NAVIGANT
CONSULTING

Evaluation of Regional Electricity Pricing for Northern Ontario

Prepared for

Ontario Ministry of Energy

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EXECUTIVE SUMMARY

Navigant Consulting, Inc. (Navigant Consulting or NCI) was retained by the Ontario Ministry of Energy to provide an independent analysis of whether a cost-based regional pricing regime would lead to lower delivered electricity prices for customers in Northern Ontario.[1] Our analysis is based on a review of differences between Northern and Southern Ontario in the various cost components of delivered electricity prices. This analysis is in response to requests from regional interests for regional electricity pricing. Contributing to the calls for regional pricing for Northern Ontario are the shadow locational marginal prices (LMPs) that have been estimated by the IESO[2] which show LMPs about 50% lower for Northwestern Ontario than for the rest of Ontario.

All electricity customers in Ontario pay three basic kinds of charges for electricity:

- A charge for the electricity they receive,
- A charge for delivering the electricity to them and
- Other charges as required by regulation.

Under current rules, only the distribution portion of the delivery charge varies by location, because different local distribution utilities have different charges.

In this study, Navigant Consulting considered the likely patterns of relative generation and delivery costs in the proposed Northern and Southern regions. Such an assessment is important because regional prices should be based on underlying cost differences. Otherwise, any regional pricing framework creates an interregional subsidy that unfairly disadvantages one or more regions of Ontario. Any consideration of what prices consumers might pay must take into account the important influence of the global price adjustments for all consumers.

The IESO's shadow prices significantly overstate regional price differentials that can be expected in a regional pricing regime. If market participant's financial interests were affected by these prices, their behaviour in the market would change. With respect to electricity suppliers from outside Ontario, the LMPs as calculated would lead Manitoba to seek to divert its electricity exports to Minnesota. They also would likely cause the owners of the two coal-fired generators in Northern Ontario to raise their bids in order to recover their fixed costs. The IESO's shadow prices also assume that losses are fixed, which understates the effect of losses incurred when power is flowing from South to North.

Navigant Consulting's analysis, considering the generation resources available to Northern Ontario, likely losses, and the transmission links, suggests that the price differential would average about 2.5%, or $1 per MWh, assuming that congestion on the transmission lines is no worse than its historical average.

Further, any cost difference would be blurred by the enforced hedges of the Global Adjustment (GA) and OPG Non-Prescribed Asset (ONPA) rebate. Only about 20% of the total generation in Ontario is not

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[1] Northern Ontario is defined here as the Northwest and Northeast transmission zones defined by the IESO. Effectively, it defines Northern Ontario as the province north of the French River.

[2] In preparation for the consideration of locational pricing, the IESO has computed locational prices from the dispatch solutions under current rules. They are referred to as shadow prices because they are not used in any settlements.

covered by either the GA or the ONPA, so that consumers in Northern Ontario would see only about 20% of any favorable generation cost differential. Alternatively, if these adjustments were not applied under a regional pricing regime in the north, northern customers would assume more risk associated with regional market volatility.

Aside from generation costs, the analysis indicated that transmission costs per unit of electricity delivered may be higher in Northern Ontario than in Southern Ontario. This relates to the lower customer density in Northern Ontario as well as to the relatively rugged terrain and the consequent difficulty of maintaining transmission lines. However, Hydro One points out that these calculations do not properly reflect the cost of serving customers in Northern Ontario, because many of the transmission lines located there are used to bring power from Manitoba to Southern Ontario.

Also, distribution costs are higher in Northern Ontario. Electricity consumers subsidize distribution rates of many distribution customers in the rural areas of Northern Ontario. Such subsidies may be seen as inappropriate if a regional pricing approach were to be implemented so that only Northern Ontario consumers were to benefit from lower spot prices.

In summary, this analysis has concluded that, under conditions where the locational prices affect both what generators receive, the total electricity supply cost differential between Southern Ontario and Northern Ontario is not likely to be high. The differential in what consumers pay is likely to be even smaller.

NAVIGANT CONSULTING

1. INTRODUCTION

Navigant Consulting, Inc. (Navigant Consulting or NCI) was retained by the Ontario Ministry of Energy to provide an independent analysis of whether a regional pricing regime would lead to lower delivered electricity prices for customers in Northern Ontario. Our analysis is based on a review of differences between Northern and Southern Ontario in the various cost components of delivered electricity prices. If a regional pricing regime is not based on underlying cost differences then it would result in an interregional subsidy that unfairly disadvantages one or more regions of Ontario. Conversely, if there are not sufficient regional cost differentials then a regional pricing regime that sends proper price signals to promote economic efficiency does not provide a locational advantage to the region.

In response to calls by the Ontario Forestry Coalition and the Northwestern Ontario Muncipalities Association for regional pricing for Northern Ontario, Premier McGuinty indicated that the government would look at regional based electricity pricing. In July 2006, the Stakeholder Advisory Committee to the Independent Electricity System Operator (IESO) asked the IESO to initiate a study of locational marginal pricing (LMP) in the province.[3] The IESO agreed to undertake this study.

In contrast to the IESO's study of locational marginal pricing, this study of a regional pricing regime focuses on a two-zone scenario split between northern and southern Ontario.[4] Contributing to these calls for regional pricing for Northern Ontario are the shadow locational marginal prices (LMPs) that have been estimated by the IESO[5] which show LMPs about 50% lower for Northwestern Ontario than for the rest of Ontario. These prices have led to the belief that electricity costs in Northern Ontario are significantly below those in the rest of the province, potentially allowing lower prices and prompting the call for regional prices.

LMPs are an important, but not the only, potential determinant of any regional electricity price. Given that importance, this report reviews how actual LMPs established by market forces might compare with the LMPs estimated by the IESO. The other cost components (i.e., transmission and distribution costs) are also reviewed and regional cost differences assessed.

A locational marginal pricing framework can achieve results similar to a regional pricing regime if the regime sets prices in relation to locational costs. However, a regional pricing regime that would be established by Government mandate might or might not use regional boundaries similar to those of a

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3 The IESO's study is part of its ongoing market evolution efforts. It will assess the options for moving away from uniform energy prices. The IESO has defined ten potential pricing zones within Ontario that could be used for a zonal LMP framework where prices are uniform within the zone, but differ across zones.

4 This study does not evaluate the merits of locational marginal pricing which is designed to determine and communicate the market value of electricity at different locations recognizing congestion and loss costs by setting price at the locational marginal cost. Locational marginal pricing focuses on providing the proper price signals to promote efficient short-term consumption decisions and long-term investment decisions.

