

# Ontario Wholesale Electricity Market Price Forecast

For the Period  
November 1, 2010 through April 30, 2012

Presented to  
**Ontario Energy Board**

October 5, 2010

Navigant Consulting Ltd.  
One Adelaide Street East, 30<sup>th</sup> Floor  
Toronto, Ontario M5C 2V9

[www.navigantconsulting.com](http://www.navigantconsulting.com)



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Some of the assumptions used in the preparation of this wholesale electricity market price forecast, although considered reasonable at the time of preparation, inevitably will not materialize as forecasted as unanticipated events and circumstances occur subsequent to the date of the forecast. Accordingly, actual electricity market prices will vary from the electricity market price forecast and the variations may be material. There is no representation that our Ontario electricity market price forecast will be realized. Important factors that could cause actual electricity market prices to vary from the forecast are disclosed throughout the report.

## EXECUTIVE SUMMARY

Navigant Consulting Ltd. (Navigant) was retained by the Ontario Energy Board (OEB or the Board) to provide an independent market price forecast for the Ontario wholesale electricity market. This wholesale electricity price forecast will be used, as one of a number of inputs, to set the price for eligible consumers under the Regulated Price Plan (RPP).

Navigant used a statistical model of the Ontario electricity market to develop our hourly Ontario electricity price (HOEP) forecast. Navigant’s Ontario model draws on our Ontario database, which reflects the Ontario hourly load shape, all committed new entrant generation, best available information regarding the operating profile of Ontario’s hydroelectric generation (baseload and peaking resources), and operating characteristics and fuel prices for Ontario’s thermal generation. Our assumptions and their sources are discussed in detail in Chapter 3 of this report.

The table below presents the results of our base case market price forecast. The on-peak and off-peak prices presented are simple averages, i.e., not load weighted.

**Table ES-1: HOEP Forecast (\$ CAD per MWh)**

Term	Quarter	Calendar Period	On-Peak	Off-Peak	Average	Term Average
RPP Year	Q1	Nov 10 - Jan 11	\$51.91	\$36.64	\$43.59	
	Q2	Feb 11 - Apr 11	\$48.79	\$33.64	\$40.59	
	Q3	May 11 - Jul 11	\$44.52	\$27.21	\$35.20	
	Q4	Aug 11 - Oct 11	\$47.66	\$29.17	\$37.57	\$39.23
Other	Q1	Nov 11 - Jan 12	\$46.77	\$30.42	\$37.87	
	Q2	Feb 12 - Apr 12	\$42.27	\$26.70	\$33.85	\$35.88

Source: Navigant Consulting

Notes

- 1) The price forecast reflects an average exchange rate of \$1.00 CAD to \$0.999 USD between November 2010 and April 2012 (\$0.992 USD between November 2010 and October 2011 ). The exchange rate forecast is taken from the Bank of Montreal’s “Canadian Economic Outlook”, issued October 1, 2010.
- 2) On-peak hours include the hours ending at 8 a.m. through 11 p.m. Eastern Time (EST) on working weekdays and off-peak hours include all other hours.

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## 1. INTRODUCTION

Navigant Consulting Ltd. (Navigant) was retained by the Ontario Energy Board (OEB or the Board) to provide an independent market price forecast for the Ontario wholesale electricity market. This wholesale electricity price forecast will be used, among other inputs, to set the price for eligible consumers under the Regulated Price Plan (RPP).

This report presents the results of our forecast of the Hourly Ontario Energy Price (HOEP) for the period from November 1, 2010 through April 30, 2012 and describes the major economic and energy market assumptions and inputs for the forecast, as well the sources of information. In addition, given that this forecast is based on a specific set of assumptions, the report evaluates major risk factors in the forecast.

This forecast of the HOEP will be used along with the following to establish the price for the RPP:

- the regulated payment amounts for Ontario Power Generation's (OPG's) prescribed assets,
- the cost of non-utility generation (NUG) contracts administered by the Ontario Electricity Financial Corporation,
- the cost of renewable energy supply (RES) and clean energy supply (CES) contracts administered by the Ontario Power Authority (OPA),
- the cost of renewable energy standard offer program (RESOP) and Feed-In tariff (FIT) program contracts administered by the Ontario Power Authority,
- the cost of the "Early Mover", Combined Heat and Power and Bruce Power contracts administered by the OPA; and
- the balance in the variance account held by the OPA.

This forecast will also be used to determine the estimated value of the Global Adjustment as part of the RPP price.

### 1.1 Contents of This Report

This report contains five chapters. The first is this Introduction. The second reviews the forecasting methodology, including the framework used for evaluating forecast uncertainty. The third chapter reviews the source of forecast assumptions and key forecast assumptions. The fourth chapter reviews the forecast results. The final chapter discusses the forecast risks.

## 2. PRICE FORECASTING METHODOLOGY

The major factors driving the equilibrium of supply and demand are reflected in our statistical forecast model. The model draws on the history of the Ontario electricity market to determine the relationship between the drivers of market prices and the resulting market prices. This relationship is then extended forward to produce a forecast of expected wholesale electricity prices.

### 2.1 Overview of the Forecasting Model

Navigant used our statistical price forecasting model to develop the HOEP forecast. Navigant's Ontario electricity database reflects all committed new entrant generation, best available information regarding the operating profile of Ontario's hydroelectric fleet (baseload and peaking resources), and operating characteristics and fuel prices for Ontario's thermal generation. The sources of our assumptions are reviewed in the next chapter. Presented below is a brief review of our electricity price forecasting model.

