#### EB-2010-0008

#### **ONTARIO ENERGY BOARD**

**IN THE MATTER OF** the *Ontario Energy Board Act, 1998*, S.O. 1998, c. 15, Schedule B;

**AND IN THE MATTER OF** an Application by Ontario Power Generation Inc. pursuant to section 78.1 of the *Ontario Energy Board Act, 1998* for an Order or Orders determining payment amounts for the output of certain of its generating facilities (the "OPG 2011-2012 Payment Amounts Application").

#### **POLLUTION PROBE**

#### CROSS-EXAMINATION REFERENCE BOOK FOR OPG PANELS 6 AND 10

#### October 18, 2010

#### **KLIPPENSTEINS**

Barristers & Solicitors 160 John Street, Suite 300 Toronto, Ontario M5V 2E5

**Murray Klippenstein Basil Alexander** Tel: (416) 598-0288 Fax: (416) 598-9520

**Counsel for Pollution Probe** 

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- 1 The Darlington Re-Build Consumer Protection Plan [1-10]
  - Marked copy of Ontario Clean Air Alliance Research Inc. Energy Report dated September 23, 2010
  - Available online at http://www.cleanairalliance.org/files/active/0/darlington.pdf

#### **Documents for Panel 6**

- 2 Direction for Change: Charting a Course for Competitive Electricity and Jobs in Ontario dated November 1997 (marked excerpt) [11-12]
  - Government of Ontario report available online at http://www.archive.org/download/directionforchan00ontauoft/directionforchan00ontauoft.pdf
- 3 OPG Annual Information Form for 2000 (marked excerpt) [13-14]
  - Available online at http://www.opg.com/investor/pdf/AIF\_000.pdf
- 4 Calculation of All-In Capacity Factor for Ontario's Nuclear Units in Year 2000 [15]
  - Based on values in OPG Annual Information Form for 2000
- 5 Report of the Pickering "A" Review Panel dated December 2003 (marked excerpt) [16-21]
  - Available online at http://www.mei.gov.on.ca/en/pdf/electricity/pickering\_report\_dec2003\_en.pdf
- 6 Transforming Ontario's Power Generation Company (marked excerpt) [22-23]
  - OPG Review Committee report dated March 15, 2004 available online at https://ozone.scholarsportal.info/bitstream/1873/6273/1/242803.pdf
- 7 Ministry of Energy News Release dated July 7, 2004 (marked copy) [24-25]

• Archived version available online at http://news.ontario.ca/archive/en/2004/07/07/Ontario-government-restarts-Pickering-unit-to-increase-electricity-supply.html

8 OPG News Release dated November 11, 2005 (marked excerpt) [26-27]

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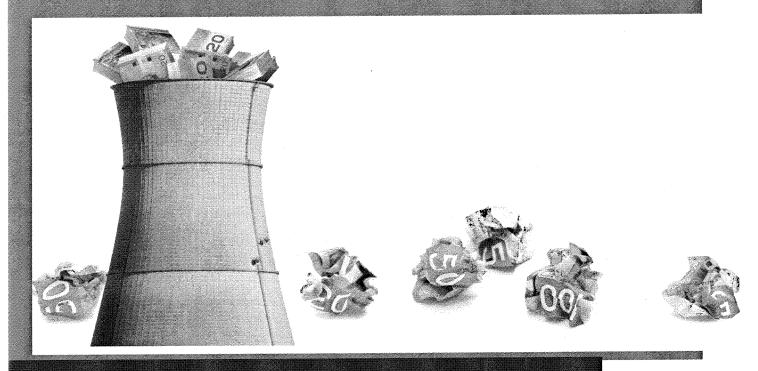
• Available online at http://www.opg.com/news/releases/NewsNov11\_05.pdf

- 9 OPG News Release and Project Management Principles dated February 16, 2010 (marked excerpt) [28-30]
  - Available online at http://www.opg.com/news/releases/100211%20Nuclear%20Investment%20Str ategy.asp and
  - http://www.opg.com/news/releases/100216%20Darlington%20Principles.pdf
- 10 OPG Response to Pollution Probe Interrogatory No. 14 (marked copy)
  - Issue 4.5, Exhibit L, Tab 10, Schedule 14

#### **Document for Panel 10**

- 11 Exhibit D2, Tab 2, Schedule 2, Pages 1-3 (marked excerpt)
  - Excerpt from OPG evidence related to Darlington CWIP

# The Darlington Re-Build Consumer Protection Plan



AN OCAA RESEARCH ENERGY REPORT | www.cleanairalliance.org



Ontario Clean Air Alliance Research Inc.

**SEPTEMBER 23, 2010** 

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# Darlington Re-Build Proposal

The purpose of Ontario Power Generation's (OPG's) proposed Darlington Re-Build project is to extend the operating life of the Darlington Nuclear Generating Station by 30 years.<sup>1</sup>

OPG is seeking permission from the Ontario Energy Board (OEB) to raise its rates commencing March 2011 to finance the Darlington Re-Build "Definition Phase" and the "Darlington Site Campus Master Plan". The expenditures for the Definition Phase include: "the establishment of the project organization, scope finalization, engineering, planning and estimating, procurement of long lead time items and contract establishment. Additionally, all regulatory work will be completed in this phase including the EA [Environmental Assessment], ISR [Integrated Safety Review], Global Assessment and the IIP [Integrated Improvement] Plan]." The Campus Master Plan includes facilities and infrastructure upgrades to support the Darlington Re-Build.<sup>2</sup>

OPG is planning to spend \$1.1 billion on the Definition Phase and Campus Master Plan between 2011 and 2014.<sup>3</sup>

In 2014, OPG's management will "revise its feasibility assessment, establish the project scope, cost and schedule" and seek approval from its Board of Directors to proceed with the Darlington Re-Build "assuming that the economics of the project remain favourable."<sup>4</sup>

#### The Economics of the Darlington Re-Build Proposal

According to OPG's preliminary economic analysis, the Darlington Re-Build will have a capital cost of \$8.5 to \$14 billion<sup>5</sup> and will provide electricity at a cost of 6 to 8 cents (2009\$) per kWh.<sup>6</sup> OPG's economic analysis is problematic for at least four reasons.

- 1. According to OPG, its input variables (e.g., re-build costs, post re-build costs, performance and post re-build station life) for the Darlington Re-Build are "fairly uncertain at this early stage".<sup>7</sup>
- OPG's 6 to 8 cents per kWh estimate is based on the assumption that a re-built Darlington will have an average annual capacity utilization rate of 82 to 92%<sup>8</sup> despite the fact that Ontario's fleet of nuclear reactors has never achieved an average annual capacity utilization rate of 82% or better during the last 25 years.<sup>9</sup>

To-date, OPG has re-built two nuclear reactors, namely Pickering A Unit 4 which was returned to service in 2003 and Pickering A Unit 1 which was returned to service in 2005. The average annual capacity utilization rate of Unit 4 during the last four years (2006 to 2009) was 59%.<sup>10</sup> In 2004 the OPG Review Committee, which was chaired by John Manley, recommended that OPG continue with the Pickering A Unit 1 Re-Start based on the assumption that it would have an average annual capacity utilization rate of 85%.<sup>11</sup> However, its actual average annual capacity utilization rate during the last four years has been only 69%.<sup>12</sup> Therefore the average annual capacity utilization rate of the Pickering A Units 1 & 4 nuclear reactors during the past four years was only 64%.

To-date Bruce Power has re-built two of its nuclear reactors, namely, Bruce A Units 3 and 4. Their average annual capacity utilization rate during the last four years was 75%.<sup>13</sup>

According to OPG, assuming a 64% annual average capacity utilization rate, the Darlington Re-Build Proposal's cost of electricity would rise to 8 to 10 cents per kWh (2009\$).<sup>14</sup>

While the current Darlington reactors have performed better than the fleet average, the established pattern is for a large drop off in performance as CANDU units age and there is no precedent for re-built reactors achieving capacity factors of 82% or better.