5 In preparation for the consideration of locational pricing, the IESO has computed locational prices from the dispatch solutions under current rules. They are referred to as shadow prices because they are not used in any settlements.

zonal pricing approach and it might or might not have prices within each region consistent with those that would be achieved with a zonal LMP approach. The closer the regional approach is to an LMP approach, the more likely it is that their outcomes will be similar.

There are many differences between electricity cost and electricity price in Ontario, caused by several factors, including government pricing policies as expressed in the Global Adjustment, by regional policies like the Rural and Remote Settlement Charge, and by policies promoting uniform pricing throughout the province. This study will carefully distinguish between regional costs and regional prices. The study will also distinguish between delivered prices and costs (the price to the end-user and the total cost of getting that electricity to the end user) and generation supply prices and costs (the costs of the commodity alone). This study will also point out which elements of the total delivered cost of electricity might be candidates for regional differentiation and will indicate possible directions for such differences, at least with respect to the two-zone approach considered here.

1.1 Relevant Experience of Navigant Consulting

Navigant Consulting is a specialized independent consulting firm providing professional services to businesses, institutions, governments, associations and legal firms. We have more than 200 professionals in North America with a depth of energy industry experience, and over 1,700 consultants worldwide. With offices in Toronto and Ottawa, we have extensive experience with Ontario's electricity market. Our electricity client base in Ontario is diverse reflecting our reputation for independence and includes large industrial customers, industry associations, generators, transmitters, distribution companies, the Ontario Energy Board, Independent Electricity System Operator (IESO), Ontario Power Authority and Ontario Electricity Financial Corporation.

We forecast the wholesale market prices for the Ontario Energy Board that are used to establish prices for the regulated rate plan and have developed Ontario spot market price forecasts for over 40 clients. We have advised regarding the implementation of LMP in other markets across North America and are actively participating in the IESO Market Pricing Working Group's evaluation of the potential impacts of the adoption of LMP in Ontario. Navigant Consulting has assisted numerous clients to establish transmission and distribution rates and advised the OEB staff in the initial proceedings that were used to establish Hydro One's transmission rates.

1.2 Organization of this Report

This report has four chapters, the first of which is this Introduction. The second chapter reviews the various components of delivered costs and prices of electricity in Ontario, outlining the major components of electricity bills for typical residential and large industrial customers. Chapter 3 evaluates regional differences in electricity supply and delivery costs, focussing on differences between Northern and Southern Ontario. Chapter 4 offers some conclusions on regional prices based on the analysis presented in the earlier chapters.

2. Current Delivered Electricity Prices

2.1 Analysis of delivered prices of electricity in Ontario

2.1.1 Major components of electricity bill

All electricity customers in Ontario pay three basic kinds of charges for electricity:

- A charge for the electricity they receive,
- A charge for delivering the electricity to them and
- Other charges as required by regulation.

Under current rules, the charges for electricity and the regulated charges do not vary in different locations of the province. The charge for electricity delivery does differ because different local distribution utilities (local distribution companies, or LDCs) have different charges. These basic charges also differ for customers in different customer rate classes. This analysis will consider charges for residential and for large industrial customers.

2.1.2 Residential customers

Electricity Charges

This charge is for the electricity that a consumer uses, bought either through the local utility or through a licensed electricity retailer. Under current rules, this charge is the same throughout the province for all consumers who either pay real-time prices as a pass-through from their LDC or take their electricity supply under the Regulated Price Plan.[6] Prices under this Plan are set by the Ontario Energy Board (OEB).

The OEB sets RPP rates for consumers with and without meters capable of recording the time that electricity is used (smart meters). For consumers on the Regulated Price Plan who do not have smart meters, from November 1, 2006 to April 30, 2007, residential consumers will pay 5.5 cents per kilowatt hour (kWh) for consumption below a monthly threshold and 6.4 cents per kWh for consumption above that level.[7] For non-residential consumers, a 750 kWh per month threshold is in place year-round.

Customers with smart meters will pay according to the time that they use electricity under a three–part structure with a peak rate of 9.7 cents per kWh, a mid-peak rate of 7.1 cents per kWh and an off-peak rate of 3.4 cents per kWh.

Prices under the Regulated Price Plan are set to recover, over time, the cost of the electricity supply. Those costs consist of several components. The first is the market price of electricity, as represented by

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6 The Regulated Price Plan (RPP) applies to all residential consumers, small business consumers who use under 250,000 kWh per year and “designated” consumers who buy their electricity from a distribution utility.

7 The threshold will be 1000 kWh in winter (from November 1 to April 30) and decrease to 600 kWh per month in the summer months from May to October.

the hourly Ontario energy price (HOEP). The second is a Global Adjustment which reflects the payments made to Ontario Power Generation's (OPG's) baseload nuclear and hydroelectric assets, payments made to generators under contracts to the former Ontario Hydro, and contracts for generation and other supply entered into by the Ontario Power Authority (OPA). The Global Adjustment will be discussed further below. The third factor is a rebate from the OPG non-prescribed assets whose prices are capped. Finally, the prices are set to recover (or pay back) any variance of the fixed charges from the actual costs over the preceding period.

Delivery

Electricity delivery charges include distribution and transmission costs assessed at rates approved for individual utilities by the Ontario Energy Board (OEB).

Distribution charges are set to recover the LDC's cost of delivering the electricity to the customer. Each LDC charges its customers rates as approved for it by the Ontario Energy Board. Distribution charges include:

- *Customer Service Charge*: The utility's administrative costs, such as meter reading, billing, customer service and maintenance of accounts. It is a fixed cost per month. These charges vary
- *Distribution Charge*: The costs involved to deliver electricity from the local utility. It includes the cost of building and maintaining infrastructure, such as wires and hydro poles. The distribution charge varies with the amount of electricity consumed.

Transmission charges recover costs of operating and maintaining Ontario's transmission system and delivering the electricity at high voltage from various generation facilities.

- *Transmission costs* refer to the costs of delivering electricity from generating stations to the local utility along the high-voltage transmission system which is primarily owned by Hydro One Networks Inc. Transmission costs vary with the amount of electricity used. Most LDCs assess transmission charges as a single per kWh amount, and some add them into their distribution charges. The transmission cost for each LDC reflect the charges it must pay to Hydro One.

