Analysis of Ramp Rate Impacts

October 2008

The purpose of this report is to update two aspects of the study of ramp rates and associated issues. In particular, it will report the results of simulations conducted using a full year of actual data collected after the ramp rate parameter was changed from 12 to 3. Also reported is an updated analysis of exports from Ontario to New York. This is an update of work originally undertaken by the Market Surveillance Panel.

I. Simulations of Ramp Rate Impact

A. Review

Before the ramp rate policy change was implemented, simulations were conducted in order to estimate the impact of changing the ramp rate parameter from 12 to 3. Those simulations found that the average price would have been approximately $1.50 higher had the ramp rate multiplier been 3 instead of 12.[1, 2] This value does not account for the effect that a response in export demand would have had on the market. Export demand response would affect the market in that at higher levels of HOEP there would be a lower quantity of exports demanded.[3] Accounting for this effect, it was simulated that the increase of HOEP would have been about $0.75 due to the policy change.

An analysis conducted in May and June 2008 and reported to the Market Price Working Group at the June 5, 2008 meeting used actual market data collected after the policy change – over the period September 12, 2007 to May 31, 2008 to simulate the impact on HOEP and the quantity of exports. That analysis found that the policy change led to $0.68 increase of HOEP with no export response. Accounting for export response it was simulated that the price increase was $0.38.[4]

The analysis to follow replicates the one reported in June, except that the data used covers the period October 1, 2007 to September 30, 2008.

[1] For clarity, the simulations work by using an algorithm that approximates the Dynamic Scheduling and Optimization (DSO) process using actual data on bids, offers and market conditions to determine what the market equilibrium would have been had the ramp rate parameter (or any other) been different.

[2] The $1.50 figure was derived from simulations conducted over the period Nov. 1, 2005 to April 30, 2006.

[3] Exporters pay the HOEP. Thus, a higher HOEP raises the cost to the trader of exporting. We assume that demand for exports is decreasing in its price.

[4] This was associated with a 28 MW decrease of exports. Also reported was that the policy change has a positive impact of the level of HOEP in all hours and that the largest effects were in interval 1, with the 3x MCP lower than the 12x MCP in hours with up-ramping demand and higher in hours with down-ramping demand.