- 3. OPG has underestimated the required commercial risk-adjusted rate of return on capital for this high-risk project. Specifically, OPG assumes the project can be 53% debt financed and its required rate of return on equity would be only 9.85%.<sup>15</sup> On the other hand, according to CIBC World Markets, only 20 to 40% of Bruce Power's Bruce A Units 1 and 2 Re-Start project could be debt financed and its required return on equity could be up to 18%.16 According to OPG, assuming 30% debt financing and a 18% return on equity, the cost of the Darlington Re-Build rises to 10 to 14 cents per kWh (assuming an 82% average annual capacity utilization rate) or 12 to 18 cents per kWh (assuming a 64% average annual capacity utilization rate).<sup>17</sup>
- 4. OPG's analysis assumes that the Darlington Re-Build project will be completed on budget despite the fact that every nuclear project in Ontario's history has experienced huge capital cost overruns (see Appendix A). Similarly, the retrofit of the Point Lepreau reactors in New Brunswick is reported to be massively over budget despite assurances at the outset of the project that the pattern of massive cost overruns would not be repeated. <sup>66</sup>

On average, the actual costs of Ontario's nuclear projects have been 2.5 times greater than their original cost estimates. If the Darlington Re-Build's actual cost exceeds OPG's original cost estimate range by 2.5 times then its final cost will be \$21.25 to \$35 billion. As a consequence, it will produce electricity at a cost of 19 to 27 cents per kWh (assuming an 82% average annual capacity utilization rate) or 24 to 37 cents per kWh (assuming a 64% average annual capacity utilization rate).<sup>18</sup>

#### Lower Cost and Lower Risk Options

Fortunately Ontario has numerous lower cost and lower risk options to meet its electricity needs. Specifically, improving energy efficiency; reducing wasteful natural gas usage; and water power imports from Quebec.

#### Energy Efficiency

Energy efficiency is the lowest cost option to meet our electricity needs. However, as the following facts reveal the Ontario Power Authority (OPA) is not aggressively pursuing the province's low cost energy efficiency investment opportunities.

- 1. As of December 31, 2009, the OPA's total spending on energy conservation and demand management was \$541.6 million; whereas it has contracted for electricity supply projects with a total capital cost of \$23.622 billion.<sup>19</sup> That is, for every dollar that it has spent on energy conservation and demand management, it has contracted for \$44 of new supply.
- 2. The OPA's *Industrial Accelerator Program* pays large industrial customers up to 23 cents for each kWh that their energy efficiency investments save *during the first year* of their operation.<sup>20</sup> Assuming these investments actually deliver savings for at least 5 to 10 years, a payment of 23 cents per kWh saved *during the first year* is equivalent to an average annual payment of only 2.3 to 4.6 cents per kWh. That is, OPA's payments for saving a kWh are therefore 76 to 94% less than the cost of producing a kWh by re-building Darlington.

#### Ending Wasteful Natural Gas Use

Most buildings and factories in Ontario use natural gas to produce just one service, namely heat. It is much more efficient to use these same molecules of natural gas to simultaneously produce heat and electricity. This is what combined heat and power (CHP) plants do. They can have energy efficiencies of 80 to 90% compared to the 33% energy efficiency of a nuclear reactor.<sup>21</sup>

CHP plants can be installed in apartment buildings, condominiums, shopping centres, hospitals, schools, airports and factories.

According to the OPA, CHP plants can supply electricity at a total cost of 5.7 to 6.0 cents per kWh assuming a natural gas cost of \$8 per 3

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MMBTU.<sup>22</sup> [On August 27, 2010 the spot price of natural gas was \$3.74 (U.S.\$) per MMBTU at Henry Hub].

Ontario's existing CHP capacity is 1,281 megawatts (MW).<sup>23</sup> There are three available estimates of Ontario's total CHP potential capacity:

- 1. According to industry expert Tom Casten, it is 11,400 MW.<sup>24</sup>
- 2. According to a report prepared for Natural Resources Canada, it is 13,735 MW.<sup>25</sup>
- 3. According to a report prepared for the Ontario Ministry of Energy, it is 16,514 MW.<sup>26</sup>

This means that Ontario's incremental CHP supply potential is at least 2.8 times greater than the size of the Darlington Nuclear Generating Station (3,512 MW).<sup>27</sup>

## Water Power Imports from Quebec

Currently, Ontario's net electricity imports from Quebec are negligible. However, with the completion of a new 1,250 MW interconnection between Quebec and Ontario earlier this year, the total transfer capacity between the two provinces is now 2,788 MW.<sup>28</sup> As a consequence, water power imports from Quebec could displace more than 75% of Darlington's generation capacity without the need for new transmission capacity between Ontario and Quebec.

In 2009 Hydro Quebec exported 23 billion kWh of electricity (mostly to the U.S.) at an average price of 6.5 cents per kWh.<sup>29</sup>

Pursuant to the National Energy Board Act, Hydro Quebec must give Ontario an opportunity to purchase electricity on terms and conditions (including price) as favourable as the terms and conditions of its export sales to the U.S. Therefore the latest market data indicates that Ontario could purchase electricity from Quebec at a cost of approximately 6.5 cents per kWh.

#### Protecting Electricity Consumers from Capital Cost Overruns

In 2004, the Province of Ontario created the Ontario Power Authority (OPA) to promote energy conservation and demand management and to contract for new electricity supplies. To-date the OPA has signed only one contract that allows a power producer to pass its capital cost overruns on to the province's electricity consumers or taxpayers. That contract was a nuclear re-build project.

#### Renewable and Natural Gas-Fired Electricity Generating Facilities

The OPA has entered into over 400 contracts with individuals, co-ops, First Nations communities, municipal electric utilities and private sector corporations for electricity from wind, water, bioenergy, solar and natural gas-fired power plants.<sup>30</sup> None of these contracts permit the suppliers to pass their capital cost overruns on to Ontario's electricity consumers or taxpayers.

#### Bruce A Units 1 & 2 Re-Start Project

On October 17, 2005 the OPA signed a contract with Bruce Power for the re-start of the Bruce A Nuclear Generating Station's Units 1 & 2 reactors at a forecast cost of \$2.75 billion. According to the October 2005 contract, if Bruce Power has capital cost overruns, it can pass 25-50% of these extra costs on to the OPA.<sup>31</sup>

#### Approximate Costs of Ontario's Electricity Resource Options

Energy Efficiency	Combined Heat and Power	Water Power Imports from Quebec	Darlington Re-Build
2.3 to 4.6 cents per kWh	5.7 to 6.0 cents per kWh	6.5 cents per kWh	19 to 37 cents per kWh

On April 18, 2008 the *Toronto Star* reported that the Bruce A Units 1 & 2 re-start was \$300 to \$650 million over budget.<sup>32</sup>

On July 6, 2009 when George Smitherman was Minister of Energy & Infrastructure, the Bruce Power contract was amended to cap the cost overruns that can be passed on to Ontario's electricity consumers at \$3.4 billion.<sup>33</sup>

#### Darlington New Build Competitive Procurement Process

On March 7, 2008, Ontario's then Minister of Energy, Gerry Phillips, announced that Ontario was proceeding with a competitive procurement process for the construction of two new nuclear reactors at the Darlington Nuclear Generating Station. Minister Phillips invited four companies to submit bids: Areva, Atomic Energy of Canada Limited (AECL), GE Hitachi Nuclear Energy and Westinghouse Electric Company.<sup>34</sup>

As of June 16, 2008, according to the Government's proposed procurement process, the successful bidder would **not** be required to submit a fixed price bid for building the two new nuclear reactors. That is, the winning bidder would be allowed to pass on at least some of its capital cost overruns to Ontario's electricity consumers.<sup>35</sup>

On June 20, 2008, George Smitherman became Ontario's Minister of Energy and Infrastructure. Minister Smitherman amended the procurement process to require the bidders to submit a fixed price bid. AECL was the only bidder that "met the province's demand that the vendor assume all the risk for cost overruns."<sup>36</sup> However, AECL's price for building new nuclear reactors, \$10,800 per kW, was 3.7 times higher than the Ontario Power Authority forecast of \$2,900 per kW.<sup>37</sup> As a consequence, Minister Smitherman suspended the nuclear procurement process and said that Ontario will only proceed with the construction of new nuclear reactors if the Government of Canada will subsidize their cost.<sup>38</sup> To-date Prime Minister Stephen Harper has not responded positively to this request.