Regulatory Charges

The Regulatory charges are approved by the Ontario Energy Board and applied at uniform levels to all residential customers in the province. They include:

- *Wholesale Market Service Charges*: This charge covers the cost of services associated with operating the electricity system (including ancillary services and congestion management) and running the market. For 2006 year-to-date this charge has been 0.52 cents/kWh on average. The Independent Electricity System Operator (IESO) operates Ontario's competitive electricity market, where electricity is bought and sold.
- *Rural and Remote Rate Protection:* Added to the Wholesale Market Service Charge is the charge of 0.1 cent per kWh charge for Rural and Remote Rate Protection which all customers pay to offset the higher cost of distributing electricity to consumers in rural and remote areas of Ontario.
- *Standard Supply Service Charge*: This charge of 25 cents per month covers administrative costs incurred by the local utility in providing electricity to Regulated Price Plan customers (those who do not choose to purchase electricity from a licensed electricity retailer).

- *Debt Retirement Charge* This charge of 0.7 cents per kWh has been set by the Ontario Ministry of Finance to pay down the outstanding debt of the former Ontario Hydro.

Table 1 below shows these charges as they would apply in illustrative electricity bills during December 2006 for four different LDCs: a representative LDC in southern Ontario (Enersource Hydro Mississauga), two Hydro One distribution rates (for customers in high density and normal density areas, and one northern LDC (Thunder Bay Hydro). Table 1 indicates that electric energy charges represent over 60% of the electricity bill for all but the Hydro One Rural customers and this is the element of the bill which is subject to the greatest variation, with changes possible every six months under the RPP. Note that for comparison purposes, the electric energy charge shown in Table 1 does not include a loss adjustment factor.[8]

Table 1: Components of Residential Electricity Bill

	Components of Electricity Bill : Residential			
	Northern LDC	Hydro One Semi urban	Hydro One Rural	Southern LDC
Electric Energy	$41.25	$41.25	$41.25	$41.25
Delivery charges				
Customer service	$10.90	$13.60	$28.30	$11.19
Distribution	$2.09	$1.55	$1.13	$1.13
Transmission		$0.71	$0.83	$0.83
Regulated charges				
Wholesale market service charge	$3.90	$3.90	$3.90	$4.65
Rural and Remote rate assistance	$0.75	$0.75	$0.75	$0.75
Standard Supply Service	$0.25	$0.25	$0.25	$0.25
Debt Retirement Charge	$5.25	$5.25	$5.25	$5.25
Total monthly bill	$64.39	$67.26	$81.66	$65.30

Customer using 750 kWh per month

Sources: Thunder Bay Hydro, Hydro One, Enersource Hydro Mississauga

8 The loss adjustment factor is LDC-specific and reflects losses in the distribution system. This adjustment is typically in the range of 3% to 6% for most Ontario LDCs.

2.1.3 Large Industrial Customers (direct customers)

Billing for large industrial customers who are directly connected to the transmission grid i.e. direct customers, is more complex. They receive an invoice from the IESO which covers a variety of charges and credits. The charges and credits cover electricity, transmission services, hourly uplift, fixed uplift, the OPG rebate, the Debt Retirement Charge, and the Global Adjustment. The hourly uplift includes several costs that vary over time: operating reserves and other ancillary services, losses, congestion management, and the intertie offer guarantee. The Global Adjustment passes through to consumers the benefit of the lower prices paid to the OPG baseload hydroelectric and nuclear assets and the cost of generation contracted by the OPA or by the former Ontario Hydro.

Direct industrial customers who buy their electricity from the IESO pay the hourly Ontario energy price (HOEP) for their energy. HOEP is determined by the IESO from the competitive Ontario market. It is not differentiated by location within the province.

Similarly, none of the other charges paid by direct industrial customers is differentiated by location within the province.

A typical monthly bill for a large direct industrial customer with a peak demand of 50 MW and an 86% load factor would be about $2.4 million, of which energy supply would be over 73%. For a smaller direct customer, with peak demand of 5 MW and a 70% load factor, the monthly bill would be about $204,000, about 71 % of which is for energy.

2.2 The Global Adjustment

When the current Liberal Ontario Government took office, retail electricity prices had been frozen and fixed by legislation at prices that were not sustainable. The Government had a policy of phasing out all of the coal-fired generation in the province. There was also concern that the market, on its own, would not deliver adequate supply For these reasons, the Government decided to make the Ontario electricity market a hybrid. The hybrid market mixes administered-price elements with elements of the competitive wholesale market originally put into place in 2002. The administered-price elements include fixed prices for some generation owned by OPG, certain contracts in place at the time of creation of the GA and the cost of future contracts by Government or Government-related counterparties.

The hybrid market was aimed at accomplishing several apparently disparate objectives: ensuring that electricity supply of the kind that the Government wanted was available, ensuring that consumers would not be faced with unwanted price variability, while matching consumer prices to costs over the longer run, but spreading the benefit of existing low-cost generation to all consumers and by so doing keeping prices as low as possible.

The Global Adjustment (GA) became the key to this hybrid market. It is the mechanism that integrates all of the existing and future administered-price elements and makes them compatible with the hybrid nature of the market. The GA itself consists of four key adjustment terms:

- A term to adjust the regulated priced paid to OPG for its prescribed assets (the baseload hydraulic and nuclear),
- A term to adjust for the cost of contracts entered into by the former Ontario Hydro,

- A term to adjust for supply procured under contract by the OPA, and
- A term to adjust for other procurement contracts entered into by the OPA, such as those for demand response.

The first of those terms will, at least for the first years of the GA, be a credit to consumers in most months. The last three are likely to be costs to consumers.

The GA is payable to (or chargeable to) all Ontario consumers, whether or not they take their supply directly from the IESO or through an LDC. However, consumers who wish to can contract for supply from competitive retailers. This uniformity of application ensures that the benefit from the existing low-cost generation goes to all consumers and that the cost from new higher-cost generation will also be paid by all consumers.

Not directly included in the GA is the OPG Non-Prescribed Assets (ONPA) rebate. This covers 85% of the output of the remaining OPG assets, including non-baseload hydroelectric generation and the fossil fuel plants (except Lennox). OPG rebates an amount equal to the difference between HOEP and the rebate basis price for the ONPA generation (covering 85% of the qualifying generation's output) in each hour. The rebate is set to expire in 2009.

Only about 20% of the total generation in Ontario is not covered by either the GA or the ONPA rebate. The amount of supply actually priced in the market is relatively small. In effect, consumers are provided with an automatic price hedge for over 80% of their supply.[9] This relatively low level of exposure to market prices protects consumers from price variability in the market.