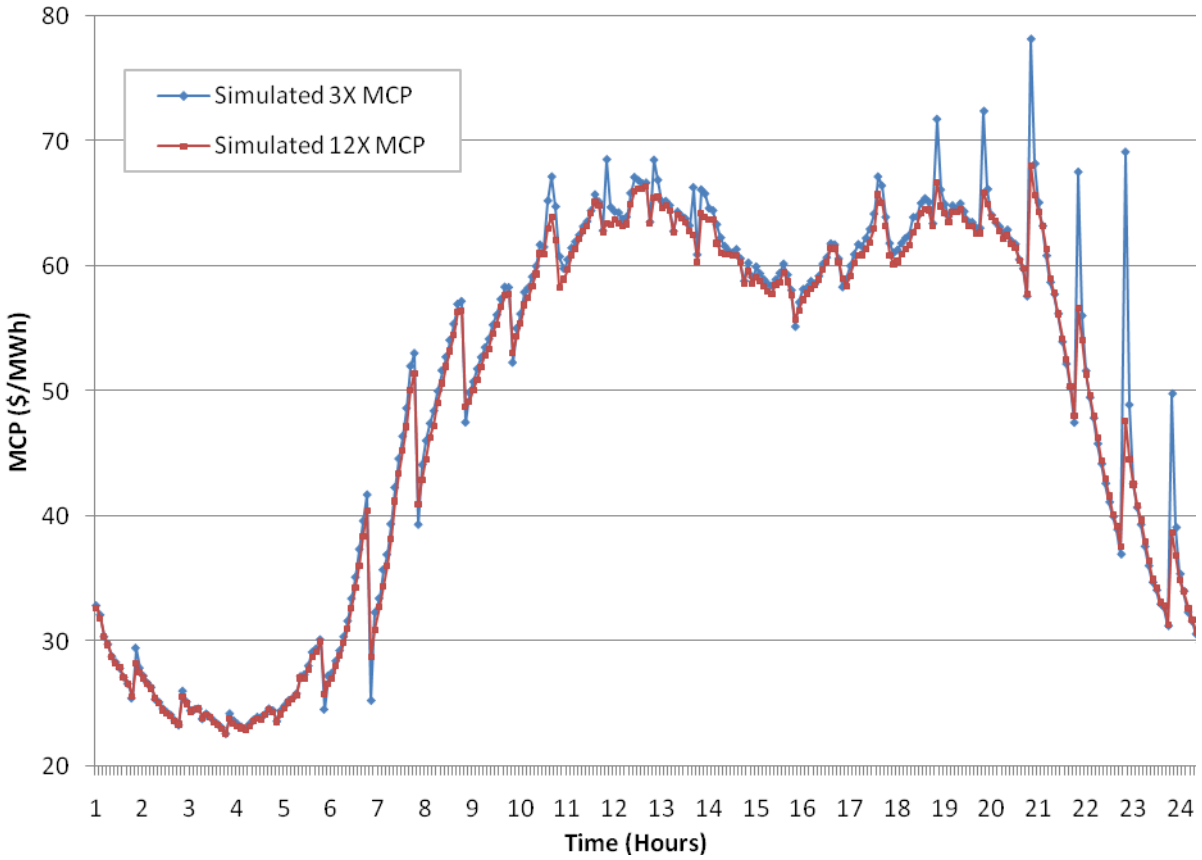
B. Simulation Results

Over the whole study period the average simulated increase in the HOEP – with no export demand response – was $0.74. Chart 1 displays the simulated effects on HOEP (hourly) with no export response. Figure 1 illustrates the simulated data at the interval-level.

Chart 1: Simulated Impacts on HOEP with No Export Response

Hour	Impact on HOEP	Hour	Impact on HOEP	Hour	Impact on HOEP
1	$0.26	**9**	$0.55	**17**	$0.80
2	$0.15	**10**	$1.12	**18**	$0.81
3	$0.05	**11**	$0.60	**19**	$0.90
4	$0.13	**12**	$1.05	**20**	$0.78
5	$0.18	**13**	$0.92	**21**	$0.94
6	$0.60	**14**	$0.85	**22**	$0.85
7	$0.85	**15**	$0.58	**23**	$1.98
8	$0.77	**16**	$0.34	**24**	$1.03