#### Recommendations

- 1. To protect Ontario's electricity consumers and taxpayers from a capital cost overrun of up to \$21 billion or more the Government of Ontario should subject the Darlington Re-Build proposal to the Level Playing Field Rule first espoused by George Smitherman. That is, the Government of Ontario should tell Ontario Power Generation (OPG) that it will not be allowed to pass on any capital cost overruns associated with re-building the Darlington Nuclear Generating Station to Ontario's electricity consumers or taxpayers. To proceed with the Darlington Re-Build proposal and to comply with the Level Playing Field Rule, OPG must find a third party (e.g., Areva, Atomic Energy of Canada, Bruce Power, General Electric) that will agree to re-build Darlington under a fixed price contract.
- 2. The Government of Ontario should direct the Ontario Power Authority to aggressively pursue the lower cost and lower risk options to meet our electricity needs. That is, energy efficiency investments, combined heat and power and water power imports from Quebec.

4 Ontario Clean Air Alliance Research Inc. - The Darlington Re-Build Consumer Protection Plan

#### Appendix A: Ontario's History of Nuclear Cost Overruns and Ontario Hydro's Stranded Nuclear Debt

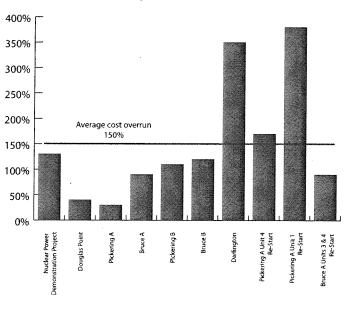
#### Ontario's History of Nuclear Cost Overruns

Every nuclear project in Ontario's history has gone over budget.

- The original cost estimate for the 20 megawatt (MW) Nuclear Power Demonstration Project on the Ottawa River was \$14.5 million.<sup>39</sup> The actual cost was 2.3 times higher at \$33 million.<sup>40</sup>
- The original cost estimate for the 200 MW Douglas Point Nuclear Power Station on Lake Huron was \$60 million.<sup>41</sup> The actual cost was 1.4 times higher at \$85 million.<sup>42</sup>
- In 1967 Ontario Hydro estimated that the 2,160 MW Pickering A Nuclear Generating Station would cost \$527.65 million.<sup>43</sup> The actual cost was 1.3 times higher at \$700 million.<sup>44</sup>
- In 1969 Ontario Hydro estimated that the 3,200 MW Bruce A Nuclear Generating Station would cost \$944 million.<sup>45</sup> The actual cost was 1.9 times higher at \$1.8 billion.<sup>46</sup>
- In 1975 Ontario Hydro estimated that the 2,160 MW Pickering B Nuclear Generating Station would cost \$1.8 billion.<sup>47</sup> The actual cost was 2.1 times higher at \$3.8 billion.<sup>48</sup>
- In 1975 Ontario Hydro estimated that the cost of the 3,200 MW Bruce B Nuclear Generating Station would be \$2.7 billion.<sup>49</sup> The actual cost was 2.2 times higher at \$5.9 billion.<sup>50</sup>
- In 1975 Ontario Hydro estimated that the cost of the 3,400 MW Darlington Nuclear Generating Station would be \$3.2 billion.<sup>51</sup> The actual cost was 4.5 times higher at \$14.319 billion.<sup>52</sup>
- In 1999 Ontario Power Generation (OPG) estimated that the total cost of returning the shutdown Pickering A Unit 4 to service would be \$457 million.<sup>53</sup> The actual cost was 2.7 times higher at \$1.25 billion.<sup>54</sup>

- In 1999 OPG estimated that the total cost of returning the shutdown Pickering A Unit 1 to service would be \$213 million.<sup>55</sup> The actual cost was 4.8 times higher at \$1.016 billion.<sup>56</sup> Nevertheless, a February 2010 OPG news release asserted that the project was completed "on budget".<sup>57</sup>
- Bruce Power estimated that the total cost of returning the shutdown Bruce A Units 3 and 4 to service would be \$375 million. The actual cost was 1.9 times higher at \$725 million.<sup>58</sup>
- In 2005 the Ontario Power Authority signed a contract with Bruce Power for the return to service of the shutdown Bruce A Units 1 and 2. In 2005 the estimated capital cost was \$2.75 billion. The units have still not been returned to service, but in February 2010 TransCanada Corp. (a major shareholder of Bruce Power) estimated that the project will cost \$3.8 billion.<sup>59</sup>

On average, the actual costs of the Ontario nuclear projects that have been completed to-date have exceeded their original cost estimates by 2.5 times.



Fool me once, shame on you. Fool me twice, shame on me. Fool me 11 times...

#### **Ontario's History of Nuclear Cost Overruns**

#### Ontario Hydro's Stranded Nuclear Debt

In 1999, as a result of the cost overruns and the poor performance of its nuclear reactors, Ontario Hydro was broken up into five companies. All of its generation assets were transferred to Ontario Power Generation (OPG). In order to keep OPG solvent, \$19.4 billion of Ontario Hydro's debt or unfunded liabilities associated with electricity

generation facilities was transferred to the Ontario Electricity Financial Corporation (an agency of the Government of Ontario) as "stranded debt" or "unfunded liability".<sup>60</sup>

The Ontario Electricity Financial Corporation (OEFC) collects revenues from the following sources to help pay off the nuclear stranded debt.

- A debt retirement charge of 0.7 cents per kWh which is levied on all Ontario electricity consumers.
- All of the provincial income tax payments from OPG, Hydro One and Ontario's municipal electric utilities (e.g., Toronto Hydro).

• All of the dividend payments from OPG and Hydro One to their sole shareholder, the Government of Ontario.

In 2009, the sum of the above-noted nuclear debt retirement payments was \$1.8 billion.<sup>61</sup> This is equivalent to an annual nuclear debt retirement charge of \$137.73 per person in Ontario or \$551 for a family of four.<sup>62</sup>

The defunct Ontario Hydro's nuclear debt costs Ontario's consumers and taxpayers \$1.8 billion per year. In 2001 the OEFC forecast that the nuclear debt would be fully paid off "in the years ranging from 2010 to 2017".<sup>63</sup> However, as of 2009, the debt has only been reduced by \$3.2

billion to \$16.2 billion.<sup>64</sup> The OEFC is now forecasting that the debt will be eliminated between 2014 and 2018.<sup>65</sup>

#### Endnotes

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- 2 Ontario Energy Board Docket No. EB-2010-0008, Exhibit D2, Tab 2, Schedule 1, Page 11.
- 3 Ontario Energy Board Docket No. EB-2010-0008, Exhibit L, Tab 10, Schedule 014.
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- 9 Ontario Ministry of Energy, Science and Technology, Direction for Change: Charting a Course for Competitive Electricity and Jobs in Ontario, (November 1997), page 7. The Ontario nuclear industry often claims higher average capacity utilization rates by ignoring the performance of reactors that are temporarily or permanently and pre-maturely shutdown.
- 10 Email from Carrie Reid, Customer Relations, Independent Electricity System Operator to Jack Gibbons, Ontario Clean Air Alliance, June 24, 2010.
- 11 OPG Review Committee, Transforming Ontario's Power Generation Company, (March 15, 2004), Page 50.
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- 16 Letter from CIBC World Markets Inc. to James Gillis, Ontario Deputy Minister of Energy, October 17, 2005.
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- 18 According to OPG, assuming 70% equity financing and a required equity rate of return of 18%, the Darlington Re-Build will produce electricity at a total cost of 10 to 14 cents per kWh (assuming an 82% capacity utilization rate) or 12 to 18 cents per kWh (assuming a 64% capacity utilization rate). Furthermore, according to OPG, the Darlington Re-Build's non-capital costs (i.e., operating, maintenance, administration and fuel costs) are 3.9 to 5.2 cents per kWh. All costs are in 2009\$. We have increased OPG's estimated capital costs

per kWh by a factor of 2.5 to calculate the impact of a 150% capital cost overrun on the Darlington Re-Build's total cost of power. Ontario Energy Board Docket No. EB-2010-0008, Exhibit L, Tab 10, Schedules 003 and 006.