[9] Navigant Consulting memo "Consumer Electricity Price Impact of Wholesale Electricity Market Price Change" to the IESO, October 23, 2006.

3. Evaluation of Differences in Electricity Supply and Delivery Costs

In this chapter we review the differences in electricity supply and delivery costs for Northern and Southern Ontario. Such an assessment is an important element of establishing a regional pricing regime given that regional prices should be based on underlying cost differences. If regional price differences are not based on underlying cost differences then any regional pricing framework creates an interregional subsidy that unfairly disadvantages one or more regions of Ontario. Furthermore, there need to be significant regional cost differences, and economic harm from not recognizing these differences, to warrant circumventing the IESO's formal deliberative process of evaluating locational marginal pricing.

Chapter 2 showed the elements of electricity price in Ontario. Of these elements, the three that could be further differentiated by geographic location are the electricity supply price, the rate for transmission and the rate for distribution services for Hydro One Networks customers. LDC distribution rates are already based on the costs of serving customers in the LDC's territory. The other components of electricity prices are effectively province-wide costs and not readily susceptible to differential allocation by geographic area.

3.1 Possible Definitions of Northern Ontario

The regional pricing calls suggest the establishing a Northern Ontario electricity price; in effect, they would create a zonal pricing system with two zones, Northern Ontario and the rest of the province. The geographic definition of where this Northern electricity price would apply has important implications for its relative price level. There are two possible geographic definitions for this Northern region using the Independent Electricity System Operator's (IESO's) transmission zones. The first is the IESO's Northwest zone which covers the area west of Wawa, Ontario. The second includes the Northwest zone and the Northeast zone which covers the area east of the Northwest Zone to the Hanmer substation in Sudbury. Figure 1 identifies the IESO's ten different transmission zones. They have been used when presenting LMPs for Ontario given that LMPs within the zones are generally consistent.[10] The definition adopted by the parties that have called for regional pricing encompasses the IESO's Northwest and Northeast zones. The report focuses on this definition. However, given that the LMPs presented by the IESO indicate that the Northwest zone has LMPs significantly below the rest of Ontario, including the Northeast zone, the report also evaluates these LMPs and assesses the degree to which they represent an adequate basis for establishing a regional pricing regime.

Whether the proposed regional pricing framework has two zones or one, the zones should be defined so that there is little transmission congestion within them. Transmission congestion costs within the zone would then be socialized (i.e., paid by all market participants -- most likely loads), within each zone. The zone would thus be treated as an unconstrained region, similar to the current treatment of the entire province.

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10 Given their size and the radial nature of the transmission network, the Northwest and Northeast zones do experience relatively significant differences among the LMPs for different nodes within the zone.

Figure 1: IESO Transmission Zones

Source: IESO

3.2 Generation Supply Costs

The IESO has underway a multi-stakeholder consultation process to evaluate the impacts of the implementation of locational marginal prices (LMP) in Ontario. To assist stakeholders to evaluate the potential implications of LMP, the IESO calculates shadow prices for about 250 nodes on the transmission grid. However, these shadow prices are not the prices that would prevail if locational prices were actually used for settlement. There are several critical differences between the conditions which would obtain under LMP in Ontario and those that led to the published shadow prices. LMPs have three components: (1) the marginal cost of generation; (2) the marginal cost of losses; and (3) the marginal cost of transmission congestion. The market dynamics that influence the first component are reviewed first followed by analysis of the marginal cost of losses.[11]

Unlike the Hourly Ontario Energy Price (HOEP), consumers don't pay and generators don't receive the shadow prices that were posted. Therefore, there is no demand or supply response reflected in these shadow prices and to the degree that these LMPs differ from the HOEP, they don't reflect anticipated supplier or buyer responses to higher or lower prices.[12] The LMPs for Northwest Ontario for November 2005 through April 2006 are almost 40% below the HOEP for this period.[13] (See Figure 2.) If this LMP were the price paid to suppliers some would either have elected to not sell or reduced sales to the market (e.g., if they had access to other markets or the LMP were below their marginal operating costs) or increase their offer prices. The net effect is that the LMPs for Northwestern Ontario are likely to be considerably higher than the shadow prices.

This is best demonstrated by an actual example. Imports from Manitoba averaged 168 MW over this six-month period, representing about 15 percent of Northwest regional demand. These imports received the HOEP unless the Manitoba/Ontario interface was constrained for imports which only occurred for three hours during this period. Manitoba Hydro who is likely exporting much of this power into Ontario has interties with the U.S. and Saskatchewan that provide an export capability of just over 2,500 MW.[14] LMPs in Minnesota at Excel Energy with whom Manitoba Hydro has a major transmission connection were 40% higher on average than the LMPs for the Northwest zone while the HOEP during this period was over 50% higher. Therefore, Ontario (based on the HOEP) offered Manitoba Hydro higher prices during this period than sales to the MISO market in Minnesota. However, the Northwest Ontario LMPs were well below the Minnesota prices. Therefore, Manitoba Hydro would have sold more power to Minnesota markets rather than sell to Ontario at the LMPs projected by the IESO. Reduced imports from Manitoba Hydro would increase LMPs in Northwestern Ontario.

Another important source of supply in Northwestern Ontario that would respond to these LMPs is Ontario Power Generation's (OPG) two coal-fired generating stations in the region, Atikokan and

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11 The marginal cost of transmission congestion is the total of these other two other marginal costs.

12 This is acknowledged by the IESO who indicated that "Bidding behaviour will change with any change in pricing methodology." (*Location-Based Pricing Study: Proposed Scope*, Market Pricing Working Group, September 1, 2006). This point was made more forcefully by Manitoba Hydro who is directly interconnected with Ontario. "[I]t [the IESO's historical shadow pricing methodology used to develop these LMP estimates] absolutely can not capture the behavior of external market participants who have the option of selling into Ontario or into alternative markets." (September 22, 2006 Comments of Manitoba Hydro on the Locational Pricing (SE-25) draft Stakeholder Engagement Plan)

