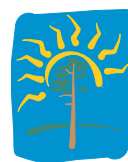


An End to Dirty Power:

A real plan to achieve
a true coal
phase out



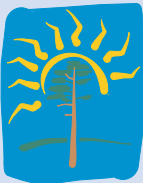
Ontario Clean Air Alliance

NOVEMBER 23, 2006

Table of Contents

- Introduction1
- OPA’s Forecast of Ontario’s Coal-Fired Electricity Requirements2
- The Ontario Clean Air Alliance’s Coal Phase-Out Plan4
 - Benefits4
 - Costs4
 - Capital Costs4
 - Energy Costs5
 - Total Incremental Cost of Phasing-Out Coal by 20095
 - Rate Impacts5
 - Residential Customers5
 - Large Industrial Customers6
 - Residential Customer Bill Impacts.....6
 - Additional Rate and Bill Reductions6
 - Feasibility.....7
- Conclusion8
- Endnotes9

The Ontario Clean Air Alliance is a coalition of health, environmental, and consumer organizations, faith communities, municipalities, utilities, unions, corporations and individuals working for cleaner air through a coal phase-out and the shift to a renewable electricity future. Our partner organizations represent more than six million Ontarians.



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OCAA Members

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Introduction

On June 13, 2006, Ontario's Energy Minister, Dwight Duncan, directed the Ontario Power Authority (OPA) to develop a plan "for coal-fired electricity generation in Ontario to be replaced by cleaner sources in the earliest practical time frame that ensures adequate generating capacity and electricity system reliability in Ontario."¹

In November 2006 the OPA released its draft coal phase-out plan.²

The OPA's proposed coal phase-out plan is as follows.

1. Retain the existing coal-fired generation capacity (6,434 MW) in-service to 2010 with the ability to produce 25-30 terawatt-hours (TWh) of coal-fired electricity per year. (In 2005, Ontario Power Generation produced 29.6 TWh of coal-fired electricity.³)
2. Reduce coal-fired generation capacity to 5,000 MW in 2011 and 3,000 MW in 2012.
3. Potentially install end-of-pipe pollution control devices on up to 3,000 MW of coal-fired generation capacity.
4. Convert the Atikokan coal-fired power plant to biomass.
5. Phase-out all coal burning on December 31, 2014 if and only if a coal phase-out will not jeopardize electricity system reliability.⁴

The OPA's coal phase-out plan is inconsistent with Minister Duncan's directive and the public interest for the following reasons.

1. It does not phase-out coal burning "in the earliest practical time frame that ensures adequate generating capacity and electricity system reliability." Specifically, coal-burning can be phased-out well in advance of 2015 by converting the Nanticoke and Thunder Bay Generating Stations' boilers from coal to natural gas.
2. It will not enable Ontario to meet its Kyoto Protocol obligations in 2010.
3. According to a report prepared for the Ontario Ministry of Energy, installing the best end-of-pipe pollution control technologies on 3,000 MW of Nanticoke's capacity will cost \$1.91 billion.⁵ However, these technologies will not reduce Nanticoke's greenhouse gas emissions by a single tonne. As a result, they will only reduce Nanticoke's total air emissions by one-half of 1%.⁶ This is a band-aid solution the people of Ontario cannot afford.
4. It does not guarantee a coal phase-out in 2015. If Ontario is experiencing a shortage of alternative generation capacity in 2015, it will be necessary to continue to operate the coal plants.

In this report we will:

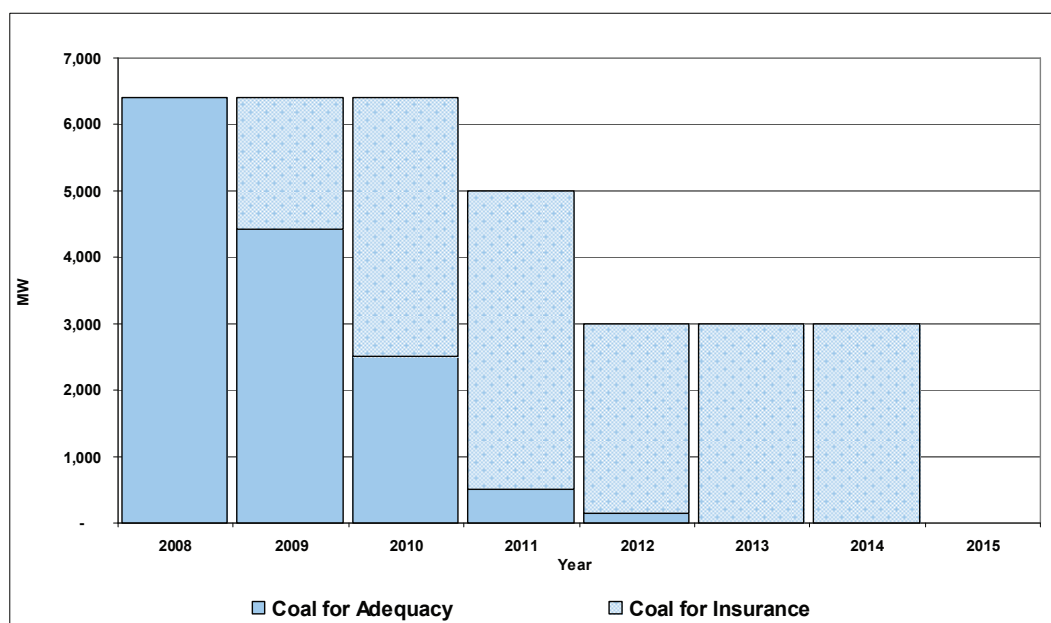
1. Critically review the OPA's forecasts of Ontario's coal-fired electricity requirements;
2. Outline the Ontario Clean Air Alliance's (OCAA's) strategy to permanently phase-out coal by December 31, 2009 without jeopardizing the reliability of Ontario's electricity system; and
3. Compare and contrast the benefits and costs of the OPA's and the OCAA's coal phase-out strategies.

OPA's Forecast of Ontario's Coal-Fired Electricity Requirements

Figure 1 shows the OPA's estimate of the amount of coal capacity Ontario will require from 2009 to 2015 inclusive to maintain the reliability of Ontario's electricity system under two scenarios: a) Coal for Adequacy; and b) Coal for Insurance. The "Coal for Adequacy" scenario estimate is based on the assumption that all of the planned new electricity supplies (conservation and demand management; renewable, natural gas and nuclear generation; and supporting transmission systems) are implemented on time.

The Coal for Insurance Scenario shows the OPA's estimate of the amount of coal-fired capacity Ontario should maintain in case some of the planned new electricity supplies are not implemented on time. According to the OPA, the required amount of "Coal for Insurance" could rise or fall over time. Specifically, the OPA is reserving the right to announce at a later date that we should keep our coal plants operating beyond 2014 for insurance purposes.

Fig. 1 - Range of coal capacity requirements



Source: OPA

According to Figure 1, Ontario's required "Coal for Adequacy" capacity will decline from 4,430 megawatts (MW) in 2009 to zero MW in 2013.⁷

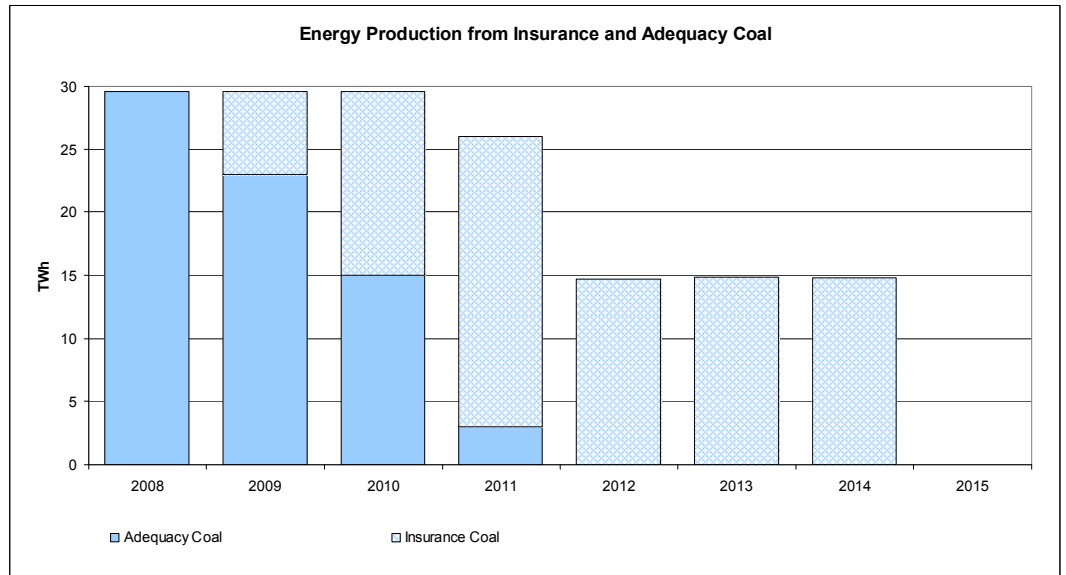
The "Adequacy Coal" bar graphs in Figure 2 show the OPA's estimate of Ontario's required coal-fired electricity generation (TWh) from 2008 to 2015 under the following scenario:

- a) all the planned new electricity supplies are implemented on time;
- b) Ontario makes large net electricity exports to the U.S. (e.g., 14 TWh in 2010)⁸; and
- c) Ontario will continue to operate its coal plants even when new, high-efficiency natural gas-fired power plants can meet our electricity needs at a lower total (financial, health and environmental) cost to society.⁹

As a result of contracts between the OPA and investor-owned power companies, 3,999 MW of new high-efficiency natural gas-fired generation capacity will come into service between 2008 and 2010.¹⁰ These power plants will be able to provide Ontario with 31.5 TWh of gas-fired generation per year.¹¹ As a consequence, by eliminating the forecast coal-fired electricity exports to the U.S. and by increasing

the output of our new high-efficiency natural gas-fired power plants we will be able to completely eliminate the need for “Adequacy Coal” generation in 2010 and 2011.

Fig. 2 - Forecast Coal-Fired Energy Production



Source: OPA

The Ontario Clean Air Alliance's Coal Phase-Out Plan

The OCAA is proposing the following three-pronged strategy to complete the coal phase-out by 2009.

1. Convert the Nanticoke and Thunder Bay Generating Stations's boilers (4,000 MW and 310 MW respectively) from coal to cleaner-burning natural gas by 2009.
2. Phase-out coal-burning at the Lambton Generating Station (1975 MW) when the Greenfield Energy Centre (1005 MW) and the St. Clair Generating Project (570 MW) come into service. According to the Independent Electricity System Operator: a) Greenfield and St. Clair are expected to be in-service in 2008; and b) the Lambton Generating Station can be phased-out after these two new natural gas-fired facilities, near Sarnia, come into service.¹²
3. Convert the Atikokan Generating Station to biomass on a test basis with a ban on co-firing with coal.¹³

Benefits

The benefits of the Ontario Clean Air Alliance's phase-out plan are as follows.

1. It will permit Premier McGuinty to keep his critically important promise to phase-out all of Ontario's coal-fired power plants by 2009 in order to reduce smog and climate change emissions.
2. It will prevent at least 657 deaths in Ontario per year.¹⁴
3. It will reduce Ontario's total (financial, health and environmental) cost of electricity generation by \$1.7 billion per year.¹⁵
4. It will provide Ontario with 50-80% of the total greenhouse gas emission reductions the entire province needs to meet its Kyoto Protocol obligations in 2010.¹⁶
5. The conversion of the three plants to natural gas or biomass will guarantee a permanent coal phase-out by 2009 without compromising our electricity system reliability. The conversion of the Nanticoke and Thunder Bay plants, in particular, can fill the role proposed for coal in both the OPA's "Adequacy" and "Insurance" scenarios more cleanly and in a more climate-responsible manner.

Costs

Capital Costs

According to the OPA, the capital cost of converting Nanticoke's boilers to natural gas would be \$240 million to \$400 million and the capital cost of building a natural gas pipeline to Nanticoke would be \$300 million to \$350 million.¹⁷ Therefore the total capital cost is \$540 million to \$750 million. The mid-point of these estimates is \$645 million. Assuming an 8% cost of capital and a 20 year amortization period, the annual capital cost to ratepayers of the Nanticoke conversion would be \$65.7 million.

According to the Ontario Ministry of the Environment, the capital cost of converting Thunder Bay's boilers to natural gas would be \$6.2 million to \$18.6 million.¹⁸ According to Union Gas, the cost of building a pipeline to the Thunder Bay Gen-

erating Station would be \$29.9 million.¹⁹ Therefore the total capital cost of the Thunder Bay conversion would be \$36.1 million to \$48.5 million. The mid-point of these estimates is \$42.3 million. Assuming an 8% cost of capital and a 20 year amortization period, the annual capital cost to ratepayers of the Thunder Bay conversion would be \$4.3 million.