The Ontario electricity market features a mandatory competitive wholesale pool. Any generator wishing to supply electricity to the Ontario market must offer its output to the system operator – the Independent Electricity System Operator (IESO) – as a series of hourly price/quantity pairs. The IESO then chooses the least-cost combination of generation resources which can meet the demand in each hour, subject to technical factors such as ramp rates (for fossil resources) and to transmission constraints. The cost of the most expensive generation dispatched then becomes the market-clearing price which each generator located within the same market area (i.e., Ontario) receives for its energy output, regardless of its actual offer price.

The hourly electricity price in Ontario is therefore determined by the interaction of supply and demand as reflected in the information provided to the IESO. A statistical model will represent these factors.

The Navigant statistical model was developed using our extensive historical database for the Ontario electricity market. The data include a complete history of HOEP, historical electricity output by fuel type of plants in Ontario and historical electricity demand in Ontario. The database also includes information on market prices for the important fuels (natural gas, coal, and uranium) used for electricity generation in Ontario. In the development of the model, all of these factors were considered. The model was selected as that which best represents the actual history of Ontario electricity prices.

The model considers HOEP to be determined by several important factors.

- Hourly demand for electricity is an important determinant of demand, as noted above. The demand variable included in the model is the total energy demand over the time period.
- The amount of nuclear and hydroelectric energy available to the Ontario market has a strong influence on the hourly electricity price, due to their low operating costs.

The more such low-cost energy is available, the less the IESO has to rely on relatively high-cost sources like natural gas generation. The availability of these two forms of low-cost energy is treated in the model as a determinant of electricity price.

- The price of natural gas is also an important determinant of electricity price in Ontario, because it is likely to be the marginal fuel (that is, the resource that sets the market-clearing price) in times when supplies from lower-priced resources (hydroelectric, nuclear, and coal) are insufficient. Ontario’s fleet of natural-gas fired generators has increased. The recent retirement of four coal units, representing almost 2000 MW of generation, will further increase the importance of natural gas generation in Ontario. Natural gas is also important in setting the price in neighbouring markets, which can influence prices in Ontario. Therefore, natural gas prices have a strong role in explaining HOEP and the model includes the price of natural gas as a determinant of the Ontario electricity price.

## 2.2 Treatment of “OPG Regulated Assets” in the Model Specification

A significant portion of Ontario’s generation, i.e., OPG’s nuclear and major baseload hydroelectric generating units (Saunders, Beck, and DeCew Falls), have been designated as regulated assets. The price for the output of these plants is set by the Board. While the price for the output of these plants is regulated, their value in the Ontario market will be established by the same market dynamics that are in place currently, i.e., a bid-based pool where participating generators receive a uniform price. Specifically, the party responsible for operating this generation would seek to ensure that it is available to the maximum degree possible, particularly during periods when market prices are high and the value of the generation is the greatest. Furthermore, if the scheduling and dispatch of these units does not change given that OPG’s regulated assets do not establish the market-clearing price for the vast majority of hours, we expect that the treatment of these generating stations as regulated assets will not affect the HOEP.

## 2.3 Recognizing Market Pricing Volatility

Experience demonstrates that electricity market prices are inherently volatile. Any wholesale market price forecast should reflect this volatility or, at a minimum, acknowledge it as a source of risk to the price forecast. To determine the volatility of power prices and reflect the uncertainty around any forecast one needs to properly characterize how power prices behave and reflect the shape of the power price probability distribution.

However, each price forecast is itself subject to random (or apparently random) variation. That variation can be measured as the variance of price around the expected value. Variance is a statistical measure of random variation around an expected value. This type of price volatility is not fully captured by the statistical model. Therefore, in determining the RPP price for eligible consumers, Navigant and the OEB have developed a methodology that captures and reflects this potential price volatility. It is referred to as the stochastic adjustment. A discussion of this methodology and the results of the analysis are presented in the *RPP Price Report (November 2010 – October 2011)*.



### 3. SHORT-TERM FORECAST ASSUMPTIONS

As discussed above, Navigant has used our statistical model as the primary price forecasting tool. The sources of the primary modeling assumptions as well as a review of the key assumptions are presented below.

Broadly, three classes of primary assumptions underpin our short-term HOEP forecast:

1. Demand forecast
2. Supply forecast
3. Fuel Prices

The forecast U.S. - Canada currency exchange rate<sup>1</sup> also influences the short term HOEP forecast indirectly by affecting the price of fuel in Ontario and the price of electricity in neighbouring U.S. markets. The following sections present the data sources for each of the primary assumptions in the base case scenario which represents the expected forecast.

#### 3.1 Demand Forecast

The demand forecast is comprised of an energy forecast for each month over the forecast period. The energy forecast defines the total (sum over all hours) hourly consumption in each month. The energy forecast is taken from the IESO's *18-Month Outlook Update: An Assessment of the Reliability and Operability of the Ontario Electricity System From September 2010 to February 2012* (August 23, 2010).

The IESO's *18-Month Outlook Update* bases the energy forecast on "normal weather". The "normal weather" forecast assumes that each day in a year experiences weather conditions that are representative of normal weather conditions for that day.

Table 1 shows the forecast of monthly energy consumption that was used from the IESO. Energy consumption is consistent with the IESO's "normal weather" forecast and reflects load reduction due to conservation initiatives over the forecast horizon.

