HYDROELECTRIC INCENTIVE MECHANISM

1.0 PURPOSE
This evidence provides a description of the hydroelectric incentive mechanism and presents a review of how this mechanism has impacted OPG’s operating decisions as required by the OEB in its EB-2007-0905 Decision.

2.0 HYDROELECTRIC INCENTIVE MECHANISM
Under the incentive mechanism approved in EB-2007-0905, OPG is financially obligated to supply a given quantity of energy (“hourly volume”) in all hours and receives the regulated rate for the hourly volume in all hours regardless of the actual output from its regulated hydroelectric facilities. If OPG produces more actual energy than the hourly volume in a given hour, it receives regulated payment amounts up to the hourly volume, and market prices for the incremental amount of energy above this hourly volume. If OPG’s actual energy production from its regulated hydroelectric facilities is less than the hourly volume in a given hour, the amount payable to OPG at the regulated rate is reduced by the production shortfall multiplied by the market price.

The hydroelectric incentive mechanism improves OPG’s operational drivers by tying operational decisions, regardless of hourly output, to market prices instead of the regulated rate.

3.0 IMPACT OF THE INCENTIVE MECHANISM ON OPERATING DECISIONS
3.1 Overview
OPG’s decisions to move energy production from off-peak to on-peak periods are, within the constraints imposed by market, asset and hydrological conditions, based on economics. Specifically, these decisions are based on expectations of short run market conditions (price and demand) and the expected price spread between the off-peak and on-peak periods. The deployment of the Pump Generating Station (“PGS”), in conjunction with the Sir Adam Beck Generating Stations 1 and 2 (“SAB 1 and SAB 2”), can move substantial quantities of energy from off-peak to on-peak periods. The extent to which the PGS is used to move energy
between these periods is largely dependent on the difference between on-peak and off-peak prices. While there is some peaking capability at R.H. Saunders and the DeCew Falls Generating Stations, the great majority of peaking activity occurs at the Sir Adam Beck complex.

In real time, the cost of pumping in the off-peak periods (e.g., expected market prices for electricity, incremental/decremental gross revenue charges, non-energy load charges) is continually compared with the forecast value of the additional generation in the next on-peak period(s). Similarly, during on-peak periods, the value of generation is continually compared with the net cost of re-filling the PGS reservoir during the next off-peak period(s). The associated incremental effects of PGS operations on SAB output are also included in these assessments. In both instances, if the expected value of generation exceeds the expected cost of pumping, then the PGS is bid/offered into the market to operate. This economic assessment does not incorporate any consideration of either the regulated price or the hourly volume.

The use of market signals is important to all market participants (and ultimately ratepayers) as this facilitates the movement of energy from low value periods (typically off-peak) to high value periods (typically on-peak) thus reducing overall demand-weighted market prices and hence customer costs.

OPG estimates that between December 2008 and December 2009, usage of the PGS lowered demand-weighted market prices by approximately $1.14/MWh. This value incorporates both the decrease in on-peak prices due to added generation from the PGS and the associated increase in SAB 1 and 2 output, partially offset by an increase in off-peak prices due to additional PGS load and reduced SAB 1 and 2 output. This figure is an estimate because some information - such as the offer prices of other market participants' generation - is not available to OPG and must be estimated. This reduction in market prices demonstrates the value of moving energy from off-peak to on-peak periods.
In EB-2007-0905 at Ex. I1-T1-S1, OPG estimated that the hydroelectric incentive mechanism would provide it with, on a forecast basis, approximately $12M in incremental market revenues in 2009. Between January and December 2009, OPG’s actual incremental market revenues have totaled $23.2M. The difference between actual and forecast incremental revenues is attributable to:

- More energy was shifted from off-peak hours to on-peak hours than was forecast. In 2009, actual hourly production in excess of the hourly volume at Niagara (where most time shifting occurs) was 986 GWh which was approximately 25 per cent higher than the forecast of 783 GWh.

- The difference between average on-peak and average off-peak market prices (referred to as the market price spread) was higher than forecast. While actual market prices were well below expectations - the average forecast price was almost $44/MWh versus an actual of $29.5/MWh, off-peak market prices fell at a greater rate than on-peak prices resulting in higher price spreads. The actual market price spread in 2009 was $14.8/MWh; $0.7/MWh higher than forecast.

For the test period, OPG anticipates that the incentive mechanism will result in incremental revenues of $13.3M in 2011 and $16.3M in 2012, as market price spreads are expected to fall relative to 2009. It should be noted that forecasting the value associated with peaking resources, including the PGS, is subject to great uncertainty as the PGS can operate in response to significant short-run differences in hourly prices that are both difficult to forecast and not adequately described by average price spreads.

### 3.2 Review of Impact of Hydroelectric Incentive Mechanism on Operating Decisions

During EB-2007-0905, OPG undertook to provide a review of the incentive mechanism’s effect on operating decisions. The following sections provide the results of that review.