Therefore the total annual capital cost of the Nanticoke and Thunder Bay conversions would be \$70 million. In 2010, this \$70 million charge would raise electricity rates by 0.046 cents per kWh (less than 5/100ths of a cent per kWh).²⁰

Energy Costs

If Ontario stops exporting coal-fired electricity to the U.S. on December 31, 2009, the OPA's forecast of our required coal-fired electricity generation (see Figure 2) will fall to:

- a) 1 TWh (15 TWh – 14 TWh) in 2010; and
- b) 0 TWh in 2011 and all subsequent years.²¹

As a consequence, phasing-out coal on December 31, 2009 will require Ontario to increase the output of its new, high-efficiency natural gas-fired power plants by 1 TWh in 2010. This in turn will raise Ontario's *domestic energy-related* electricity costs in 2010, relative to the OPA's base case forecast, by \$37.8 million or 0.025 cents per kWh.²²

Total Incremental Cost of Phasing-Out Coal by 2009

Table 1 shows the total incremental costs of eliminating coal-fired electricity generation for the year 2010 and for the years 2011- 2029.

Table 1: Total Annual Incremental Cost of Phasing-Out Coal

	2010	2011-2029
Total Cost	\$107.8 million	\$70 million
Total Cost Per kWh	0.071 cents	0.046 cents

Rate Impacts

Residential Customers

According to the OPA, residential electricity rates will be between 9.238 and 10.029 cents per kWh in 2010.²³ Table 2 shows the rate impact of our coal phase-out plan for residential customers.

Table 2: Rate Impact of Coal Phase-Out for Residential Customers

	2010	2011-2029
Rise in Electricity Rate Due to the Coal Phase Out	0.071 cents per kWh	0.046 cents per kWh
Percentage Rise in Electricity Rates Relative to OPA's Base Case Forecast for 2010	0.7% - 0.8%	0.5%

For 2010, residential electricity rates will be 0.7% to 0.8% higher as a result of the complete coal phase-out on December 31, 2009. In 2011 the rate impact of the coal phase-out will decline to 0.5% relative to the OPA's base case forecast for 2010 rates.

Large Industrial Customers

According to the OPA, electricity rates for large industrial customers will be between 7.467 and 8.271 cents per kWh in 2010.²⁴ Table 3 shows the rate impact of our coal phase-out plan for large industrial customers.

For 2010, the electricity rates of large industrial customers will be 0.9% to 1.0% higher as a result of the complete coal phase-out on December 31, 2009. In 2011 the rate impact of the coal phase-out will decline to 0.6% relative to the OPA's base case forecast for 2010 rates.

Table 3: Rate Impact of Coal Phase-Out for Large Industrial Customers

	2010	2011-2029
Rise in Electricity Rates Due to the Coal Phase Out	0.071 cents per kWh	0.046 cents per kWh
Percentage Rise in Electricity Rates Relative to OPA's Base Case Forecast for 2010	0.9% - 1.0%	0.6%

Residential Customer Bill Impacts

Table 4 shows the impact of the Ontario Clean Air Alliance's coal phase-out strategy on the monthly electricity bill of the average residential electricity customer.

For 2010, the monthly electricity bill of the average residential customer will be 53 cents higher as a result of a complete coal phase-out on December 31, 2009. In 2011 the monthly bill impact will decline to 34 cents for the average residential customer.

Table 4: Monthly Residential Bill Impact of the OCAA's Coal Phase-Out Strategy²⁵

	2010	2011-2029
Increase in Monthly Electricity Bill Due to the Coal Phase Out	53 cents	34 cents

Additional Rate and Bill Reductions

If the OPA were to implement more aggressive energy conservation and efficiency programs, the rate and bill impacts of the coal phase-out would be reduced even more. In fact, we believe the OPA could achieve significantly higher kilowatt savings than it has projected by adopting stronger efficiency targets and incentives.

Feasibility

According to the OPA, conversion of Nanticoke's eight boilers to natural gas would take five years. This claim is simply not credible for a number of reasons. First, in 1998, Ontario Power Generation (OPG) converted two 500 MW boilers at its Lennox Generating Station from oil to dual fuel capability (oil and natural gas) in five months. (According to OPG, it completed this conversion six months ahead of schedule.) Second, virtually all the work except for direct connections, boiler work and commissioning can typically be done while the units are running. Good project scheduling and planning could achieve minimal actual downtime and minimize output losses. Downtime could be in the order of two months per boiler. Thus the total elapsed time for the conversion might more realistically be 15-20 months.