**Table 1: Forecast Monthly Energy Consumption and Peak Demand**

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	Energy (TWh)											11.6	12.6
	Peak Demand (MW)											20,718	21,878
2011	Energy (TWh)	13.3	12.0	12.6	11.0	11.0	11.5	12.4	12.4	11.0	11.3	11.7	12.7
	Peak Demand (MW)	22,474	22,186	21,020	18,577	18,606	22,156	23,350	22,739	20,316	18,816	20,738	21,704
2012	Energy (TWh)	13.4	12.5	12.7	11.0								
	Peak Demand (MW)	22,707	21,986	21,259	19,436								

Source: IESO, *18-Month Outlook Update: An Assessment of the Reliability and Operability of the Ontario Electricity System From September 2010 to February 2012* (August 23, 2010)

<sup>1</sup> The price forecast reflects an average exchange rate of \$1.00 CAD to \$0.999 USD between November 2010 and April 2012 (\$0.992 between November 2010 and October 2011). The exchange rate forecast is taken from the Bank of Montreal's "Canadian Economic Outlook", issued October 1, 2010.

### 3.2 Supply Assumptions

The existing generation capacity assumptions are consistent with the IESO's *18-Month Outlook Update* (August 23, 2010). Four coal units retired on October 1, 2010: Units 1 and 2 from Lambton and Units 3 and 4 from Nanticoke. Bruce A Unit 2 is expected to return to service in the third quarter of 2011, according to the Ontario Power Authority (OPA). Unit 1 is also being refurbished, and is expected to return to service in the fourth quarter of 2011.

In addition to the existing supply resources, several major projects are expected to come on-line during the forecast horizon, as listed in the IESO's *18-Month Outlook Update*. These projects are listed in Table 2 and have been included in the model specification. One large gas-fired generator, Halton Hills CCGT, came into service in the third quarter of 2010.

**Table 2: Major Generation Capacity Additions**

Term	Project Name	Resource Type	Capacity (MW)	In-service date
RPP Period	Halton Hills Generating Station	Gas	632	2010-Q3
	Shutdown of Lambton G1 and G2	Coal	-970	2010-Q4
	Shutdown of Nanticoke G3 and G4	Coal	-980	2010-Q4
	Return of Sandy Falls as 60 Hz plant	Water	5	2010-Q4
	Return of Lower Sturgeon as 60 Hz plant	Water	14	2010-Q4
	Return of Wawaitin as 60 Hz plant	Water	15	2010-Q4
	Hound Chute	Water	10	2010-Q4
	Leamington Pollution Control Plant	Oil	2	2011-Q1
	Grid-connected FIT Projects	Wind	166	2010-Q4
	Grid-connected FIT Projects	Wind	49	2011-Q1
	Grid-connected FIT Projects	Wind	60	2011-Q1
	Grid-connected FIT Projects	Wind	69	2011-Q2
	Becker Cogeneration	Biomass	15	2011-Q3
	Grid-connected FIT Projects	Wind	125	2011-Q3
	Bruce Unit 2	Uranium	750	2011-Q3
	Raleigh Wind Energy Centre	Wind	78	2011-Q1
		Greenwich Wind Farm	Wind	99
Bruce Unit 1		Uranium	750	2011-Q4
Talbot Windfarm		Wind	99	2011-Q4
Grid-connected FIT Projects		Wind	100	2011-Q4
Grid-connected FIT Projects		Wind	20	2011-Q4
Grid-connected FIT Projects		Wind	60	2011-Q4
Grid-connected FIT Projects		Wind	210	2011-Q4
Kruger Energy Chatham Wind Project		Wind	101	2011-Q4

Source: IESO, *18-Month Outlook Update: An Assessment of the Reliability and Operability of the Ontario Electricity System From September 2010 to February 2012* (August 23, 2010).

In addition to the projects in Table 2, the OPA has contracted with various small renewable energy power producers under the Renewable Energy Standard Offer Program (RESOP). In March 2009 the Ontario government announced the Feed-In Tariff program (FIT), which offers higher rates and replaces RESOP and request for proposal processes as the primary method to procure renewable energy supply contracts. In the interim, many RESOP contract holders have opted to apply for the FIT program; however as of the last status report published by the OPA, updated for the second quarter of 2010, 997 MW remain under contract, of which 258 MW were

in commercial operation. Of the 739 MW under development, 217.5 MW are wind projects, the majority of which are assumed to have signed an Advanced RESOP FIT Amendment and are therefore required to achieve commercial operation by December 31, 2010. In addition, another 476 MW are solar PV projects under development; a significant proportion of these are assumed to have signed a RESOP extension, allowing them to reach commercial operation one year later than their original expected commercial operation date.

The OPA has received over 20,000 applications under the microFIT program and over 3,000 applications under the FIT program representing approximately 190 MW and 15,500 MW, respectively. As of September 29, 2010, it had issued over 12,000 conditional offers to microFIT applicants and almost 1,400 contracts for FIT projects. About 58% of the total FIT MWs approved to date are for wind projects and 33% are for solar PV projects.

Renewable generation under contract with the OPA supplied generation equivalent to approximately 3% of Ontario demand in 2009. This is estimated to increase to 5% by 2009 and 9% in 2012. The effect of this increase in supply is to decrease Ontario wholesale electricity prices.

### 3.3 Nuclear Capacity

The statistical model finds that the performance of the nuclear generation fleet is an important factor in influencing HOEP, so the HOEP forecast needs a forecast of nuclear output. Historical generation patterns were used to estimate monthly capacity factors for each plant. Average annual capacity factors range from 72% for Pickering to 91% for Darlington, but all plants show higher capacity factors during summer and winter and lower capacity factors during the shoulder seasons (spring and fall). Capacity factors are multiplied by the available capacity (taking into account capacity additions such as the return to service of Bruce Units 1 and 2) and the number of hours in each month to estimate monthly nuclear generation.