Figure 1: Simulated Market Clearing Prices with No Export Response

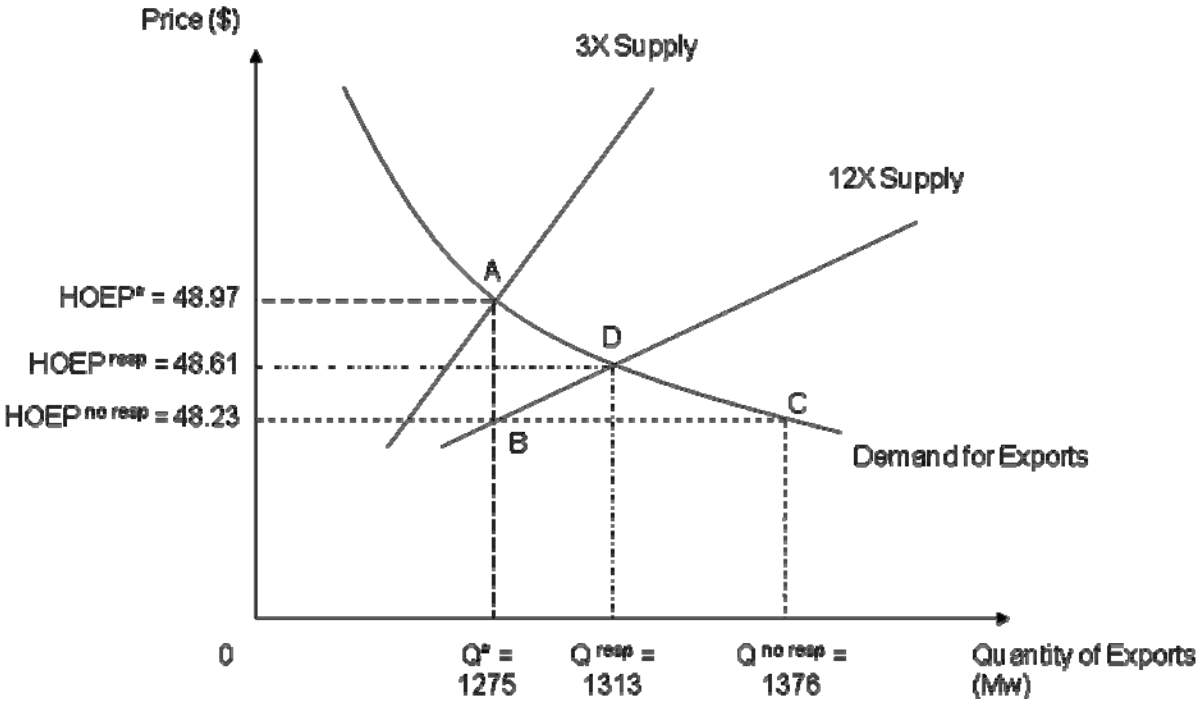


It can be seen from Chart 1 that the simulated effect of the policy change was to increase HOEP in each hour of the day. From Figure 1 it can be seen that the largest effect of the policy change manifests itself in the first (and second) interval(s) of the hour, and that this effect is larger in the major up-ramping and down-ramping hours. Qualitatively, these results are similar to the previous analysis.

C. Role of Export Demand Response

As stated, price responsiveness of exports will act to mitigate the effect of the policy change by causing the volume of exports to change. Figure 2 illustrates this process.

Figure 2: Illustration of the Role of Export Demand Response



Point A represents the actual average HOEP and quantity of exports (to New York) over the study period: average HOEP was $48.97 and average exports to New York were 1275 MW. Point B represents the no-export-demand-response simulated results presented above. Point D represents the simulated equilibrium that would have obtained had the policy change not been implemented.[5] The HOEP and quantity of exports at this point are illustrated in Figure 2. It can be seen that, accounting for export

[5] There are a number of assumptions that are critical to finding point D. In particular, and given that point B had been found from the simulation software::

1. The elasticity of demand for exports was estimated to be equal to 4. This estimate was derived from recent econometric analyses.
2. The slope of the 12X supply schedule was 0.02. This estimate was derived from data collected before the policy change was implemented. Had a larger estimate been used, which would be supportable given the data set, the 12X supply schedule would be steeper and the average effect (accounting for export demand response) of the policy change on HOEP would be smaller.

demand response, the effect of the policy change was to raise HOEP by (an average of) $0.36 and decrease exports to New York by (an average of) 38 MW. These results are roughly equivalent to those presented in June 2008.

II. Analysis of Inefficient Exports over the New York Interface

A. Introduction

Previous analyses by the MSP have noted the existence of socially and privately inefficient exports on the New York interface.[6] Export inefficiency is one manifestation of the inefficiencies that may occur when the uniform price differs from the nodal shadow prices that represent the incremental costs of energy at given locations throughout the province.

This study updates the work done before, and is conducted over the time period January 2006 to September 2008. Thus, there are 33 months in the study sample.

B. Theory

An energy export is deemed inefficient whenever the incremental cost of producing the energy in Ontario is greater than the delivered price of the jurisdiction to which the energy is transmitted. We assume that the delivered price of the external jurisdiction is equal to the incremental cost of producing additional energy in that market less an adjustment for transactions costs. Thus, a net trade flow out of Ontario when prices in Ontario are higher than delivered external prices is inefficient.