It is also important to note that the OCAA's plan would eliminate the need to add expensive and less effective pollution controls to coal units. Such pollution controls would cost almost three times as much in capital costs and more than twice as much in total incremental costs as the combined conversion of Nanticoke and Thunder Bay.

Similarly, while a boiler conversion at Nanticoke would mean the plant was less efficient than a modern combined cycle gas generator, it would be as efficient as our existing coal plants. Because Nanticoke would be used post-conversion almost exclusively for dealing with peak demand periods on very hot summer days, this lesser efficiency is an acceptable tradeoff for the large improvements in smog and greenhouse gas emissions that would result from burning cleaner natural gas.

Conclusion

The Ontario Clean Air Alliance's strategy to phase-out Ontario's coal-fired power plants by 2009 is superior to the Ontario Power Authority's strategy in every aspect:

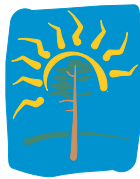
1. The OCAA strategy will permit Premier McGuinty to keep his promise to permanently phase-out Ontario's dirty coal-fired power plants by 2009; whereas the OPA strategy cannot even promise a permanent coal phase-out by 2015.
2. The OCAA strategy will reduce electricity-related sulphur dioxide emissions (asthma, heart and lung disease, strokes and premature mortality) by 99.5%; mercury and lead (neuro-toxin) emissions by 100%; and cancer-causing emissions by (e.g., arsenic, cadmium, chromium) by 100%; the OPA plan offers no such emissions-reduction guarantees.
3. The OCAA strategy will provide Ontario with 50-80% of the total greenhouse gas emission reductions the entire province needs to meet its Kyoto Protocol target by 2010; the province will fall well short with the OPA plan.
4. The OCAA strategy has a lower financial cost than the OPA strategy. Specifically, the total cost of the OCAA strategy is \$725.1 million (a capital cost of \$687.3 million plus incremental energy costs of \$37.8 million) versus the OPA's strategy, which would cost \$1.91 billion.
5. The OCAA strategy will increase the typical residential customer's electricity bill by only 53 cents per month in 2010 and 34 cents per month from 2011 to 2029 in return for eliminating \$1.7 billion per year in health, environmental and economic costs. (This increase is in comparison to the OPA base case scenario, which does not include the \$1.91 billion capital cost of adding pollution controls to certain coal units if they continue to operate.)
6. More aggressive promotion of energy conservation and efficiency by the OPA, as called for by the OCAA and many others, would further reduce the bill impact and increase the benefits of the coal phase-out.

Fundamentally, there is absolutely no reason to wait another decade or more to realize these benefits. A potential cost of 34 to 53 cents per month for the average household is a very small price to pay for cleaner air and a real response to the very real threat of global warming. It also represents a significantly lower cost than would result from outfitting some coal units with pollution controls that would have absolutely no impact on their enormous greenhouse gas emissions. With climate scientists warning us that action on curbing CO₂ emissions is needed now — and not a decade from now — phasing out coal also simply represents the responsible thing to do.