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- 22 Assuming energy efficiencies of 80 to 90% and an average annual capacity utilization rate of 90%. Ontario Power Authority, *Integrated Power System Plan*, Exhibit I, Tab 31, Schedule 90.
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- 24 Integrated Power System Plan, Exhibit L, Tab 8, Schedule 7: Thomas R. Casten, Recycled Energy Development LLC, The Role of Recycled Energy and Combined Heat and Power (CHP) in Ontario's Electricity Future, page 3.
- 25 Catherine Strickland & John Nyboer, MK Jaccard and Associates, *Cogeneration Potential in Canada: Phase 2*, (April 2002), page 30.
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- 63 Ontario Electricity Financial Corporation, *Annual Report* 2001, page 29.
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- 65 Ontario Electricity Financial Corporation, Annual Report 2009, page 20.
- 66. According to the NB Power Group's 2007/08 Annual Report, total construction costs, excluding replacement fuel and purchased power costs, would be approximately \$1 billion (see page 20). According to recent reports, the project is approximately \$1 billion over budget. See Chris Morris, "Leaders spar over Lepreau", Telegraph-Journal, (August 23, 2010).



#### Ontario Clean Air Alliance Research Inc.

625 Church Street, Suite 402 Toronto M4Y 2G1 Tel: (416) 926-1907 ext. 246 Fax: (416) 926-1601

E-mail: contact@cleanairalliance.org Web Site: www.cleanairalliance.org

# **DIRECTION FOR CHANGE**

Charting a Course for Competitive Electricity and Jobs in Ontario

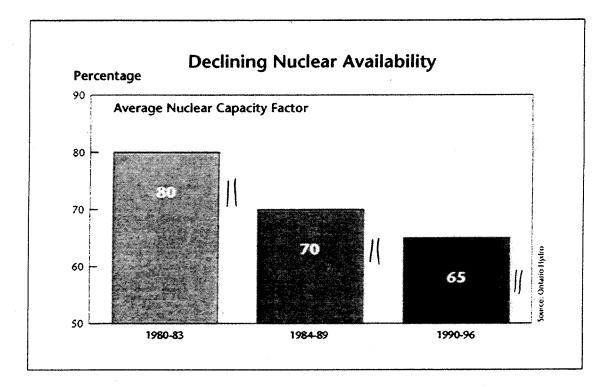


Pibs 3600e

ISBN 0-7778-6867-9

Printed on recycled paper

Ontario Hydro has written-off more than \$7 billion in non-performing assets over the last five years. It could be facing additional write-offs related to the Pickering A and Bruce A nuclear stations. Write-offs occur in business because of significant, unexpected changes in market conditions and technology. In Ontario Hydro's case, they also reflect a record of poor decision-making over the last ten years.



# ONTARIOPOWER GENERATION

#### **ANNUAL INFORMATION FORM**

FOR THE YEAR ENDED DECEMBER 31, 2000

**ONTARIO POWER GENERATION INC.** 

April 30, 2001

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Station	No. of In Service Units	Net In Service Capacity per Unit (MW) <sup>(1)</sup>	Net In Service Capacity (MW)	Capacity Factor <sup>(1)</sup>	% of Nuclear Capacity <sup>(1)</sup>	Net Energy (TWh) <sup>(1)</sup>	% of Nuclear Net Energy <sup>(1)</sup>	Original Unit In Service Dates	Estimated Operating Life <sup>(2)</sup>
Darlington	4/4	881	3,524	85.9%	25	26.6	44	1990-1993	2022-
Pickering A <sup>(3)</sup>	0/414)	515	2,060	0%	15	(0.1)	0	1971-1973	2025 2011- 2013 <sup>(5)</sup>
Pickering B	4/4	516	2,064	55.6% <sup>(12)</sup>	15	10.1	17	1983-1986	2013-
Bruce A <sup>(3)</sup>	0/4	769	3,076	0%	22	(0.1)	0	1977-1979	2016 TBD <sup>(7)</sup>
Bruce B <sup>(6)</sup>	4/4	785(8)	3,140(9)	84.7%	23	<u>23.4</u>	<u> 39</u>	1984-1987	2012-
Subtotal	<u>12/20</u> <sup>(4)</sup>		13,864	78.3%(10)	100	59.8(11)	100		2015
Total Excluding									
Bruce A and B	<u>8/12</u> <sup>(4)</sup>		7.648	<u>74.7%</u>		<u>36.7</u>			

#### Summary of Nuclear Generating Facilities and Performance (2000)

#### Notes:

(1) Net capacity and production information is provided as at or for the year ended December 31, 2000.

- (2) With the exception of Pickering A, the estimated operating life of each nuclear generating station is assumed to end when substantial capital expenditures are required to replace life-limiting components such as fuel channels and steam generators, typically after 25 to 30 years of operation. The operating lives of these stations can be extended with substantial capital expenditures but OPG will incur these expenditures only if justified by prevailing economic, financing and market conditions.
- (3) 5,136 MW of capacity is not in service as a result of the short term lay-up of Pickering A and the longer term lay-up of Bruce A under OPG's nuclear recovery plan. See "-Nuclear Recovery Plan".
- (4) OPG applied to the Canadian Nuclear Safety Commission to restart the four Pickering A units incrementally at approximately six to nine month intervals commencing in early 2002. See "- Nuclear Recovery Plan".
- (5) OPG replaced the pressure tubes of Pickering A between 1984 and 1993 after the discovery of a design flaw. Thereafter, OPG extended the operating life estimate for Pickering A to 40 years because of these new pressure tubes and the operating condition of the existing steam generators.

(6) OPG has agreed to enter into a long-term lease for the Bruce A and B stations, which is expected to close by the end of the second quarter of 2001.

(7) Bruce Power recently announced its intention to restart two of the four nuclear units at Bruce A by 2003, provided it receives regulatory approval. See "Bruce Decontrol".

(8) New capacity rating of 790 MW is effective January I, 2001 to reflect new technical limits on maximum reactor power. Each Bruce B unit had been de-rated from 860 MW to 785 MW in January 1998.

- (9) Net in-service capacity of Bruce B increased to 3,160 MW effective January 1, 2001.
- (10) The percentage represents the average capacity factor for in-service units.
- (11) Numbers may not add up exactly due to rounding.

(12) This figure is primarily due to the planned five week vacuum building outage at Pickering B described above.

#### Unit Lay-Up and Restart

One of OPG's key strategic initiatives is the restart of the four laid-up units of the Pickering A station. The return to service of these units will add 2,060 MW of low cost and smog free nuclear production capacity. Subject to receiving Canadian Nuclear Safety Commission approval, OPG plans to return the first unit to service in early 2002, with the remaining three units being added at approximately six to nine month intervals thereafter. The total cost of this project, the majority of which is being expensed, is approximately \$1.1 billion, of which approximately \$200 million had been incurred as of December 31, 2000.

#### Calculation of All-In Capacity Factor for Ontario's Nuclear Units in Year 2000

Net Energy (MWh)

Net In Service Capacity (MW) x Number of Hours in a Year

=

59.8 TWh

13,864 MW x 8760 hours

=

59,800,000 MWh

121,448,640 MWh

= .49 or 49%

# REPORT of the PICKERING "A" REVIEW PANEL

December 2003

## **Pickering Review Panel**

The Citadel Suite 830, 1075 Bay St. Toronto, Ontario, M5S 2B1 Telephone: (416) 212-4477 Hon. Jake Epp, P.C., BA., B.Ed.LL.D (Hon.) Peter Barnes Dr Robin Jeffrey FREng

November 30, 2003

The Honourable Dwight Duncan, MPP Minister of Energy 4<sup>th</sup> Floor, Hearst Block 900 Bay Street Toronto, Ontario

Dear Minister:

The Pickering "A" Review Panel has the honour of presenting our report to you in accordance with the terms of reference set out for the review in May 2003.