**Table 3: Historical and Forecast Nuclear Capacity Factors**

	2007	2008	2009	2010	2011	RPP Year	18 Months
Average monthly MW	9,166	9,540	9,361	9,175	9,909	9,716	10,047
Average monthly capacity	11,378	11,378	11,378	11,378	11,878	11,628	12,045
Annual capacity factor	80.6%	83.8%	82.3%	80.6%	83.4%	83.6%	83.4%

Source: Navigant Consulting analysis of IESO generator disclosure reports.

### 3.4 Transmission Capabilities and Constraints

Given that the HOEP is based on a uniform price which does not reflect transmission congestion within Ontario, internal Ontario transmission constraints are not tracked in the forecast model. The transfer capabilities of transmission interconnections with adjacent markets are shown in the IESO's *Ontario Transmission System* (May 20, 2010) report, differentiated by season and direction of flow. Table 4 shows the ratings of Ontario's interconnections with adjacent markets based on the information presented in this report.

The flow capacities for Quebec include the full 1,250MW capacity of the new Hawthorne-Outaouais HVDC line. The market forecast has not been adjusted to reflect this new transmission capacity, as the impact that it will have on prices has yet to be determined.

Some narrowing of the difference between on-peak and off-peak prices can be expected (as Quebec is likely to buy more off-peak power from, and sell more on-peak power to, Ontario), but it is not clear whether the net impact will be an increase or a decrease in the average price.

**Table 4: Ontario Interconnection Limits**

Interconnection	Flows Out of Ontario (MW)	Flows Into Ontario (MW)
Manitoba		
<i>Summer</i>	262	330
<i>Winter</i>	274	342
Minnesota		
<i>Summer</i>	140	90
<i>Winter</i>	140	90
Michigan		
<i>Summer</i>	1,870	1,580
<i>Winter</i>	2,160	1,860
New York		
<i>Summer</i>	1,960	1,520
<i>Winter</i>	2,280	1,770
Quebec		
<i>Summer</i>	1,912	2,788
<i>Winter</i>	1,997	2,883

Source: IESO, *Ontario Transmission System*, May 20, 2010

### 3.5 Fuel Prices

Given the uncertainty associated with fuel price forecasts, Navigant typically relies on liquid financial and physical markets to specify the underlying fuel forecasts we use in power market modeling, unless our clients derive their own forecasts. Since we forecast prices in US dollars, we specify fuel prices within the model in US dollars.

#### *Natural Gas*

For short-term forecasts, we use the futures prices as reported publicly on the NYMEX website in US\$/MMBtu. Sufficient liquidity exists through the end of the forecast period to justify this source. To reduce the volatility associated with taking a snap-shot of future prices on a single day, an average of settlement prices over the past a three week period is used. This is similar to the process that Enbridge Gas Distribution and Union Gas use in determining forecast natural gas prices as part of their quarterly rate adjustment mechanism (QRAM) applications to the OEB.

To these futures prices, we apply a basis differential. For natural gas this basis differential is from Henry Hub to the Dawn trading hub in South-western Ontario. This basis differential is based on Navigant’s North American gas price forecast.

Natural gas price assumptions are presented in Table 5 below. All prices are in dollars per MMBtu – US dollars for Henry Hub, Canadian dollars for Dawn. The forecast average Dawn

natural gas price for the twelve months commencing November 2010 is C\$4.86/MMBtu. The forecast average price over the entire 18-month period is C\$5.07/MMBtu. The twelve-month forecast was used to establish the RPP prices in the *RPP Price Report (November 2010 – October 2011)*.

**Table 5: Natural Gas Price Forecast**

Term	Month	Henry Hub \$/MMBtu)	(US	Dawn (C\$/MMBtu)
RPP Year	Nov-10	\$4.04		\$4.70
	Dec-10	\$4.28		\$4.83
	Jan-11	\$4.48		\$4.98
	Feb-11	\$4.49		\$4.99
	Mar-11	\$4.42		\$4.91
	Apr-11	\$4.36		\$4.81
	May-11	\$4.39		\$4.79
	Jun-11	\$4.44		\$4.83
	Jul-11	\$4.50		\$4.81
	Aug-11	\$4.55		\$4.85
	Sep-11	\$4.58		\$4.89
	Oct-11	\$4.66		\$4.92
Other	Nov-11	\$4.90		\$5.33
	Dec-11	\$5.20		\$5.53
	Jan-12	\$5.38		\$5.71
	Feb-12	\$5.35		\$5.66
	Mar-12	\$5.22		\$5.49
	Apr-12	\$4.94		\$5.24

Source: NYMEX, Navigant Consulting

### 3.6 Coal Prices and Output

Under carbon dioxide (CO<sub>2</sub>) emissions limits introduced in 2009 in Ontario, the impact of coal generation on market prices will be less dependent on the price of the fuel and more dependent on OPG's management of its coal resources.

Between 2005 and 2008, OPG's coal-fired fleet contributed an average of 27.6 TWh to Ontario's electricity supply. The government has directed OPG to limit CO<sub>2</sub> emissions from its coal-fired electricity generation facilities beginning January 1, 2009. OPG faces a limit of 15.6 million tonnes in 2010 and 11.5 million tonnes from 2012 on. The coal plants emit approximately one tonne of CO<sub>2</sub> for each MWh of electricity produced, so this means the output of the coal plants will be limited to approximately 16 TWh in 2010, and 12 TWh in 2011.