#### 3.2.1 Representative Metrics
To demonstrate the effectiveness of the hydroelectric incentive mechanism, OPG has chosen two measures. Because of limited peaking capability at DeCew and R.H Saunders, these measures relate only to operations at SAB/PGS. The two measures are:
3.3 Analysis and Discussion

3.3.1 Number of hours of PGS utilization from December 1, 2008 to December 31, 2009

The PGS was pumping for 27 per cent of the total time and was generating for 44 per cent of the total time. The PGS was not operating for 29 per cent of the total time. Based on the on/off peak price spreads, PGS is used for pumping or generating 71 per cent of the time. When PGS is not operating it is because operation is not considered economic. This demonstrates that, under the incentive mechanism, the PGS appropriately operates in accordance with the financial signals provided by the forecast of on/off peak price spreads. See section 3.3.2 for a detailed discussion of price spreads.

3.3.2 Daily market price spreads during PGS generation and consumption

The column in Table 1 below titled 'Market price spread' shows, by month for the period from December 2008 to December 2009, the difference between the average market prices for the hours that the PGS was generating, and the average market prices for the hours when PGS was pumping. As indicated in section 3.3.1 above, the PGS generates 44 per cent of the time and pumps 27 per cent of the time.

In order to further capture the relationship of price differential and production volume, the column in Table 1 titled 'Production-weighted price spread' shows the difference in market

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1 Sometimes PGS is utilized for operational reasons as opposed to economic reasons.
2 On a daily basis, the market price spread is computed as the arithmetic average market price during the hours PGS was generating less the arithmetic average market price when the PGS was pumping. The monthly value is the arithmetic average of all daily values.
prices over the same hours but weighted by the generation and consumption quantities\(^3\). This assigns higher weighting to prices during instances of high production value, thereby providing a meaningful measure of the success of economic decisions exercised in the scheduling of the PGS. High production-weighted price spreads indicate that the actual operation of the pump storage complex occurred in proportion to the presence of stronger market signals.

### Table 1

<table>
<thead>
<tr>
<th>Month</th>
<th>Market on/off peak price spread ($/MWh)</th>
<th>Production-weighted price spread ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 2008</td>
<td>18.3</td>
<td>27.8</td>
</tr>
<tr>
<td>Jan 2009</td>
<td>15.3</td>
<td>26.6</td>
</tr>
<tr>
<td>Feb 2009</td>
<td>14.2</td>
<td>31.7</td>
</tr>
<tr>
<td>Mar 2009</td>
<td>13.1</td>
<td>22.0</td>
</tr>
<tr>
<td>Apr 2009</td>
<td>18.5</td>
<td>27.1</td>
</tr>
<tr>
<td>May 2009</td>
<td>17.6</td>
<td>26.7</td>
</tr>
<tr>
<td>Jun 2009</td>
<td>19.0</td>
<td>24.3</td>
</tr>
<tr>
<td>Jul 2009</td>
<td>11.1</td>
<td>15.4</td>
</tr>
<tr>
<td>Aug 2009</td>
<td>14.3</td>
<td>19.8</td>
</tr>
<tr>
<td>Sep 2009</td>
<td>14.5</td>
<td>20.4</td>
</tr>
<tr>
<td>Oct 2009</td>
<td>8.8</td>
<td>22.4</td>
</tr>
<tr>
<td>Nov 2009</td>
<td>15.2</td>
<td>21.9</td>
</tr>
<tr>
<td>Dec 2009</td>
<td>8.4</td>
<td>13.6</td>
</tr>
</tbody>
</table>

\(^3\) On a daily basis, the production-weighted price spread is computed as the sum of hourly generation multiplied by the corresponding hourly market price divided by the daily generation quantity less the sum of the hourly consumption multiplied by the corresponding hourly market price divided by the daily consumption quantity. The monthly value is the arithmetic average of all daily values.
Table 1 and Chart 1 show that during the period between December 2008 and December 2009, the operation of the PGS occurred when there were positive market price spreads, thereby demonstrating operation in accordance with economic drivers.

Further, the notably higher production weighted price spreads observed throughout the review period provide additional evidence that operating decisions were made to utilize a greater number of PGS units during instances of higher price spreads. The magnitude of the difference between the market on/off peak price spread and the weighted price spread is directly related to the success associated with placing the greatest volume of PGS generation in the most appropriately priced hours. Reserving PGS generation for periods of high price is an important factor in capturing and consequently reducing the spreads between on peak and off peak prices.
3.4 Conclusions

As OPG indicated in EB-2007-0905, the new hydroelectric incentive mechanism improves the drivers for operating its peaking facilities by clearly linking decisions to market prices.

As discussed in section 3.3 above, operation of the PGS in 2009 demonstrates the value in moving energy from low- to high-value periods as shown by the decline in demand-weighted market prices. Furthermore, this benefit is realized even during periods of low demand and depressed market prices.

Finally, as discussed in EB-2007-0905, within the constraints imposed by market, asset and hydrological conditions, OPG’s decisions regarding the PGS operation include an ongoing assessment of expected short run market price spreads. The measures shown in section 3.3 illustrate that the PGS operates (or does not operate) consistent with the forecast of those market price spreads.