We would like to express appreciation to the participants who contributed to our understanding of the many, complex issues associated with the Pickering "A" return to service project. The Panel would also like to acknowledge the cooperation provided by officials from Ontario Power Generation.

Finally, we wish to thank the staff from the Ontario Financing Authority of the Ministry of Finance and Ministry of Energy for the assistance they provided to the Panel over the course of its review.

Respectfully submitted,

~ L ~

The Honourable Jake Epp Chair

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Dr. Robin Jeffrey

#### Introduction

In late September 2003, the first of four Pickering A reactors (designated Unit 4) returned to service. Compared with the plan approved by the Board of Directors of Ontario Power Generation, Inc. (OPG) in August 1999, the cost for Unit 4 return to service had almost tripled, and the return to service date had slipped by more than two years.

These facts are alarming, but they are not the only price paid. The delay in the return to service of Pickering A has adversely affected Ontario's electricity sector and pushed up prices for residential and business consumers. The costs and delays of the project have also reduced OPG's revenues, capital resources and corporate value. But perhaps most seriously, faith has been compromised in the affordability and certainty of the supply of electricity vital to Ontario's citizens and businesses.

While the analysis of what went wrong provides a catalogue of problems, ultimate responsibility must lie with the OPG Board and senior management and how they exercised their oversight responsibilities.

The failings of the Unit 4 restart execution have been recognized by OPG, and over the past few months, more appropriate project management and oversight arrangements have been put in place.

The Panel considers it imperative that the decision on whether to continue with the restart of the remaining units be made as soon as possible. To make this decision, OPG must provide the Government and the Minister of Energy with a firm estimate of cost and timelines for completion.

This report sets out the findings and recommendations of the Review Panel's investigation.

#### THE REPORT OF THE PICKERING "A" REVIEW PANEL

#### Mandate and Scope

The Pickering "A" Review Panel was established at the end of May 2003 with the following terms of reference:

- Determine the reasons and reasonableness of the changes in the schedule and return to service dates.
- Determine the reasons and reasonableness of cost estimates and cost increases.
- Review the financial reporting for project costs.
- Make recommendations to the Minister on means of improving the management of the project to restore the Pickering A Generating Station to full operation, including measures to ensure the cost-effective and timely completion of the project.

The Panel began its work in June 2003 and has:

- Held more than 40 days of working sessions.
- Reviewed over 300 documents including key reports, management memoranda, submissions to the OPG Board, internal project reviews, and an external study on performance metrics.
- Met with members of the OPG Board of Directors.
- Interviewed senior OPG executives and a number of current and former Pickering A project managers.
- Met with the leadership of the Power Workers' Union and the Society of Energy Professionals.
- Met with senior staff from two main contractors:
  - Atomic Energy of Canada Limited (AECL), the federal Crown corporation that acted as an independent consulting engineer to OPG; and
  - Canadian Nuclear Engineers and Constructors (CANEC), the joint venture that was initially involved as the general contractor and project director.<sup>1</sup>
- Discussed the project and the regulatory process with officials from the Canadian Nuclear Safety Commission (CNSC).
- Received presentations from Schiff, Hardin & Waite, a U.S. firm with expertise in construction law.<sup>2</sup>
- Visited the Pickering A Generating Station to review and discuss the project.

<sup>&</sup>lt;sup>1</sup> CANEC was formed for this project in June 1999 as a joint venture of Stone & Webster of Canada L.P., Comstock Canada Ltd., and Canatom NPM/BFC Industrial.

<sup>&</sup>lt;sup>2</sup> OPG retained Schiff, Hardin & Waite in March 2003 to undertake an independent review and root-cause analysis audit to determine the reasons for the problems encountered with Unit 4 and identify key lessons learned from Unit 4 applicable to the return of the remaining units. Schiff, Hardin & Waite were assisted by J. Wilson & Associates and by Myer Construction Consulting.

#### Then and Now

In January 1997, Ontario Hydro, the predecessor to OPG, commissioned an Independent, Integrated Performance Assessment (IIPA) of Ontario's nuclear plants. The IIPA pointed out shortcomings in performance and concluded that the performance of Ontario's stations was well below that being achieved by the world's best nuclear stations.

Shortly after the release of the IIPA, Ontario Hydro endorsed a plan that included the temporary lay-up of the four units at Pickering A and the three operating units at Bruce A so that resources could be focussed on upgrades to the remaining operating units at Bruce B, Pickering B and Darlington. In addition to declining performance, the decision to lay up the Pickering A station also reflected the fact that the federal nuclear regulator, the Atomic Energy Control Board (AECB),<sup>3</sup> had earlier established that the station could not operate after the end of 1997 without enhancements to its shutdown system.

The four units at Pickering A were laid up by the end of 1997 and the three at Bruce A by May 1998. A major difference between these two lay-ups was the decision to remove the fuel in the reactors at Bruce A, but leave the fuel in the Pickering A reactors, reflecting management's view that Pickering A would be returned to service sooner than Bruce A.

The Ontario Hydro Board of Directors approved work supporting the restart of all four units at Pickering A in August 1997, based on a budget of \$780 million and an expectation that the first unit would return to service in June 2000. This estimate was revised in May 1999 to \$840 million to reflect increased labour costs.<sup>4</sup>

The August 1999 approval to proceed by the Board of Directors of the newly created OPG was based on a total project cost of \$1.1 billion with the following breakdown by unit: \$457 million for Unit 4 and systems common to all four units, \$213 million for Unit 1, \$219 million for Unit 2, and \$211 million for Unit 3.

When Pickering A Unit 4 returned to commercial service at the end of September 2003, the costs had nearly tripled from the \$457 million estimate, and the return to service was more than two years behind the August 1999 schedule.

Three units remain out of service. OPG did not provide to the Panel an estimate for the cost of returning all four units to service. All that was made available was a range of estimates they had

<sup>&</sup>lt;sup>3</sup> The Atomic Energy Control Board was the predecessor to the Canadian Nuclear Safety Commission, which came into being on May 31, 2000.

<sup>&</sup>lt;sup>4</sup> Neither of these early estimates included the costs of operations, maintenance and administration (OM&A) during the start-up phase. Starting from August 1999, estimates reported by OPG included an estimated cost for pre-startup OM&A of \$200 million.

prepared for financial modelling purposes of \$3 to \$4 billion. Timelines for completion of the last unit range from October 2006 to August 2008.

OPG is currently undertaking some physical work on Unit 1, as well as completing design engineering, planning and assessing, and verifying detailed estimates by contractors. It is understood that in early 2004, OPG will present to its Board a detailed cost estimate for returning Unit 1 to service. Given that the current expenditure on the remaining three reactors is about \$25 million per month, it is critical that a decision on whether to continue with the return to service of additional units be made as soon as possible.

Figure 1 below highlights the degree to which costs have escalated and schedules have extended beyond the original plan.

	gure	1. 1111	e anc	i Cost	Estin	iales		
UN	IT 4 and	Common	Systems	;				
Aug	1999 Esti	mate:						
	\$457	millionI	Mid-2001	In-Service I	Date			
Actu	ıal:		I					
			\$1.25 bi	llion—Sep	t. 2003 In	-Service Da	te	
			-					
Tota	al Project	:: Four Ur	nits and (	Common	Systems			
	a <b>l Project</b> 1999 Estin		nits and (	Common	Systems			
		mate:			Systems	t In-Service	Date	
Aug	1999 Estin	mate: \$1	.1 billion-	—Dec. 2003	2 Last Uni			
Aug	1999 Estin	mate: \$1	.1 billion-	—Dec. 2003	-			for a second
Aug	1999 Estin	mate: \$1	.1 billion-	—Dec. 2003	2 Last Uni			illion Oct. 2006 - Aug. 2008 In-Service Range

#### THE REPORT OF THE PICKERING "A" REVIEW PANEL



March 15, 2004

The Honourable Dwight Duncan, MPP Minister of Energy 4<sup>th</sup> Floor, Hearst Block 900 Bay Street Toronto, Ontario

#### Dear Minister:

In accordance with your direction of December 16, 2003, we have the honour of presenting to you our report on the future role of Ontario Power Generation Inc. (OPG) in the electricity sector; the future structure of OPG; the appropriate corporate governance and senior management structure; and the potential refurbishing of Pickering A Units 1, 2, and 3.