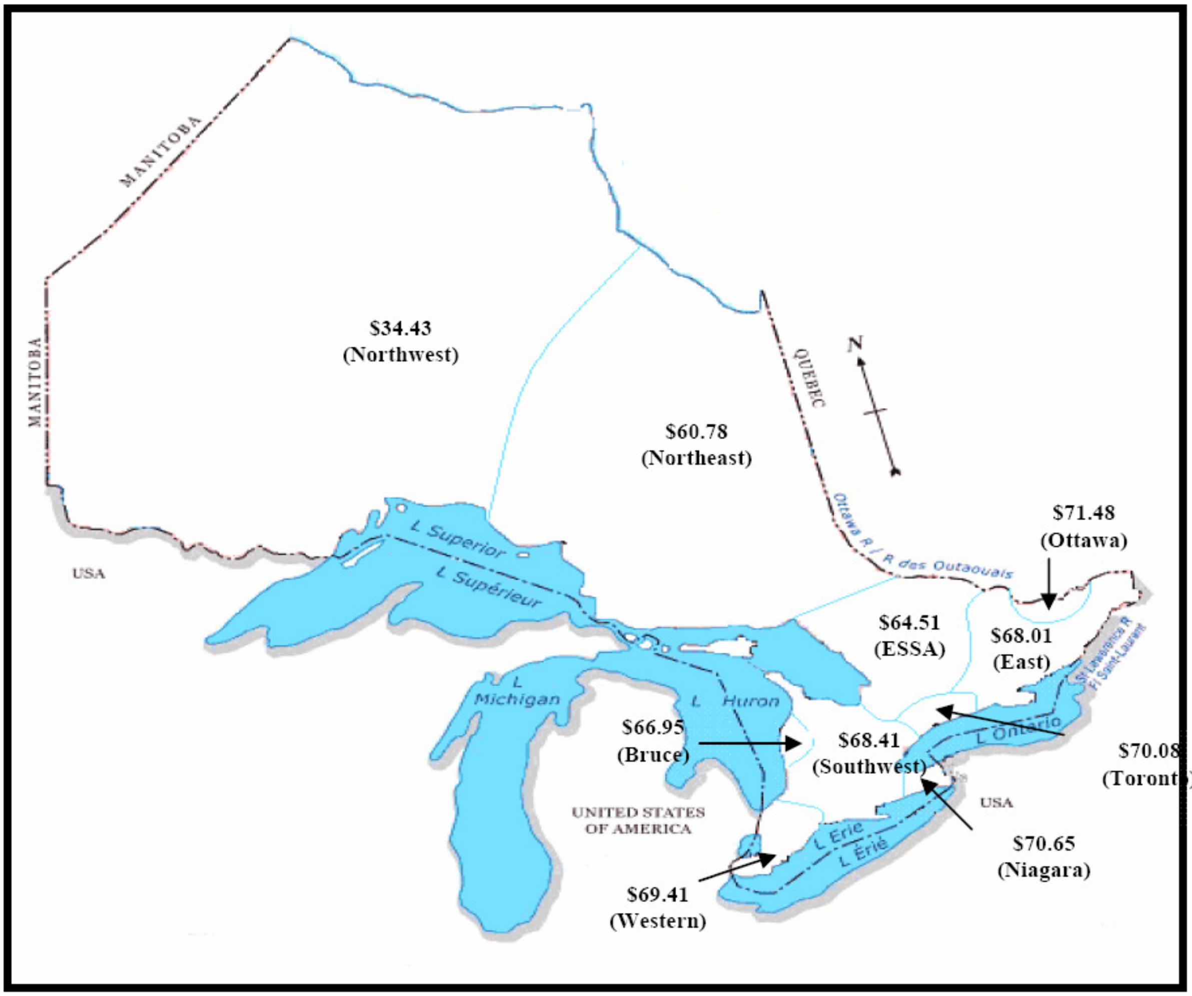
13 The Market Surveillance Panel (MSP) Report (*Monitoring Report of the IESO-Administered Electricity Markets for the Period November 2005 to April 2006*) (MSP Report) indicates that the HOEP for this period was $55.88/MWh and the LMP for Northwestern Ontario was $34.43/MWh. Navigant Consulting bases our analysis on the LMPs reported for this period given that they have received the most public dissemination (presented in MSP Report and the IESO's August 4, 2006 Presentation to the Market Pricing Working Group, indicating that the IESO was going to evaluate the impacts of introducing LMP in Ontario.). The LMPs for this period are generally consistent with those for other longer periods.

14 Submission to the Manitoba Clean Energy Commission, Need for and Alternatives to the Wuskwatim Project, Chapter 5.

Thunder Bay, which provide over 500 MW of local generating capacity. Under a uniform price for Ontario, such as currently exists, where transmission constraints are not considered when establishing the HOEP, the offer strategy for these generating units is most likely based on their variable operating costs which are likely to be in the low $20/MWh range.[15] The shadow prices developed by the IESO assume that this same offer strategy is utilized. In reality if these generating units were establishing the LMPs for Northwestern Ontario for an extended period of time, their offer strategy would increase otherwise OPG would be unable to recover the fixed costs of these facilities. This would cause LMPs in Northwestern Ontario to increase. If these two coal-fired units were to be retired, then natural gas-fired generation would represent the marginal resource in Northwestern Ontario for many hours in the year similar to Southern Ontario. In fact, if Thunder Bay were to be retrofitted to burn natural gas, the heat rate for natural gas-fired generation in Northwestern Ontario could be higher than that for Southern Ontario, leading to higher prices in Northwestern Ontario.

15 A report for the MOE (*Cost Benefit Analysis: Replacing Ontario's Coal-fired Electricity Generation*, April 2005) indicates that the delivered coal price for these two generating stations is about $1.56 and $1.60/MMBtu and that they have variable operating costs of $5/MWh. Assuming a heat rate of approximately 10,000 Btu/kWh, the variable operating costs for these two generating stations would be approximately $21/MWh.

Figure 2: Average InternalZonal Price: November 2005 to April 2006



Source: MSP Report

The preceding discussion assumes that the geographic definitions for the regional pricing framework are Northwestern Ontario and the remainder of Ontario. However, the calls for regional pricing are for the establishment of a Northern price which would encompass the IESO's Northwest and Northeast zones. Under this geographic definition, the surplus generation that exists in Northwest Ontario (estimated by the IESO to be about 300 MW)[16] and leads to lower LMPs in the region, would be available to larger Northern region.[17] Given that the transmission interface between Northeast Ontario and the rest of Ontario (Flow South Interface) is rarely constrained, price differences between Northern and Southern Ontario are likely to be relatively limited. Figure 3 shows the loading of the Flow South and Flow North interface that would represent the electrical boundary of the Northern region. As indicated, even with