Previous analyses have pointed to Ontario's uniform pricing regime as a cause of inefficient exports. The issue is that exporters pay the HOEP for the energy they export, while the shadow price that prevails near the interties may deviate significantly from this. However, it is the shadow price – and not the HOEP – that provides the most accurate signal of the cost of supplying an additional unit of energy in a particular area. Since exporters do not pay the price that best represents relevant costs, there is a misalignment among the signals that market participants receive, and a potential for inefficient export transactions to occur.

There is a distinction between the private efficiency and the social efficiency of particular export. An export is deemed to be privately efficient if it was scheduled in an hour where the HOEP (the price exporters pay) plus transmission charges was less than the New York price.[7] Thus, an export is said to be privately efficient if it was privately profitable. An export is deemed to be socially efficient if it was

[6] See analyses conducted by, and published in the reports of, the Market Surveillance Panel. In particular, see the reports published June 2006 (for the period November 2005 to April 2006), December 2006 (for the period May 2006 to October 2006), and August 2007 (for the period November 2006 to April 2007).

[7] We define the New York price to be received by the exporter to be the greater of the New York West real-time and hour-ahead prices. This is due to the New York price mechanism containing an IOG-like payment.

scheduled in an hour where the Beck Ebus shadow price was less than the real-time New York price.[8, 9] Thus, an export is said to be socially efficient if it displaces more expensive New York generation. All trades are assumed to be *ex ante* privately efficient, otherwise the trader would not have scheduled them. The reason a transaction may be *ex post* privately inefficient is that the trader's expectations turned out to be incorrect, *e.g.*, due to inaccuracy of price signals.

There are two leading sources of socially inefficient exports: private inefficiency and market structure. Exports that are privately inefficient may also be socially inefficient, while market structure can distort the incentives traders face, resulting in behaviour that is privately but not socially efficient. Ontario's uniform pricing regime is an example of how market structure can result in a misalignment of the HOEP and the relevant shadow prices.

The connection between this issue and ramp rates is as follows. As stated in section I, the ramp rate policy change was anticipated to result in higher HOEPs, which would be partially offset by a decline in exports (as they would be more expensive to purchase for export). The connection to the current study of export efficiency is that the ramp rate policy change may result in a greater proportion of exports being efficient. Therefore, it is of interest to determine how the efficiency, social and private, has continued to evolve in the months after the policy change.[10]

C. Data and Results

This study uses data over the time period January 2006 to September 2008, inclusive. Figure 3 presents data on the percentage of hours that Ontario was a net exporter of electricity to New York of which exports were privately and socially efficient, respectively.

In Figure 3, statistics regarding the efficiency of export transactions are presented. The data points describe the proportion of hours during which Ontario was a net exporter to New York that also satisfied the above definitions of efficiency. The straight lines represent linear trends formed from the data points.

As can be seen from Figure 3, the proportion of net exporting hours in which exports were either privately or socially efficient has trended upward throughout the 33 months of the study period. However, only the increase of social efficiency was statistically significant.[11]

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[8] The Beck Ebus node is the Ontario node closest to New York. The Beck Ebus shadow price represents the incremental cost of generation at this point.

[9] We assume the New York West real-time price represents the incremental cost of generation in NY.

[10] It is important to note that the change of ramp rate multipliers had no effect on shadow prices as they have always been calculated from the constrained dispatch schedule (which has always used actual ramp rates).

[11] The relevant trend lines are displayed in Figure 1 (where the trend of privately efficient exports is above the trend of socially efficient exports). While both trends have moved in an upward trajectory, the increase of socially efficient exports is statistically significant (p-value of trend coefficient was 0.0224) but the increase of privately efficient exports is not (p-value of trend coefficient was 0.1886).

Figure 3: Privately and Socially Efficient Exports to New York[12]

While we are unable to conclude that the continued upward trend is the result of the ramp rate policy change, there is no evidence that the policy did not have a deleterious effect on export efficiency.

[12] To be clear, the diagram reports the percentage of hours of which Ontario was a net exporter to New York where exports meet the relevant definitions of efficiency (given in part B above).