We would like to thank the many people who helped us to better understand the complex issues surrounding the current circumstances of OPG, the Pickering Return to Service Project and the Ontario electricity sector in general.

We would particularly like to thank the staff members from across the Ontario Public Service who provided support in the areas of logistics, research and public policy advice.

Respectfully submitted,

#### Original signed by

The Honourable John Manley, P.C., M.P., B.A., LLB, Chair

The Honourable Jake Epp, P.C., B.A., B.Ed., LL.D.

Peter C. Godsoe, O.C.

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**Operating Life Ending:** This estimates how long Unit 1 will produce electricity after it returns to service.

OPG is currently working on producing a tighter estimate of project cost, essentially to reduce the expected range of the outcome. This is expected to be ready at the end of this month.

Weighted Average Cost of Capital and Discount Rate: In performing the analysis, our advisors tested the Unit 1 project using a "weighted average cost of capital" in a range of 10 to 15%. This established the discount rates used to calculate the present value of future cash flows in the project. Generally, the higher the discount rate, the higher the perceived risk of a project. The 10% rate reflects OPG's corporate discount rate and might also reflect OPG's cost of capital under rate regulation. The 15% rate reflects the higher risk profile that might be attributed to a nuclear refurbishment project.

**Price of Power:** The business case analysis depended heavily on the projected price of electricity. We used a price projection provided by OPG that is based on the current market structure.

We have also tested some options using projected prices at the level that would likely be needed to attract a new 515 MW combined cycle gas plant. This type of gas plant would be the next best alternative to refurbishing Unit 1, because it could be built reasonably quickly and would provide a similar level of output for baseload supply. The projected prices for electricity that would be needed to make the gas plant investment attractive are higher than in our business case analysis. Since higher prices in future would improve the economics of the project, this makes the case for Pickering A Unit 1 even stronger.

#### **Sunk Costs**

Total costs of work to date, or "sunk costs," on Unit 1 are significant. With any complex construction project, money has to be invested up front in exploratory work to ensure the budget is accurately developed and potential obstacles are identified. As well, because returning all four units at Pickering A was originally conceived as a single project with multiple phases, some work was completed on Unit 1 while the Unit 4 work was going on. The Unit 1 sunk costs are about \$325 million, placing the total project cost in the range of \$775 to \$925 million. The base case estimate is \$825 million.

Our main focus in each analysis has been on the go-forward cost of the project, compared with the electricity and returns that can be generated from that go-forward investment.

**OPG** Review Committee

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# Ministry Energy

#### News

#### **NEWS RELEASE**

7 July, 2004

#### **Ontario Government Restarts Pickering Unit To Increase Electricity Supply**

Project Will Deliver Enough Clean and Affordable Electricity To Power 350,000 Homes

**QUEEN'S PARK** — Energy Minister Dwight Duncan today approved an Ontario Power Generation (OPG) plan to restart a laid-up unit at the Pickering A nuclear plant to address the growing demand for electricity in Ontario.

"We are facing a looming electricity supply gap and must leverage power that is most readily available to us," Duncan said. "The restart of this Pickering unit will deliver enough affordable electricity to power 350,000 Ontario homes, or a city the size of London."

The return to service of Pickering A, Unit 1 offers the shortest lead-time of any of the major electricity supply projects available in Ontario, and is crucial to ensure a clean, diverse and reliable power supply in the province. The unit will generate 515 megawatts of electricity and is expected to cost Ontario Power Generation approximately \$900 million. The project could be completed within the next fifteen months.

"The lack of transparency and accountability at OPG under the former government led to a serious waste of money - we will do things differently, " Duncan said. "I am not willing to write OPG another blank cheque. I have directed OPG to report regularly to the public on the progress of this project, and we have an independent auditor in place to help ensure the project stays on track."

In December 2003, the Pickering A Review Panel, chaired by former federal cabinet minister Jake Epp, issued a report that found mismanagement on the part of OPG and a lack of oversight by the previous government. In response, Duncan appointed a new board of directors, chaired by Epp, and accepted the resignations of a number of senior OPG officials. A shareholder declaration was also passed to ensure that major decisions by OPG are approved by the provincial government.

"There are many differences in our approach to the Unit 1 project this time around," Epp said. "The project is ready to go and our third-party auditors will continue to monitor the progress of the restart. OPG is satisfied that every precaution has been taken to ensure that the refurbishment stays on track."

The restart of the Pickering unit is a significant step toward meeting the government's commitment to replacing coal-fired electricity in Ontario.

"The power produced from this project will go a long way toward cleaning up our air and

Ministry of Energy :: News

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#### replacing coal-fired generation in the province," Duncan said.

- 30 -

#### For consumer information call 1 888 668 4636

Contact:

Angie Robson Minister's Office (416) 327-6747

Ted Gruetzner Communications Branch (416)327-4334

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from Ontario Power Generation

700 University Avenue Toronto, Ontario M5G 1X6

Tel: 416-592-4008 or 1-877-592-4008 Fax: 416-592-2178 www.opg.com

November 11, 2005

#### ONTARIO POWER GENERATION REPORTS 2005 THIRD QUARTER FINANCIAL RESULTS

[Toronto]: Ontario Power Generation Inc. ("OPG" or the "Company") today reported its financial and operating results for the third quarter and nine months ended September 30, 2005. Net income for the three months ended September 30, 2005 was \$181 million or \$0.71 per share compared to a net loss of \$15 million or \$0.06 per share for the same period in 2004. For the nine months ended September 30, 2005, net income was \$206 million or \$0.80 per share compared to \$8 million or \$0.03 per share for the same period last year.

Effective April 1, 2005, the output from OPG's baseload hydroelectric and nuclear facilities became rate regulated, while output from its remaining hydroelectric facilities, and its fossil-fuelled and wind generating stations remain unregulated. However, the majority of the generation output from these unregulated facilities is subject to a revenue limit of 4.7¢/kWh to April 30, 2006. As a result of these changes and higher average Ontario spot market prices due to a prolonged period of high temperatures in the June to September time frame and the impact of higher natural gas prices, OPG received average prices of 5.4¢/kWh and 4.9¢/kWh respectively for the output from all of its generating facilities during the three and nine months ended September 30, 2005. While this was an increase compared to OPG's realized average prices of 4.0¢/kWh and 4.2¢/kWh for the same periods last year, it was considerably less than the average hourly Ontario electricity prices (HOEP) of 8.6¢/kWh and 6.7¢/kWh for the three and nine month ended September and nine month periods in 2005.

"Our third quarter financial results reflect higher realized electricity prices as well as increased production, compared to the third quarter of 2004. In particular, our fossil stations responded to record setting Ontario energy demand by producing 45 per cent more electricity than in the third quarter of 2004. Our year-to-date 2005 earnings exceed 2004 earnings for the same period and we expect this trend to continue to the end of 2005," said President and CEO Jim Hankinson.

Electricity production during the three months ended September 30, 2005 from OPG's generating stations was 27.1 TWh compared to 26.0 TWh during the same period in 2004. The increase in generation was primarily a result of significantly higher fossil-fuelled generation attributable to higher electricity demand especially during a period of record high temperatures in the third quarter of 2005.