OPG has published its strategy for meeting the emission limits in 2010.<sup>2</sup> It has several ways in which it can limit emissions, including planned outages, offering less than its full capacity into the market, or adding a uniform emission adder to its offers into the wholesale market. OPG does not expect to use planned outages or a bid adder in 2010. Coal generation is expected to be much lower in 2010 than it was in 2004-2008, primarily because system demand and market prices are low. Since coal provides much of the “swing” generation that makes up the difference between must-run generation and demand, coal output is likely to be significantly below historical levels even without any special efforts to reduce emissions. In addition, four of the units at the Lambton and Nanticoke coal plants, representing about one-third of the province’s coal-fired generating capacity, were closed on October 1, 2010, further reducing output and emissions. Navigant estimates that with no special efforts other than the closing of these units (i.e., no adder or withholding), CO<sub>2</sub> emissions from the coal facilities will amount to approximately 15.5 million tonnes in 2010 (slightly below to the limit of 15.6 million tonnes), and 12.0 million tonnes in 2011 (above the limit of 11.5 million tonnes). This implies that OPG will not need to put an adder on its market bids or withhold capacity during 2010, but will in 2011. The plant closures in 2010 and whatever additional measures OPG takes to limit emissions in 2010 will reduce supply and therefore push up prices.

### 3.7 Hydro Resources

Navigant’s statistical model for Ontario requires a specification of the monthly average hydroelectric output for the province. In our base case, we assume a normal hydroelectric resource level. Our forecast of hydroelectric generation is based on a statistical analysis of historical monthly generation and its seasonality pattern. Generation was very close to normal in the first three months of this year but only between 75% and 80% of normal from April through August. For the forecast, we have assumed a resumption of normal output by January of 2011, in line with historical generation levels.

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<sup>2</sup> Ontario Power Generation, “OPG’s Strategy to Meet on a Forecast Basis the 2010 CO<sub>2</sub> Emission Target”, available at <http://www.opg.com/safety/sustainable/emissions/OPG%20Strategy%20to%20Meet%202010%20CO2%20Emission%20Target.pdf>.

## 4. REVIEW OF FORECAST RESULTS

Table 6 presents the results of our base case market price forecast based on our statistical model. The prices presented are simple (i.e., not load-weighted) averages.

The seasonal price distribution is reasonably reflective of the seasonal pattern of prices that we would expect given that the highest loads are experienced in the summer and winter months and lower loads are experienced in the “shoulder” months of April, May, October and November. An additional factor contributing to the seasonal price pattern is the typical output profile of Ontario’s hydroelectric generation. September is generally the lowest hydro output month, with May and June representing the highest output based on the spring freshet.<sup>3</sup> Nuclear and coal maintenance outages tend to be scheduled in the shoulder seasons, reducing the price impact of lower demand in the shoulder seasons and the spring freshet.

**Table 6: HOEP Forecast (CAD \$ per MWh)**

Term	Quarter	Calendar Period	On-Peak	Off-Peak	Average	Term Average
RPP Year	Q1	Nov 10 - Jan 11	\$51.91	\$36.64	\$43.59	
	Q2	Feb 11 - Apr 11	\$48.79	\$33.64	\$40.59	
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Source: Navigant Consulting

Notes:

- 1) The price forecast reflects an average exchange rate of \$1.00 CAD to \$0.999USD between November 2010 and April 2012 (\$0.992 between November 2010 and October 2011). The exchange rate forecast is taken from the Bank of Montreal’s “Canadian Economic Outlook”, issued October 1, 2010.
- 2) On-peak hours include the hours ending at 8 a.m. through 11 p.m. Eastern Time (EST) on working weekdays and off-peak hours include all other hours.