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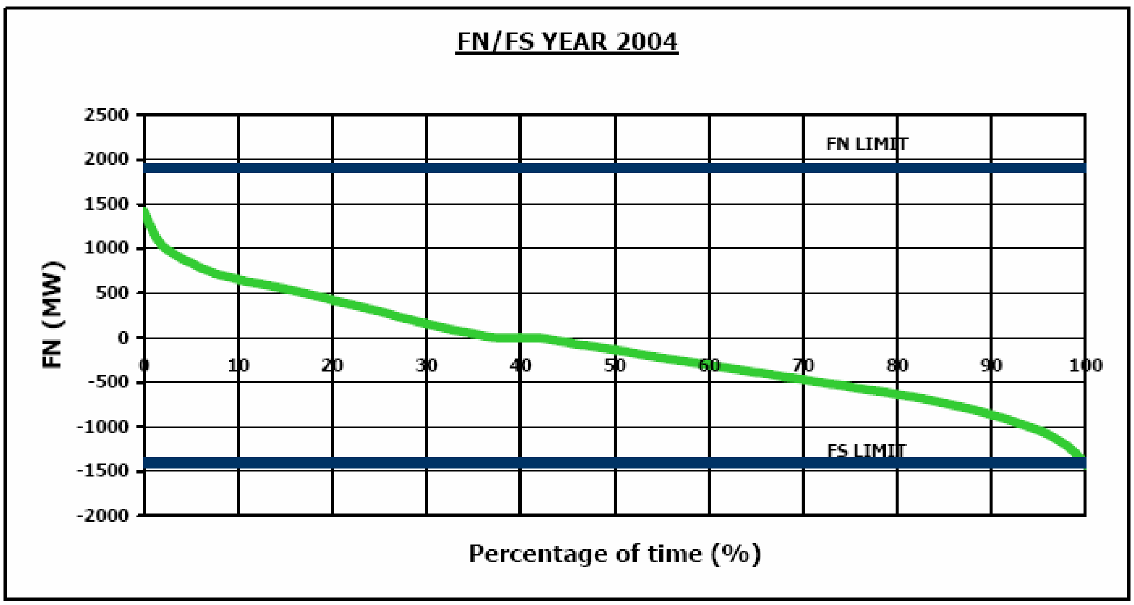
16 Bruce Campbell Letter to James Gillis, Deputy Minister of Energy.

17 However, this 300 MW surplus would be reduced to 150 MW if exports from Manitoba are significantly reduced.

an additional 300 MW of surplus generation from Northwestern Ontario the interface would rarely be constrained, reducing the potential for significant price differentials. The period when this transmission congestion does occur is typically during the spring run-off when Ontario HOEPs are lower. Figure 3 indicates that with a 300 MW increase in low cost supply from the Northwest, the Flow South interface would potentially be constrained 5% of the year. Assuming a 50% difference in price relative to a $40/MWh price for Southern Ontario, this would result in a 2.5% price difference or $1/MWh assuming that there were no transmission congestion in other hours. The LMP for Northeastern Ontario for the November 2005 through April 2006 period was $60.78/MWh, versus an average of $68.69/MWh for the zones to the South.[18] As indicated below, much of this difference in LMPs is attributable to marginal loss differences rather than transmission congestion.

Figure 3: Loading of Flow South/ Flow North Interface



Source: IESO, Ontario Transmission System, September 25, 2006, p. 11.

The second component of LMPs is marginal losses. With power flows from Northern Ontario to Southern Ontario, the marginal loss factor for Northern Ontario will be higher than Southern Ontario, suggesting a lower LMP for the region. However, with the hydroelectric resources in Northern Ontario energy limited for much of the year (other than spring runoff) power flows during a significant proportion of time are from Southern Ontario to Northern Ontario. According to Figure 3 this is about 35% of the time. During this period, we would expect that marginal losses in Northern Ontario should lead to higher LMPs in the region. The LMPs estimated by the IESO had static loss factors that were based on peak period losses and failed to consider this. This caused the LMP for the Northeast zone to be understated.

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18 This is a simple average for the eight other Ontario zones, excluding Northwestern Ontario. An output weighted price isn't likely to differ significantly.

The IESO has not distinguished between the different marginal cost components of the LMPs for the November 2005 to April 2006 period. However, in an analysis of LMPs over the period from October 2002 to December 2003, during which the Northeast region had an LMP of $63.24/MWh, marginal losses relative to Richview represented a cost of $7.14/MWh and congestion with the Essa zone represented a cost of $2.04/MWh. This suggests that the LMPs for the Northeast zone are affected more significantly by marginal losses than by transmission congestion. Given that these marginal loss costs are based on a fixed loss factor which fails to consider predominant off-peak power flows that result in a marginal loss benefit, the most important determinant of Northeast LMPs causes these LMPs to be understated.

The preceding analysis suggested that the LMPs developed by the IESO for Northwestern and Northeastern Ontario are understated given that they don't reflect market participant behavior or dynamically consider marginal losses. The LMPs for Southern Ontario are also affected by these issues. Analysis performed by Navigant Consulting indicates that the LMPs presented for Southern Ontario would cause combined cycle gas turbine (CCGT) projects to earn net operating margins that are well above their fixed operating and capital recovery costs. Simply put, these prices would incent generation project developers to build projects in Ontario to capitalize on these prices and by so doing drive down prices. Prior to this existing units (including TransAlta Sarnia, Brighton Beach and GTAA Cogeneration projects) would increase their output and by so doing drive down these LMPs. In addition, at these higher prices there would be additional imports from Michigan and reduced exports to New York. These LMPs don't reflect this supply response and as a result are overstated.

3.2.1 IESO Analysis of Regional Price Differences

Included as an Appendix to this report is a letter from Bruce Campbell to Deputy Minister James Gillis which presents a high level analysis of the likely price differences between Northern and Southern Ontario. The IESO indicates that, consistent with our analysis, they expect that for the vast majority of time the two regions will have the same prices. Based on a recent historic 6-month period, they estimate that the Northern Region price would likely average less than 0.1 cents/kWh lower than the HOEP for that period and the Southern Region would rise slightly (by perhaps 0.05 cents/kWh) compared to the HOEP for that period. In sum, the IESO estimates that there would only be a 0.15 cents/kWh price difference between the wholesale market prices for these two regions.

