, during the periods of load drop-off (such as in evening), the estimated peak demand for a given delivery hour is the average of the demand in that hour and the demand in the previous hour.

The assumption behind this approach is that the change in demand between two consecutive hours is approximately linear i.e. demand decreases in these hours at the same rate. If the demand changes at different rates, however, this approach will lead to over or under-estimation of the true peak demand. Thus even if the IMO’s forecasts of average demand for each delivery hour are accurate, the peak demand within the hour estimated by this approach would be inaccurate.

In particular, the peak demand decreases at a decreasing rate, i.e. when the demand movement path is convex. Figure 1 demonstrates the potential of over-forecasting when the demand path is convex. Assume the (actual) average demand for delivery hours 23 and 24 are respectively  $D(23)$  and  $D(24)$ , and the actual peak demand for hour 24 is  $AP(24)$ . Given the IMO’s approach, the estimated peak demand for hour 24 would be  $EP(24)$ , which is greater than the actual peak demand  $AP(24)$ . Therefore, in this case, the IMO’s approach will over-forecast the peak demand for delivery hour 24 even when the forecast of the average demands for hours 23 and 24 are correct.

Figure 1 Over-forecasting When Demand Path is Convex



The MSP report provides some results indicating that this over-forecasting is often the case for hours 23 and 24. They show that over the time frame of May 2002 through May 2004 “in over 97% of the hours, the pre-dispatch demand value exceeds the real-time average demand in hours 23 and 24. The frequency for the pre-dispatch to ‘over-forecast’ real-time peak demand is also considerably high in these hours—79 % and 87% of the hours for delivery hour 23 and 24 respectively.”(The MSP Report on June 14, 2004, pp 76)

### **Why a Pricing Issue**

The above approximating approach for selecting the hourly peak demand in hours 23 and 24 impacts the guiding principles of efficiency, transparency and possibly fairness.

First the approach impacts market efficiency as it results in an inefficient scheduling of resources in pre-dispatch (too many imports, too few exports or possibly the advance start or delayed shut-down of fossil units causing unnecessary fuel costs (speed-no load costs).

Second, the approach impacts market transparency as it leads to an incorrect market price signal in pre-dispatch. Because the pre-dispatch demand and price are the only signals that the market participants have received for their decision for the coming hours, it is important for the IMO to provide signals free of unnecessary or inappropriate biases or distortions.

Finally, the approach may impact the guiding principle of fairness. As the MSP Report of June 2004 states, the inaccurate estimation of demand also impacts the

## **ISSUE 10: SYSTEMIC OVER-FORECASTING OF PRE-DISPATCH DEMAND**

inter-tie transitions and the Inter-tie Offer Guarantee (IOG) payments. In the interest of system reliability, the IMO established the IOG mechanism to guarantee importer be paid at least the pre-dispatch price for their scheduled import. Thus the higher that the pre-dispatch price is as compared to the real-time price, the larger the IOG payment will be and the more imports will be chosen. The MSP observes that the IOG payment is persistently too high in hours 23 and 24, and questions whether those payments are worthwhile as there is less likely to be a reliability issue during those hours. The MSP also observed a persistently large amount of counter-flow of imports and exports during these two hours. Although whether or not there is a causality relationship between the persistent over-forecasting of demand and the persistently large amount of counter-flow is a subject for further investigation, the MSP argues that “improvements in the IMO’s approach to adjusting the pre-dispatch demand to project the hourly peak demand should reduce the potential for these types of offsetting transactions.” (the MSP Report of June 14, 2004, pp 82)

### **Impacts of Issue**

#### *Market Impact*

The systemic bias of forecast demand used to determine market pre-dispatch price and schedules results in two adverse impacts on the market. First, the bias in forecast demand can result in bias in forecast (pre-dispatch) price and send the market inaccurate demand signals. This violates the guiding principle of efficiency. Second, it leads to wealth transfer from load customers to importers through IOG payments, which are greater than necessary to ensure system reliability as intended. This impacts the guiding principle of fairness.

#### *Participant Impact*

TBD

#### *IMO Processes and Procedures Impact*

No significant impact is identified. The Market Rules do not prescribe how the peak demand should be chosen. The current approach to computing the peak demand for each pre-dispatch sequence is done through a spreadsheet; the formulas can be modified to allow for a non-linear adjustment in demand rather than the current linear approximation.

### **Related Issues**

- 001: Pre-Dispatch Price Bandwidths
- 009: Use of Peak demand Load Forecast in Pre-dispatch
- 013: Impact of Out of Market Resources on the Market
- 014: Hour(s)-Ahead Price Signal Uncertainty
- 015: Restriction on Changes to Dispatch Data between 4 and 2 hours ahead of Dispatch Hour

**Selected References**

1. Market Rules, Chapter 7.
2. The Market Surveillance Panel Report of Oct 2002,  
[http://www.theimo.com/imoweb//pubs/marketSurv/ms\\_mspReport\\_2002oct07.pdf](http://www.theimo.com/imoweb//pubs/marketSurv/ms_mspReport_2002oct07.pdf)
3. The Market Surveillance Panel Report of June 2004,  
[http://www.theimo.com/imoweb/pubs/marketSurv/ms\\_mspReport-20040614.pdf](http://www.theimo.com/imoweb/pubs/marketSurv/ms_mspReport-20040614.pdf)