For the nine months ended September 30, 2005, total production from OPG's generating stations was 81.4 TWh compared to 78.9 TWh for the same period in 2004. The increase in generation was primarily a result of higher fossil-fuelled generation in 2005, due to higher electricity demand and improved station performance, and higher nuclear generation due to improved station performance at OPG's Pickering B and Darlington generating stations. Hydroelectric generation during the first nine months of 2005 has been negatively impacted by lower water levels.

OPG's third quarter earnings were favourably impacted by an increase in gross margin from electricity sales primarily due to higher average sales prices during the third quarter of 2005 compared to the same period in 2004. Earnings were also favourably impacted by the establishment of a deferral account for non-capital costs related to the Pickering A nuclear generating station return to service project as required by a regulation pursuant to the *Electricity Restructuring Act, 2004*.

Earnings during the nine months ended September 30, 2005 were favourably impacted by an increase in gross margin during 2005 primarily as a result of higher average sales prices due to higher temperatures in the June to September period, higher nuclear and fossil generation, and the deferral of non-capital costs related to the Pickering A return to service project commencing in 2005. These favourable impacts were partly offset by an impairment loss on OPG's Lennox generating station recorded during the first quarter of 2005, and the impairment loss on Units 2 and 3 of the Pickering A nuclear generating station, recorded during the second quarter of 2005. In addition, earnings were impacted by higher nuclear maintenance and repairs related to continuing improvements in station reliability, and a onetime extraordinary loss to reflect the impact of adopting rate regulated accounting for income taxes effective April 1, 2005.

In August 2005, following consideration of the costs and risks associated with returning Units 2 and 3 of the Pickering A nuclear generating station to service, and taking into account the Company's current focus on improving the performance of its operating nuclear units, OPG's Board of Directors decided that while technically feasible, the return to service of these units was not justified on a commercial basis. Accordingly, an impairment loss representing the carrying value of these units was recorded in OPG's second quarter results. Units 2 and 3 have been maintained in a safe shutdown state since December 1997. Over the next two years, the fuel and heavy water will be removed from the units.

=1.016 billion

On September 26, 2005, Unit 1 at the Pickering A nuclear station was synchronized to the provincial electricity grid, sending electricity from the unit to Ontario consumers for the first time since December 1997. The unit was declared to be commercially available on November 3, 2005. Total costs incurred up to November 3, 2005 were \$996 million, excluding the impact on costs of feeder inspections and replacement of \$20 million, which were not included in the original scope of the project. The project represented a complex management and construction challenge, encompassing more that 1.9 million hours of work and almost 3,000 people at its peak. "The culmination of this project represents an outstanding achievement for OPG," said President and CEO Jim Hankinson.

### OPG Moves to Planning Phase of Darlington Refurbishment

Pickering B to Enter Final Decade of Operation with \$300-Million Investment

#### Feb. 16, 2010

Durham Region – Today, Ontario Power Generation (OPG) announced a two-part investment strategy for its nuclear generating stations in Durham Region.



First, OPG will proceed with a detailed planning phase for the mid-life refurbishment of the Darlington Nuclear Generating Station east of Toronto, with construction expected to start in about 2016. The business decision to move forward with an investment in Darlington

comes after very positive outcomes of initial studies on the plant's condition and continued strong operating performance. The next phase of the process will include an Environmental Assessment, an Integrated Safety Review and an Integrated Improvement Plan that will define the scope, cost and schedule of the refurbishment project.

OPG will also invest \$300 million to ensure the continued safe and reliable performance of its Pickering B station for approximately 10 years. Following this, OPG will begin the longer term decommissioning process as refurbishment for Pickering B station will not be pursued. The first step in this process is to layup the reactors and place them into safe storage. Pickering staff will have future opportunities placing the Pickering units in a safe storage state, at the Darlington refurbishment and operations, or at the potential new build at Darlington.

Extensive safety, environmental and equipment reliability studies conducted at the station concluded the Pickering plant can continue to operate safely and reliably to meet the province's energy needs through to 2020. OPG has indicated to the Canadian Nuclear Safety Commission that later this year it will file a Continued Operation Plan that takes Pickering B to its end of life.

#### "As Ontario's generating company,

OPG's nuclear and hydro fleets are the backbone of the provincial electricity system," said Brad Duguid, Minister of Energy and Infrastructure. "I support this business investment strategy as it aligns with the government's vision for a clean energy future. It is also respectful of employees and it will ensure continued economic benefits to the people of Durham Region and Ontario."

"OPG is committed to continued business investment in Durham Region to meet the electricity production needs of Ontarians," said Tom Mitchell, OPG's President and CEO. "Investing in refurbishment at Darlington and continuing operation at Pickering B provide the best value for the people of Ontario."

"The key to a successful refurbishment is having a clear understanding of the scope and cost of the work we need to do well before we start construction," said Bill Robinson, Executive Vice President Nuclear Projects.

In planning the Darlington refurbishment, OPG will build on the accomplishments and lessons learned during the Pickering A restart and the Pickering safe storage project. The restart of Pickering Unit 1 was completed on time and on budget, and the safe storage project for Units 2 and 3 is currently tracking on budget and on time for completion this year.

#### More Info



Our phone lines are open to answer questions.

- 1-800-461-0034
  Darlington Public Info
- 905-837-7272
  Pickering Public Info
- 1-877-592-4008 Media

#### Darlington Nuclear Backgrounders



- Project Management Principles
- Components of a CANDU Refurbishment
- Frequently Asked Questions

Pickering Nuclear Backgrounders



- Continued Operations
- Summary of Safety and Environment Studies
  - Environmental Assessment
- Integrated Safety Review
- Service History
- Summary Timeline

This phase of the Darlington refurbishment will also reflect the same thorough process undertaken for the Pickering B Environmental Assessment and Integrated Safety Review.

OPG continues to proceed with work that supports the construction and operation of a new nuclear station located at the Darlington site. The Environmental Assessment and site licence work for a potential new build will continue in parallel with the above investment activities.

Print this page.







700 University Avenue Toronto, Ontario M5G 1X6

Tel: 416-592-4008 or 1-877-592-4008 Fax: 416-592-2178 www.ontariopowergeneration.com

February 16, 2010

#### **OPG Project Management Principles**

Ontario Power Generation has considerable experience managing large projects both in our nuclear and non-nuclear generation operations.

Every CANDU unit is designed to have a mid-life refurbishment to allow for major components to be retooled and refurbished. The scope of the refurbishment work in part depends on plant condition. Darlington Nuclear is a station well-maintained through a regular inspection and maintenance regime. Based on this, and on results of further inspections over the past two years, there is strong evidence the plant condition is robust and will remain so as it enters the refurbishment process. The refurbishment planning and study phase over the next five years will validate the extent of plant condition.

Pickering Unit 4 was the first CANDU unit to be returned to service with a significant overhaul of its systems. That project encountered challenges that led to a significant review of our planning and work execution processes on the management of reactor projects. In fact, the lessons learned on the Pickering Unit 4, and a subsequent report by the Honourable John Manley provided recommendations for future project management practices. These were critical inputs, resulting in development of a rigorous planning and project management process. This set the framework for success on the Pickering Unit 1 return to service in 2005. That project was brought in on budget and on time.

Since then, OPG has continued to develop and improve its model for project management on nuclear projects and within other areas of operations. Key to this process is a strong risk mitigation model based on on-going benchmarking and learning, not only from our own projects but from those of others in the nuclear industry, and in non-nuclear industries as well.

Projects OPG has successfully managed in the last couple of years include a comprehensive Pickering B fuel channel inspection and maintenance project and the \$360-million safe storage of Units 2 and 3 at Pickering A (to be completed in 2010). In 2009, OPG also successfully completed two major projects at Darlington Nuclear: a 3,600-task Tritium Removal Facility maintenance outage and the massive Vacuum Building Outage, which included two years of planning, and completion of over 25,000 tasks within a six-week shutdown period. Other recent OPG project successes have included the construction of the Portlands Energy Centre, a 550 MW combined cycle gas-steam generating station in downtown Toronto. The project, a partnership

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billis

Filed: 2010-08-17 EB-2010-0008 Issue 4.5 Exhibit L Tab 10 Schedule 014 Page 1 of 1

#### Pollution Probe Interrogatory #014

- 3 Ref: Ex. D2-T2-S1, Table 3
- 4 5 **Issue Number: 4.5**

**Issue:** Are the capital budgets and/or financial commitments for 2011 and 2012 for the nuclear business appropriate and supported by business cases?

