

Manitoba Hydro

Book of Documents

POTOMAC – MISO Export Market

TAB 1

retained by Manitoba Hydro. Our report assesses the price forecasts and other associated issues that form the basis for Manitoba Hydro's projected MISO export revenues.

In order to assess Manitoba Hydro's price forecasts, we developed our own price forecast based on a method and approach that we find to be a reasonable and transparent. Our method is based on forecasts of key drivers of MISO market prices. These key drivers are fuel prices, load growth, generation retirement and additions, new-build generation capital and operating costs, environmental regulations, and congestion.

Manitoba Hydro's six consultants based their forecasts on essentially the same key drivers. However, we believe certain assumptions made by the consultants tended to overstate the level of future prices. Due to limits on the availability of the underlying data from the consultants' models, we were not able to perform a detailed review of the consultants' models nor could we adjust the specific assumptions in the consultants' forecasts to address differences. As result, we provide an alternative forecast and recommend that these forecasts be used to assess revenues projected under the development plans.

B. Summary of Results

Our forecast is based on MISO supply and demand characteristics and recent market outcomes. Changes in these characteristics and outcomes are forecasted for future years based on assumptions regarding the evolution of key drivers noted above.

Our results generally forecast lower prices than Manitoba Hydro's consultants due to assumptions on key inputs. In particular, our models generally rely on lower natural gas price forecasts, lower growth rates of demand, and lower quantities of coal plant retirements. As explained herein, our point-of-view on these key assumptions is based on the reference case used by the US Energy Information Agency (EIA) in its 2013 Annual Energy Outlook.

Figure 1 shows our two reference case forecasts for on-peak energy and off-peak energy prices compared to the Manitoba Hydro reference price forecasts. Manitoba Hydro's reference price forecast is the composite of its six consultants' forecasts. We produce two reference case forecast in order to reflect two CO2 price scenarios – one scenario is based on the reference

TAB 2

III. POTOMAC ECONOMICS CAPACITY PRICE FORECAST

Capacity prices in MISO's planning reserve auction have been close to zero since its introduction. This has been partly due to the prevailing capacity surplus in MISO and partly due to market design flaws that lead prices to be understated.⁶ While these flaws tend to reduce the value of capacity in MISO, load serving entities will still procure capacity through bilateral contracts or build capacity when needed to meet their planning reserve requirements.

Therefore, we assume that when surplus capacity dissipates, the capacity price will rise to the level necessary to incent the construction of new resources. As a result, our capacity price forecast is based on our estimate of the net cost of new entry ("net CONE"). The net CONE of a resource is equal to the resource's annual fixed cost of new entry less the variable profit it would earn in the MISO's energy and ancillary services markets. Therefore, the estimation of the capacity price requires calculation of (1) the variable profit a new resource can earn in the MISO markets (which requires forecast of the energy and ancillary services prices); and (2) the annual fixed cost of entry for the resource.

We estimate the net CONE of an "advanced" CT, given the parameters published by EIA⁷. Given the typical price duration curve in the MISO market, a CT is generally the most economical way to meet capacity needs. While it is conceivable that a CCGT, because it runs longer at lower costs, could overcome its higher capital cost relative to a CT, our analysis indicates that the forecasted energy prices always results in a CT being the most economical addition for capacity (i.e., having the lower net CONE).

A. Cost of New Entry

The cost of new entry is an annual number that reflects carrying cost of the fixed investment plus fixed operating costs (fixed O&M), as well as smaller fixed elements like taxes. We use a value that was published by MISO in support of the capacity auction prices in MISO South. Updating this value to 2013 dollars and incorporating updates in EIA's assumptions for an advanced CT,

⁶ See, Potomac Economics, "2012 State of the Market Report for the MISO Electricity Markets."

⁷ See, EIA, "Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants", April 2013, *supra*.