3.2.2 Implications of Hybrid Market Structure

As discussed in Chapter 2, under Ontario's hybrid market structure only approximately 20% of Ontario customer's electricity supply costs is from spot market prices. With Ontario's hybrid market structure, about 80% of consumer's electricity supply costs are represented by generation assets that are subject to regulation (e.g., Ontario Power Generation's prescribed assets which account for about 40% of electricity supply) or covered by contracts (e.g., the output of units 3 and 4 at the Bruce Nuclear Generating Station and the various contracts held by the OPA).[19] These contracts and regulatory arrangements fix the costs

[19] Approximately 30% of Ontario's energy supply is provided by the OPG's non-prescribed assets and 85% of the output of these assets is subject to a rebate. As a rebate, OPG is at risk for revenues below the rebate threshold. However, to the degree that there were to be a significant reduction in OPG revenues from the implementation of LMP there is a risk that this rebate structure would be reassessed to provide more financial protection for OPG. This could reduce the benefits to consumers of lower LMPs.

of a significant proportion of Ontario's generation such that the consumer benefit from a reduction in spot market prices is significantly reduced. Therefore, unless this hybrid market structure were to be eliminated, the effective consumer price in Northern Ontario would reflect the impact of the Global Adjustment and the benefits of lower LMPs would be reduced significantly.

This raises the question as to whether the allocation of generation assets in the calculation of the Global Adjustment should be based on the location of the specific generation assets, with the generation assets in Northern Ontario used to establish the Global Adjustment for customers in this region. Given that the vast majority of Ontario's generation fleet was developed to address the integrated needs of Ontario consumers, Navigant Consulting believes that it is inappropriate to allocate generation costs and output on a regional basis. However, if a decision were made to do this then Northern Ontario would be allocated a large share of the above-market non-utility generation (NUG) contract costs given that almost fifty percent of the capacity (and likely a corresponding proportion of above market costs) represented by these projects is located in Northern Ontario. Navigant Consulting analyses of the costs of different generation resources that comprise the Global Adjustment indicate that these NUG contracts have the highest out of market costs.

Some parties may argue that Northern Ontario would benefit from reliance on lower spot market prices offered by the LMPs projected by the IESO rather than the blended prices offered by the current hybrid market structure. However, this would subject Ontario consumers to the volatility of spot market prices. While price volatility for Northern LMPs may be less than Southern LMPs given reduced reliance on natural gas-fired generation, Northern LMPs would be significantly influenced by hydroelectric conditions. During low water years, Northern Ontario may experience higher LMPs. During February 2006, LMPs in Northeastern Ontario were higher than all other zones and in August of this year LMPs in the Northeast were higher than all other zones except Niagara and the West.

3.3 Transmission Costs

As noted, Hydro One's transmission rates do not vary by location within the province. A pricing system that matched locational prices to locational costs might consider varying transmission costs according to zones.

Hydro One has provided information indicating that 20% of its transmission stations and 35% of its transmission lines are located in Northern Ontario. Hydro One also indicated that the maintenance, vegetation management and capital replacement costs for these transmission lines are 50% of their total of such costs.[20] This is an area with about 11% of Ontario's total load.[21] Using information from the Hydro One letter, it is possible to calculate that total costs for transmission lines and stations are about two and a half times as high as those in the south per MW of peak demand.[22]

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20 Hydro One, Steve Dorey letter to James Gillis, Deputy Minister of Energy, October 17, 2006.

21 Based on Northwest and Northeast regions peak loads relative to the Ontario peak as reported in the IESO's *18-Month Outlook: Demand Forecast From October 2006 to March 2008*.

22 Hydro One, letter, op. cit.; IESO, *18-Month Outlook: Ontario Demand Forecast*, Sept. 25, 2006; Navigant Consulting calculations.

However, as Hydro One has pointed out this calculation is much too simplistic and does not properly reflect the cost of transmission that actually serves Northern Ontario. Much of the transmission that is in Northern Ontario serves to bring power from that region to Southern Ontario, especially in years when conditions are favorable for hydroelectric generation. It would therefore be incorrect to charge customers in Northern Ontario the cost of installing and maintaining transmission lines located in that area when they are not providing service to them. These same lines also bring power from Southern Ontario to Northern Ontario in times when hydroelectric generation conditions are unfavorable (that is, when there is little rainfall.)

In an integrated transmission system like Ontario's, it is extremely difficult to determine which aspects of the system benefit which customers. Electricity can and does flow in all directions. Transmission lines which connect two regions provide benefits to both regions by increasing reliability, as each can provide assistance in the event of unforeseen or planned outages in either region.

Hydro One evaluated the concept of locational transmission pricing, but the OEB dismissed this approach given that uniform transmission pricing was preferred by all of the stakeholders. Other jurisdictions have firmly adopted the principle that the costs of transmission assets which are part of the broad network should be paid for by all customers in the system. For example, this principle was recently reaffirmed by ISO New England with respect to new investment in transmission.

Differentiating transmission rates locationally would likely result in at least some inequities because of the difficulty of determining exactly how the transmission lines are used. For example, if a transmission line crosses a zone but does not serve any load in the zone, it could be argued that customers in that zone should receive a credit; they are impacted by the line but get little benefit from it. But a simple assignment of the cost of a line to the customers in the zone where the line is located would impose a cost on such customers.

Even with these warnings, it appears likely that locational consideration for transmission rates would force rates to be higher in Northern Ontario than in Southern Ontario. Terrain is rougher in the North and access to the lines is more difficult and costly. Population is much less dense, leaving fewer customers for each length of transmission line that is serving local customers.

3.4 Distribution Costs

On the other hand, distribution assets clearly serve the local customers for whom they are built. Rates for distribution service reflect the historical costs of the LDC and relate directly to the cost of serving its customers. In Northern Ontario, much of the distribution is the responsibility of Hydro One's distribution system, which covers a wide geographic region.

Hydro One does not currently differentiate its distribution rates by region. It has indicated that costs are proportionately higher for Northern than for Southern Ontario.[23] As for transmission, distribution is much less dense in the North, with fewer customers per kilometer of distribution line. Customers per kilometer is one of the key cost determinants for distribution utilities, and this lack of density implies that

[23] Hydro One, Steve Dorey Letter to James Gillis , Deputy Ministry of Energy, October 17, 2006.

costs per customer can be expected to be higher. In addition, distribution feeder lines are longer in the North and demand per customer is lower.

The information provided by Hydro One showed total distribution costs per customer higher by about 29% in Northern Ontario than in Southern Ontario.[24] Many of Hydro One's customers in Northern Ontario are eligible for some rate subsidy under the Rural and Remote Rate Plan.