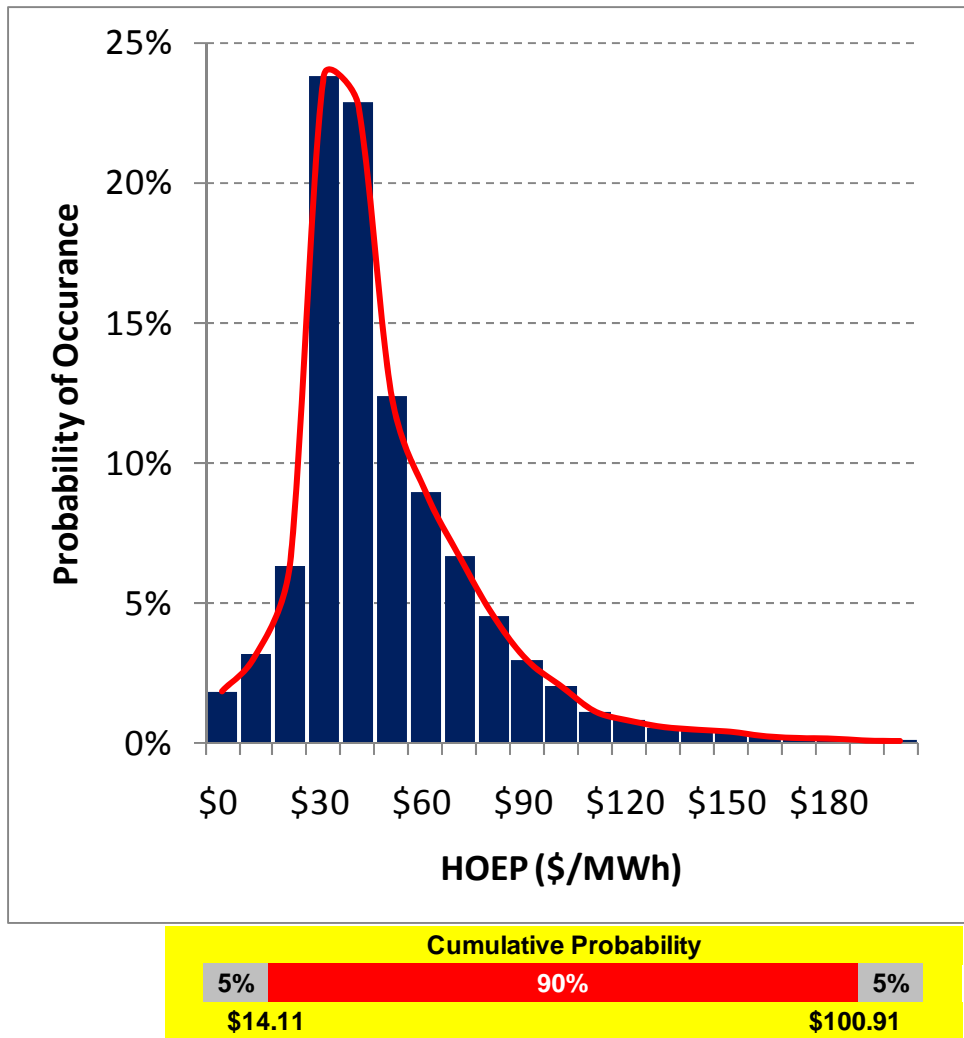
This price forecast is based on market fundamentals and reflects the assumptions used for the forecast from the statistical model. To the degree that actual market variables (gas prices, hourly loads and generator availabilities) are different from our forecast assumptions, market prices are likely to differ from our forecast. As an example of the variability of electricity prices over time, Figure 1 presents the distribution of the hourly HOEP since market opening, and Figure 2 presents the distribution of monthly average prices since market opening. The HOEP is captured on the x-axis and the number of times that the HOEP occurred is reflected in the height of the bars. A key takeaway from these curves is that both are skewed to the right, indicating that the average value is higher than the median or 50% percentile value.

Not surprisingly, the hourly price distribution is significantly more skewed to the right than the monthly price distribution, reflecting the averaging that occurs for the monthly prices.

<sup>3</sup> Freshet is the period during which melted snow causes the rise or overflowing of streams in Ontario.

While not as skewed as the distribution of hourly prices, Figure 2 demonstrates that even the distribution of monthly prices is skewed to the right.

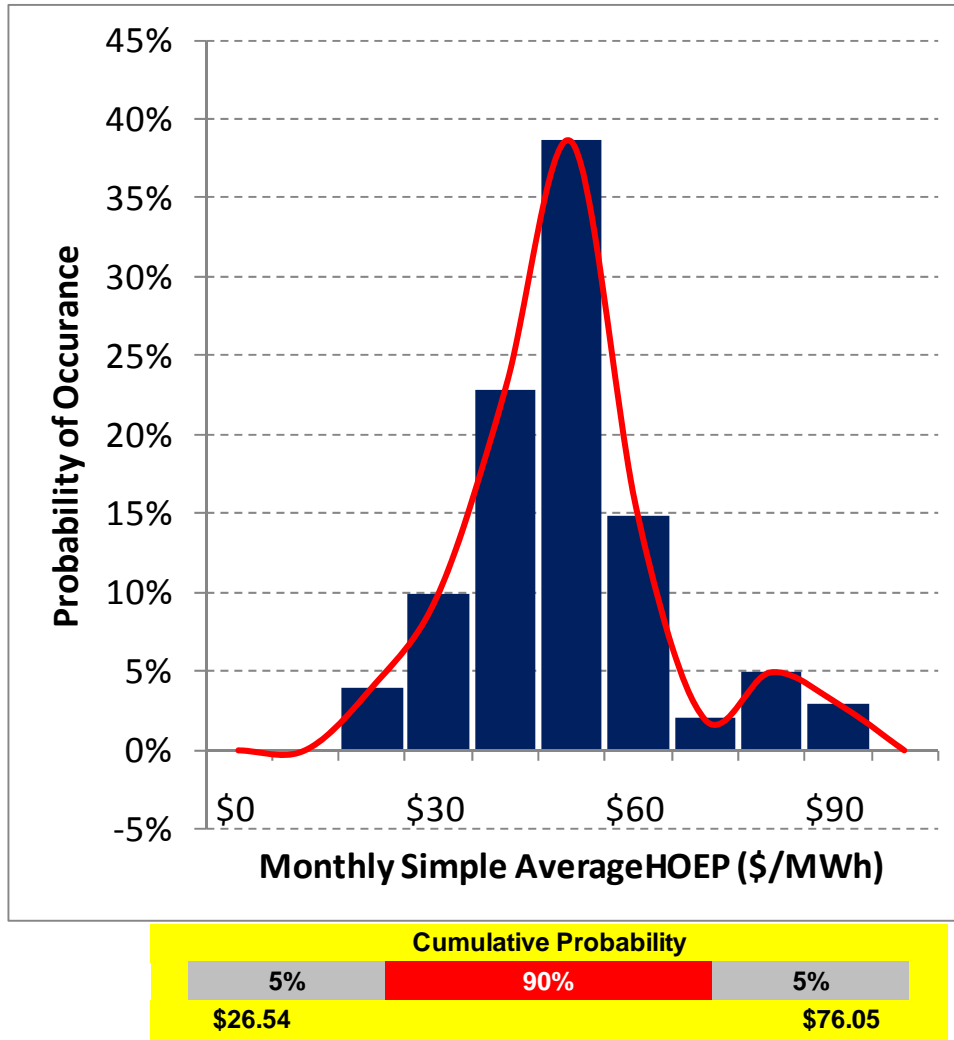
**Figure 1: Historic Distribution of Hourly HOEP**