TAB 3

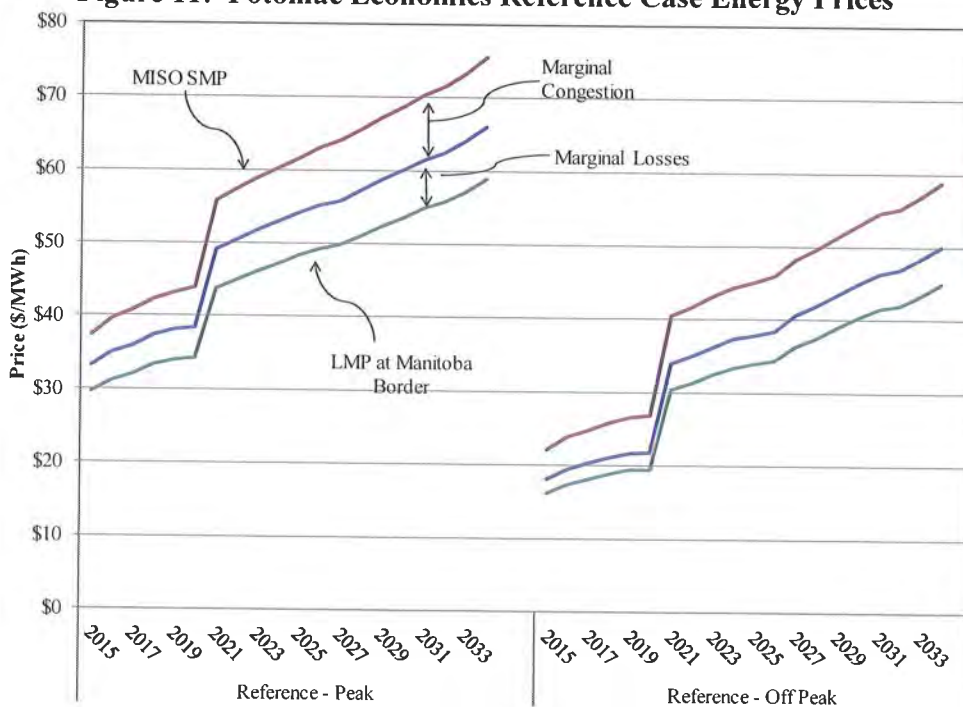
Therefore, the congestion caused by additional Manitoba Hydro exports is mostly between the Minnesota Hub and the rest of MISO. As a result, for additional exports into MISO after 2021 when the projects are proposed to be ready, we reduce the rate of additional congestion costs caused by imports to the coefficient estimated in the second regression model (\$0.59/MWh for each 1000 MW of additional exports, instead of \$0.78/MWh).

D. Full Price Forecasts

In this section we present the final results of our price forecasts: the System Margin Price combined with congestion costs and losses.

The following four figures show our estimated prices, including losses and congestion. The top line indicates the SMP. After removing congestion and losses, the bottom line indicates the LMP that Manitoba Hydro is forecasted to receive when exporting energy to MISO.

Figure 11: Potomac Economics Reference Case Energy Prices



TAB 4

1 analysis in comparison with the distance between the Minnesota Hub and the MHEB
 2 pricing node used in the Manitoba Hydro analysis, as shown in the following Figure:
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4
 5
 6 Potomac did not specifically comment on the congestion and losses adjustment that
 7 Manitoba Hydro applies to the consultants' Minnesota Hub energy price forecasts. While
 8 the Potomac congestion and losses adjustment is from a different location (as the Potomac
 9 forecast is for the MISO SMP rather than the Minnesota Hub) it is similar to the Manitoba
 10 Hydro adjustment in that both rely on an analysis of historical congestion and losses.

11
 12 **8.2 Greenhouse Gas (GHG) Emissions**

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 14 **8.2.1 The Preferred Development Plan Offers the Greatest GHG Emission
 15 Reduction Potential**

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 17 Manitoba Hydro expects that greenhouse gas (GHG) emissions will be significantly
 18 constrained, either through federal or state/provincial legislation and/or regulation.