#### Interrogatory

Please extend the time horizon of this Table to show the forecasted capital expenditures for
 Nuclear Generation Development Projects in 2013 and 2014.

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#### 15 **Response**

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- 17 18

The time horizon of Ex. D2-T2-S1, Table 3 is extended to 2013 and 2014 as shown below:

Table 3 Capital Expenditures Summary - Nuclear Generation Development Projects (\$M) Line 2007 2008 2009 2010 2011 2012 2013 2014 Description No. Actual Actual Actual Budget Plan Plan Plan Plan (a) (b) (C) (d) (e) (f) (g) (h) Darlington Refurbishment Darlington Refurbishment Project - Definition Phase 1 0.0 0.0 0.0 44.4 42.2 149.2 266.2 395.5 Darlington Campus Master Plan 2 00 00 10 28.6 63.0 106.6 76.7 48.5 3 Total Darlington Refurbishmen 0.0 0.0 10 72.9 105.2 255.8 342.9 444.0 4 Darlington New Nuclear Project 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 5 Total Generation Development Capital 0.0 0.0 1.0 72.9 105.2 255.8 342.9 444.0

19 20

The Darlington Refurbishment shown here are lower than those shown in the Nuclear Refurbishment Business Plan (Ex. D2-T2-S1, Attachment 1, page 6) because the Business Plan numbers include capitalized interest.

24

As noted in Ex. D2-T2-S1, page 16, OPG has not included any capital costs for new nuclear in its test period revenue requirement because the Province has not yet determined the cost recovery mechanism for that project. For the same reason, the 2013 and 2014 capital expenditures are shown as zero in the table above.

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1	DARLINGTON REFURBISHMENT CONSTRUCTION WORK IN						
2	PROGRESS IN RATE BASE						
3							
4	1.0 PURPOSE						
5	This evidence provides a description of the proposed regulatory treatment of construction work in						
6	progress ("CWIP") associated with OPG's Darlington Refurbishment project.						
7							
8	2.0 OVERVIEW						
9	OPG seeks approval to include CWIP in rate base for the Darlington Refurbishment project,						
10	effective March 1, 2011. This proposal to include CWIP in rate base for the Darlington						
11	Refurbishment project results in rate base being \$125.5M higher in 2011 and 306.0M higher in						
12	2012 as shown in Ex. B3-T1-S1 Table 1 and has a test period impact of \$37.9on the nuclea						
13	revenue requirement. Additional information on this project is provided in Ex. D2-T2-S1.						
14							
15	Section 3 of this exhibit provides the background and context for OPG's proposal to include						
16	CWIP in rate base for the Darlington Refurbishment project. Section 4 presents the proposed						
17	regulatory treatment and its impact. Section 5 discusses OPG's proposal for performance						
18	monitoring and reporting requirements.						
19 20							
20	This proposal is also supported in a study by Charles River Associates. The Charles River Study						
21	provides information on other North American jurisdictions and regulators that have adopted						
22	CWIP in rate base and the benefits that these jurisdictions saw flowing from its adoption. It also						
23	assesses the common arguments for and against the use of this methodology. The study, which						
24	concludes that CWIP in rate base should be adopted in Ontario for large-capital, multi-year						
25	projects, is provided as Ex. D4-T1-S1.						
26							
27	3.0 BACKGROUND						
28	On April 3, 2009, the Chair of the OEB issued a statement initiating a consultation process to						
29	consider amendments to several existing regulatory constructs with the goal of removing barriers						
30	to infrastructure investment in Ontario. In his Statement dated April 3, the Chair indicated:						

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> The magnitude of current and future utility infrastructure investment has led me to consider how the OEB could create conditions which would foster timely investment by utilities in required infrastructure.

5 This was followed up with a second Statement from the Chair, a Staff Discussion Paper and 6 stakeholder submissions. On January 15, 2010, the OEB issued EB-2009-0152, a Report of the 7 Board on The Regulatory Treatment of Infrastructure Investment in connection with Rate-8 regulated Activities of Distributors and Transmitters in Ontario (the "Report"). The Report 9 indicates that the OEB will consider, among other things, applications to include CWIP in rate 10 base on a case-by-case basis, in advance of a project being declared in-service. As concluded in 11 the Report, inclusion of CWIP in rate base is consistent with the Chair's stated objective above 12 and is an important mechanism that is widely used to reduce barriers to investment by utilities<sup>1</sup>.

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The Report, on page 6, defined CWIP in rate base to be a mechanism that would "...allow CWIP to be included in rate base prior to the asset coming into service, thereby allowing the applicant to recover the carrying cost on the capital investment, typically interest costs on debt and a return on the investment." CWIP is defined in the Report as a temporary holding account that captures the expended costs incurred in the design and construction of facilities that meet general capitalization rules and thresholds.

20

On page 15 on the Report, the OEB explains how the CWIP in a rate base model would work indicating that it would "...allow utilities to apply to include up to 100 percent of prudently incurred CWIP costs in rate base. This approach allows utilities to recover the interest costs on debt and a return on equity (i.e. the weighted cost of capital) during the construction period. The depreciation or return of investment will continue to be recovered once the project goes into service." OPG is proposing to adopt the CWIP in rate base model described above for its Darlington Refurbishment project.

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OPG engaged Charles River Associates to generally consider the question of the inclusion of CWIP in rate base. In response, Charles River has provided a study that describes the other North American jurisdictions and regulators that have adopted CWIP in rate base and the

<sup>&</sup>lt;sup>1</sup> See Exhibit D4-T1-S1 for a discussion of the inclusion of CWIP in rate base in other jurisdictions.

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benefits that these jurisdictions saw or expect from its adoption. It also assesses the common
 arguments for and against the use of this methodology. The study, which concludes that CWIP in
 rate base should be adopted in Ontario for large-capital, multi-year projects, is provided as Ex.
 D4-T1-S1.

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#### 6 4.0 PROPOSED REGULATORY TREATMENT

Inclusion of CWIP in rate base for the Darlington Refurbishment project is warranted since it meets the criteria for qualifying investments specified by the OEB in its Report. The project spans a number of years, has material costs associated with it (i.e., it is capital intensive) and it will form a significant portion of OPG's rate base once placed into service. Moreover, the risks of the project are similar to those noted by the OEB for green energy projects, which include risks related to project delays, public controversy, and the recovery of costs. Additional details on these criteria are provided below.

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15 OPG proposes to include the capital costs of the Darlington Refurbishment project in rate base 16 during the construction period consistent with the methodology approved in the OEB's Report. 17 The test period opening balance would include capital costs from January 1, 2010, the point at 18 which project costs began to be capitalized. Additions to rate base over the test period would be 19 based on OPG's capital expenditure forecast for the Darlington Refurbishment project as 20 provided in Ex. D2-T2-S1. OPG proposes that 100 per cent of the forecast capital in rate base 21 receive the OEB-approved weighted average cost of capital ("WACC") and that any recovery of 22 depreciation on this capital be deferred until the assets come into service. Differences between 23 forecast and actual expenditures for the Darlington Refurbishment project will be recorded in the 24 existing Capacity Refurbishment Variance Account as described in Ex H1-T1-S1 section 6.5. 25 This will ensure that both ratepayers and OPG are protected if actual project spending differs 26 from forecast. As with all variance accounts, any disposition from this account would require a 27 review and approval by the OEB.

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As detailed in Ex. D2-T2-S1, the project is currently starting its definition phase. Work addressed within this phase includes detailed engineering and front-end project planning, including the development of the project cost and schedule baseline. The forecast of capital spending on the

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