Source: Navigant Consulting analysis of IESO data (May 2002 to September 2010)



**Figure 2: Historic Distribution of Monthly Average HOEP**



Source: Navigant Consulting analysis of IESO data (May 2002 to August 2009)

## 5. ASSESSMENT OF FORECAST RISKS

As discussed above, the foundation of our HOEP forecast is a statistical model of the Ontario electricity market. This forecast is developed using single point forecasts for each of the determinants of price. There could be considerable variability in each of these assumptions. In setting the RPP price, Navigant and the OEB have used statistical analysis to evaluate the uncertainty around this market price forecast and the impact on the RPP price. We believe that this probability analysis allows the OEB to adequately evaluate forecast risks when determining the RPP price. In this chapter we review the factors that present the greatest forecast risk and assess, in qualitative terms, the degree to which the forecast has addressed them.

Navigant believes that there are four major risks that a specific electricity price forecast will not be realized. These stem from differences between forecast and actual: (1) load; (2) fuel prices; (3) generator availabilities; and (4) the impact of the coal emission limits. Each of these forecast risks are assessed below.

### 5.1 Load Forecast Risk

As discussed, the energy demand forecast used by Navigant was developed by the IESO. Their energy consumption forecast is based on a forecast of economic activity in Ontario and the assumption that weather conditions will be “normal”, i.e., reflective of 30-year average weather over the entire forecast period. To the degree that this economic forecast is wrong or weather conditions depart significantly from normal, as was experienced in the summer of 2005, actual energy consumption would be expected to vary from forecast consumption. In addition, other factors, such as economic activity or consumer behaviour, will cause actual loads to vary from the forecast. For our short-term forecast, Navigant believes that the greatest source of load forecast risk is weather. The IESO’s August 23, 2010 *18-Month Outlook Update* forecasts a normal weather summer peak of 22,474 MW and an extreme weather peak of 23,742 MW for the summer of 2011, reflecting how load is forecast to increase under more extreme weather conditions. The variability in loads was specifically considered in the analysis which is reviewed in the companion report, *RPP Price Report (November 2010 – October 2011)*. Analysis of historical price and demand levels clearly demonstrates that load variability is a major contributor to spot market price volatility. Therefore, Navigant believes that this risk has been considered in our price forecasting approach.

### 5.2 Fuel Price Forecast Risk

In general, the fuel price with the greatest impact on electricity market prices is the gas price. Currently, Ontario has a moderate amount of natural gas-fired generation that is likely to set the HOEP. However, natural gas-fired generation in the Ontario market will grow over time. The largest natural gas facilities include Lennox (2,140 MW) which is also capable of burning residual oil, the Greenfield Energy Centre (1,005 MW), Goreway Station (839 MW), Halton Hills Generating Station (632 MW), St. Clair Energy Centre (577 MW), Brighton Beach Power Station (550 MW), Portlands Energy Centre (550 MW), the Sarnia Regional Cogeneration Plant (505 MW), Thorold Cogeneration Plant (287 MW) and the GTAA Cogeneration Plant (90 MW). There was approximately 4,500 MW of gas-fired generation operating under contract in August 2009

(not including Lennox and the NUGs). This is expected to increase by 700 MW, to approximately 5,150 MW, by the end of the fourth quarter of 2010. There is also a considerable amount of natural gas-fired generation in interconnected markets, i.e., primarily New York and Michigan. While generation from these markets cannot set the HOEP under the IESO's Intertie Offer Guarantee rule, it nonetheless has an influence on Ontario market prices.

The gas prices used by Navigant for this forecast were based on NYMEX futures prices. While we believe that the NYMEX futures represent an appropriate fuel price outlook, as with any forecast there is a significant degree of risk that forecast fuel prices will not be realized.

The most obvious risk associated with natural gas prices is the inherent price volatility of the commodity itself. Figure 3 illustrates the trend in forward prices for natural gas for November 2010 delivery since November 2004. When using futures prices for forecasting purposes, the point in time when the natural gas price outlook is cast is another source of risk. To minimize the RPP exposure to this risk, Navigant and the OEB have used an average of settlement prices for futures contracts over a three-week period. This averaging approach mitigates some of the short-term volatility in natural gas prices. Nonetheless, there is a risk that the natural gas price forecast will be wrong, leading to higher or lower electricity prices than forecast.