Although distribution customers can be more readily associated with the assets put in place to serve them, there would again be some elements of uncertainty in ascribing Hydro One distribution costs to specific customers without creating separate rates for many local areas within which the assets can be identified. This would be against the direction of charges that Hydro One wants to implement; it has asked the OEB to allow it to harmonize rates among the 70 or so smaller LDCs which it has absorbed since market restructuring began.

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[24] Ibid.

4. Conclusions

Overall, this study has found that the impetus for a regional pricing plan for Northern Ontario is based on assumptions that do not appear to be valid and that ignore significant factors which militate against such a plan.

The basic assumption is that the differential between the shadow LMPs in Northern Ontario and those in Southern Ontario, as estimated by the IESO, would prevail in a regional pricing scheme. This assumption is not correct.

The factors that are ignored are the consequences of abandoning uniform pricing in the province in a move aimed at only one geographic area. Also ignored is the impact of a proposed regional pricing scheme on the IESO's development of a LMP approach for the province.

4.1 Energy Supply Prices in a Northern Ontario Zone

The shadow prices presented by the IESO significantly overstate regional price differentials that can be expected in an LMP regime. Here as well the IESO has come to the same conclusion: "Our analysis leads us to believe that regional price differences would have existed, but would not be near as dramatic as suggested by comparing historical shadow prices to the historical HOEP".[25]

These prices are not used for any actual settlement. If market participant's financial interests were affected by these prices, their behaviour in the market would change. Further, the IESO's calculation used assumptions that are approximations and which would affect the actual prices.

Among the changes with greatest impact is the expected reaction of suppliers from outside Ontario. The LMPs as calculated would significantly change the direction of power import and export flows. Manitoba exported power to Ontario because the price was higher here than in Minnesota. If the Ontario prices were to fall to the levels of the shadow prices, much of these imports would be diverted to Minnesota. Further, Minnesota could become a net importer of power from Ontario. These reactions alone would significantly affect the electricity demand/supply balance in a Northern Ontario zone, raising the price by reducing supply and increasing demand.

Current and potential suppliers in Northern Ontario would also react to the difference in prices. If OPG's Thunder Bay plant stays in service with coal as a fuel, its owners could be forced to change their bid strategy to ensure that the prices they receive when dispatched are high enough to pay their fixed plant costs, including cost of capital. Finally, if the Thunder Bay and other coal-fired plants are retired, they would likely be replaced by plants using natural gas. The marginal generation cost of these plants would be very close to that for similar plants in Southern Ontario, leading to greater price convergence between the two areas.

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25 Presentation to be made to the Stakeholder Advisory Committee, November 1, 2006, "Status of LMP Study", p. 10.

An IESO analysis of likely prices in Northern Ontario and Southern Ontario indicated that the prices would converge for much of the time.

Further, the IESO's calculations assume that the loss factors are fixed. In an actual LMP regime, the LMPs would be based on actual losses on the system. The fixed loss factors understate the LMPs in Northern Ontario. The loss factors are those at system peak times, when Northern Ontario is likely to be exporting power to Southern Ontario, causing loss-adjusted prices to be lower in Northern Ontario. But in off-peak periods, power may flow from Southern Ontario to Northern Ontario in order to conserve the North's hydraulic resources for use at the peak. At such times, loss-adjusted prices would be higher in Northern Ontario than in Southern Ontario. The LMPs as calculated by the IESO, therefore, have a systematic bias towards showing lower shadow prices in Northern Ontario.

4.2 Relation of Spot Market Prices to Consumer Prices

Consumers in Ontario have regulated hedges against high and volatile electricity prices, so that electricity finally priced in the market makes up only about 20% of their total supply. These hedges are applied uniformly throughout the province. The Global Adjustment transmits to all customers the benefits of the regulated low prices for OPG baseload hydroelectric and nuclear generation. It also transmits the net cost of generation contracted by OPA and it currently produces a net benefit that reduces cost. The Global Adjustment also automatically reduces volatility of consumer prices because the benefit to the consumer increases when market prices increase.

The OPG Non Prescribed Assets rebate is a similar mechanism that transmits to consumers the majority of the benefit from regulated price caps on generation from OPG's non-baseload hydraulic and fossil generation. Like the Global Adjustment, these rebates also provide an automatic hedge against price volatility because the benefit to consumers increases when the market price increases.

The result of these hedges is that, even if the spot market LMPs in Northern Ontario were as much below those in Southern Ontario as the IESO data show, Northern Ontario consumers would not pay a much lower price unless they gave up the hedges and relied more on the spot market LMP. But that would expose these consumers to the actual price, which as indicated is likely not to be as much lower as assumed. It would also expose them to additional price volatility.

4.3 Other Costs in Northern Ontario

Aside from generation costs, the analysis indicated that transmission costs per unit of electricity delivered may be higher in Northern Ontario than in Southern Ontario. This relates to the lower customer density in Northern Ontario as well as to the relatively rugged terrain and the consequent difficulty of maintaining transmission lines. Although these costs are currently charged uniformly across the province, if a regional pricing scheme were initiated with a view towards affecting only Northern Ontario, an issue could be raised as to whether the region should also pay differentiated transmission rates.

Also, distribution costs are higher in Northern Ontario. Electricity consumers subsidize distribution rates of many distribution customers in the rural areas of Northern Ontario. Such subsidies may be seen as inappropriate if a regional pricing approach were to be implemented so that only Northern Ontario consumers were to benefit from lower spot prices.

4.4 The IESO LMP Process

The IESO is currently undertaking a study of the impacts of taking a LMP approach across the entire province. This study will undergo the IESO's full multi-stakeholder consultation process, with strong analytical support from the IESO. The IESO has determined that the present shadow LMPs, as calculated, do not form a sufficient basis for decision making on implementation of LMP. It will be undertaking further analysis to determine the impacts of actual use of LMP in pricing.

Depending on its rules and how it is established, creation of a regional pricing regime in Northern Ontario could interfere with implementation of LMP in Ontario, if a decision were made to implement locational pricing.

4.5 Summary

This analysis has indicated that creating a regional pricing regime in Northern Ontario alone is not likely to create the benefits foreseen by its advocates. Under a regional pricing regime that properly recognizes regional costs, the regional prices in Northern Ontario are not likely to be significantly below those in Southern Ontario. Therefore, we believe that the administrative costs and the adverse impact on investor confidence in Ontario's electricity sector from the perception of additional government intervention as a result of establishing a regional pricing regime in Northern Ontario cannot be justified. As the ISO has noted "the current nodal-based shadow prices are not an adequate starting point from which to make a locational pricing policy decision."[26]

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[26] Ibid, p. 7.