TAB 5

**Review of Manitoba Hydro Export Price Forecast for
Needs For and Alternatives To (NFAT)**

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Introduction

Based on the market valuation, export sales revenue represents a very significant part of the plan to meet expenditures (over \$9.3 billion in present value from exports). Thus, if export prices are even slightly lower than the projected price, there will be significantly reduced revenue.

Alternative plans have reduced (but still significant) revenue from export sales.

Manitoba Hydro uses an export price forecast that is an average of six forecasts provided by various consultants. With the exception of one of these forecasts, prepared by The Brattle Group, these forecasts are not available due to the proprietary nature of the models and the competitively sensitive nature of the information. Furthermore, the assumptions behind these forecasts are not available. Thus, it is not possible to speak definitively about the reasonability of the export price forecast and assumptions. Manitoba Hydro did include supporting information in its Business Case that raises concerns about the assumptions behind its export price forecast and thus, about the export price forecast itself.

This document looks at three general areas: the applicability of the supporting information provided by Manitoba Hydro, the implication of the inclusion of carbon costs in the export price forecast, and the reasonability of the export price forecast from The Brattle Group.

Manitoba Hydro's Supporting Information

This section examines two potential issues: the existence of transmission congestion between the export region, the area into which Manitoba Hydro will be selling electricity, and the rest of the MISO market; and the future load growth in the export region.

Transmission Congestion

Manitoba Hydro indicates that there are no significant transmission congestion issues between the Minnesota/Wisconsin region and the rest of the Mid-continent Independent System Operator (MISO). This contradicts determinations by the MISO Independent Market Monitor and the U.S. Federal Energy Regulatory Commission (FERC), as well as evidence based on wholesale electricity prices. The existence of congestion is significant because it means that the additional transactions between Manitoba Hydro and the Minnesota/Wisconsin region of MISO will have a larger impact on market prices than would occur without congestion. In essence, congestion shrinks the size of the market since it excludes participants from outside the congested area. Thus, one would expect lower market prices when Manitoba Hydro is selling into the market (and lower revenues for Manitoba Hydro) and higher market prices when Manitoba Hydro is purchasing from the market (and higher costs for Manitoba Hydro).

To examine the impact of transmission congestion on market prices, an analysis of published day-ahead market price indices for the period of March through December 2013 was performed. The specifics of that analysis are included as an appendix and the pertinent results are provided here. The analysis uses on-peak and off-peak price indices published in Megawatt Daily for four hubs in the MISO market: Illinois Hub (IL), Indiana Hub (IN), Michigan Hub (MI), and Minnesota Hub (MN). A comparison of those price indices (for March-December 2013) was performed to look for consistent variations between the Minnesota Hub and the other three MISO hubs.

If congestion exists between the Minnesota Hub and the rest of MISO, it will show up in one of two ways. If the Minnesota Hub has an excess of supply which cannot get out of the region due to congestion, the hub price will be lower than the prices at the other hubs. If the Minnesota Hub has a shortage of supply and congestion keeps outside suppliers from getting energy to the region, the hub price will be higher than prices at the other hubs. It should be noted that the existence of lower (or higher) prices is not sufficient to show that congestion exists. Losses associated with transmitting the energy will result in a price differential between the exporting and importing regions. Transmission losses are generally low (a few percent), so larger price differences between hubs would be an indicator of congestion.

In order to look for evidence of congestion, the magnitude of the difference between hub price indices was examined. Figure 1 shows the percentage of days that a particular hub's off-peak price exceeded the all other hub prices by more than 10 % (in blue) or was more than 10 % less than any other hub price (in red). Since a difference of that magnitude is unlikely to arise from transmission losses alone, the figure indicates that congestion exists frequently and that the congestion affects market prices in the Minnesota region. In particular, the off-peak prices in the Minnesota Hub are often suppressed relative to the rest of MISO, with indices more than 10 % lower than any of the other three hub occurring 36 % of the time. In some hours, this effect was even larger: in 19 % of the off-peak periods, the Minnesota Hub was more than 20 % lower than any of the other three. It was more than 30 % lower in 9 % of the off-peak periods and more than 40 % lower in 5 % of the periods.