**Figure 3: Historical November 2010 Futures Prices (US\$/MMBtu)**



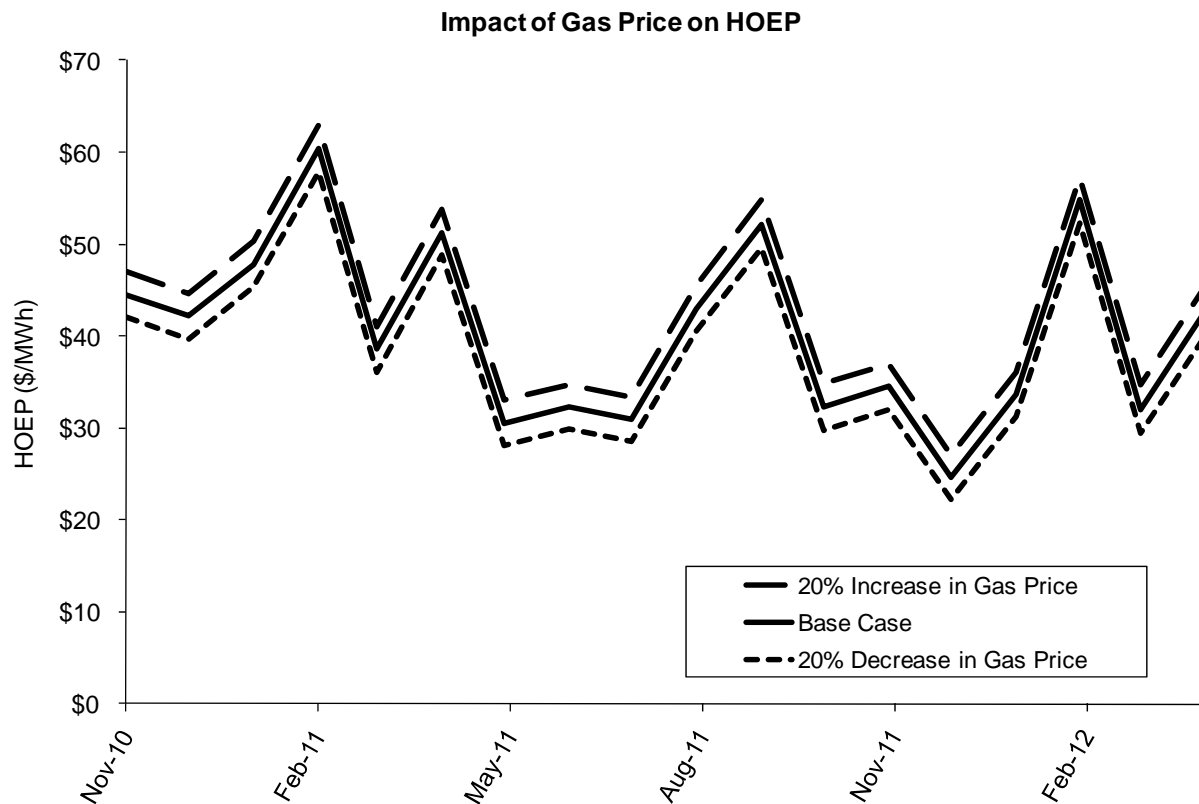
Source: NYMEX

Lennox is the only major Ontario generator which burns oil, but generally residual oil is not its primary fuel. Furthermore, there is a relatively limited amount of oil-fired generation in Ontario’s interconnected markets. Therefore, Ontario electricity market prices are not significantly influenced by oil prices.

Based on this assessment and the experience of the late summer and fall of 2005 (when both gas and electricity prices were very high), and the winter of 2006/2007 (when prices were low), Navigant believes that the most significant fuel price forecast risk remains natural gas. A cold winter or hot summer that increases the demand for natural gas-fired generation can result in significant increases in natural gas prices. Conversely, a warm winter or cool summer can result in a softening of near-term natural gas prices.

Navigant has evaluated the impact of a  $\pm 20\%$  change in Henry Hub natural gas prices on the HOEP. The results of this analysis are shown in Figure 4 which shows the monthly average HOEP for the base case as well as high and low natural gas price sensitivities. This analysis indicates that the forecast of HOEP increased by an average of 9% when natural gas prices were assumed to be 20% higher than forecast, and decreased by an average of 10% when natural gas prices were assumed to be 20% lower than forecast. HOEP will become more sensitive to increases in gas prices as the amount of coal generation available is limited by plant closures and the CO<sub>2</sub> emission limits.

**Figure 4: Comparison of Monthly Average HOEP with  $\pm 20\%$  Change in Henry Hub Gas Price**



Source: Navigant Consulting

### 5.3 Generator Availability Price Risks

The third major source of electricity price forecast risk pertains to the availability of Ontario generation. Changes in the availability of Ontario's nuclear fleet are likely to have the most dramatic impact on market prices. A 2% change in capacity factor for Ontario's nuclear fleet results in a 2 TWh change in the availability of low variable cost energy from nuclear capacity. This change in nuclear output is most likely to affect the requirements for Ontario fossil generation. As **Table 3** in Section 3.3 above shows, our capacity factor assumptions for Ontario's nuclear fleet are consistent with recent experience.

### 5.4 Impact of Coal Emission Limits

Navigant estimates that the coal plants will slightly undershoot the emissions target of 15.6 million tonnes for 2010, and would come in somewhat over the target of 11.5 million tonnes for 2011 without any adders, withholding, or other OPG efforts to limit generation. The base case price forecast takes into account the closure of four large coal units in October 2010, which will limit supply and therefore increase prices. It assumes additional measures to limit CO<sub>2</sub> emission limits in 2011, with a correspondingly larger impact on prices. The plant closures and other measures are estimated to increase electricity prices by an average of \$9/MWh between November 2010 and April 2012.

In the past, coal generation has served to moderate price fluctuations, decreasing when other factors were pushing electricity prices down, and increasing when other factors were pushing electricity prices up. The first effect may still occur: with low demand and low gas prices keeping electricity prices low, coal generation is also very low. However, the second effect is now limited by the CO<sub>2</sub> emission limits. If other factors (high gas prices, high demand, low hydro generation, nuclear outages, etc.) push electricity prices above Navigant's forecast, the increase is likely to be much greater than it would have been without the CO<sub>2</sub> emission limits.