Endnotes

- 1 Letter from the Honourable Dwight Duncan, Minister of Energy, to Jan Carr, CEO, OPA re: Integrated Power System Plan, June 13, 2006.
- 2 OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), pp. 43 to 51.
- 3 Ontario Power Generation, *Sustainable Development: 2005 Progress Report*, p. 36.
- 4 OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), pp. 31, 32 & 43 to 51.
- 5 Nanticoke has eight 500 MW boilers. The cost of installing the best end-of-pipe pollution control devices on Units 7 & 8 is \$287 million per boiler. The cost of installing the best end-of-pipe pollution control devices on Nanticoke's remaining boilers would be \$334 million per boiler. DDS Management Consultants Inc. and RWDI Air Inc., *Cost Benefit Analysis: Replacing Ontario's Coal-Fired Generation*, Prepared for Ontario Ministry of Energy, (April 2005), p. 10.
- 6 Diener Consulting Inc., *The Nanticoke Conversion Study*, (Ontario Clean Air Alliance, 2001), p. 21, Table 3.1. Compare Case A versus Case F.
- 7 Email from Bob Gibbons, OPA to Jack Gibbons, November 20, 2006.
- 8 OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), p. 5.
- 9 Email from Amir Shalaby, Vice President, Power System Planning, OPA to Jack Gibbons, November 17, 2006.
- 10 The new capacity includes: Goreway (860 MW in Brampton), Greenfield (1,005 MW near Sarnia), St. Clair (570 MW near Sarnia), Portlands (550 MW in Toronto), GTA West Trafalgar (600 MW in Halton Hills) and 414 MW of combined heat and power across Ontario. Ontario Clean Air Alliance, *Phasing Out Coal: 2006 Progress Report*, (November 9, 2006), pp. 3, 4.
- 11 Assuming that they operate at a 90% capacity factor.
- 12 Independent Electricity System Operator, *The Ontario Reliability Outlook*, (June 2006), pp.8 & 9.
- 13 According to the Independent Electricity System Operator (IESO), after the Thunder Bay Generating Station is converted to natural gas, coal-burning at the Atikokan Generating Station can be phased-out without jeopardizing Ontario's electricity system reliability. IESO, *The Ontario Reliability Outlook*, (June 2006), pp. 6 – 9.
- 14 DDS Management Consultants Inc. and RWDI Air Inc., *Cost Benefit Analysis: Replacing Ontario's Coal-Fired Generation*, Prepared for Ontario Ministry of Energy, (April 2005), p. iv.
- 15 DDS Management Consultants Inc. and RWDI Air Inc., *Cost Benefit Analysis: Replacing Ontario's Coal-Fired Generation*, Prepared for Ontario Ministry of Energy, (April 2005), p. iii.
- 16 Sarah Rang, Environmental Economics International, *More Than Hot Air: Greenhouse Gas Emissions from Ontario Power Generation's Coal-Fired Power Plants*, (Ontario Clean Air Alliance, 2005), p. 11.
- 17 OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), p. 44.
- 18 Ontario Ministry of the Environment, *Coal-Fired Electricity Generation in Ontario*, (March 2001), p. 42.
- 19 Ontario Energy Board Docket No. EB-2006-0004, Pre-filed Evidence of Union Gas, pp. 5 – 8.

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- 20 The OPA is forecasting 164 TWh of electricity production in 2010. Assuming transmission and distribution losses of 7.5% this entails that Ontario's total electricity consumption will be 151.7 TWh. \$70 million divided by 151.7 TWh equals 0.046 cents per kWh. OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), p. 86.
 - 21 OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), p. 49, Figure 2.22; and email from Bob Gibbons, OPA to Jack Gibbons, November 20, 2006.
 - 22 According to the OPA's base case forecast, Ontario's coal-fired generation in 2010 will be 15 TWh and 14 TWh of this electricity will be exported. Our cost analysis assumes that Ontario's coal-fired electricity exports cease in 2009 and that the OPA's remaining 1 TWh of "Adequacy Coal" generation in 2010 will be replaced by 1 TWh of natural gas-fired combined-cycle or combined heat and power generation. Assuming a natural gas commodity cost of \$8 per MMBTU and heat rate of 7400 BTU/kWh for the natural gas-fired combined-cycle and combined heat and power generation, the energy cost of the replacement gas-fired generation is 5.92 cents per kWh. Nanticoke's energy cost for coal-fired generation is assumed to be 2.14 cents per kWh. Therefore the cost of replacing Nanticoke's generation is \$37.8 million [1,000,000,000 kWh x (5.92 – 2.14 cents per kWh)]. The OPA is forecasting 164 TWh of electricity production in 2010. Assuming transmission and distribution losses of 7.5% this entails that Ontario's total electricity consumption will be 151.7 TWh. \$37.8 million divided by 151,700,000,000 kWh equals 0.025cents per kWh. DDS Management Consultants Inc. and RWDI Air Inc., *Cost Benefit Analysis: Replacing Ontario's Coal-Fired Generation*, Prepared for Ontario Ministry of Energy, (April 2005), pp. 8 & 12; and OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), pp. 44 & 86.
 - 23 OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), p. 93.
 - 24 Large industrial customers obtain their electricity directly from the Hydro One transmission system and therefore do not pay distribution charges. As a consequence, their rates are lower than residential rates. OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), p. 93, Table 3.5.
 - 25 According to the OPA, the average residential customer will consume 8543 to 8976 kWh per year in 2010. We multiplied 8976 kWh by the rate impacts in Table 2 and divided the sum by twelve to calculate the monthly bill impacts. OPA, *Discussion Paper 7: Integrating the Elements – A Preliminary Plan*, (November 15, 2006), p. 93.



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