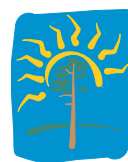


# The Ontario Power Authority's Coal Phase-Out Strategy:



## A Critical Review



Ontario Clean Air Alliance

SEPTEMBER 24, 2007

Ontario has 6,434 megawatts (MW) of coal-fired generation capacity consisting of the Nanticoke Generating Station (3,945 MW), the Lambton Generating Station (1,972 MW), the Thunder Bay Generating Station (306 MW) and the Atikokan Generating Station (211 MW).

On June 13, 2006 Ontario’s Minister of Energy, Dwight Duncan, directed the Ontario Power Authority (OPA) to develop a plan “for coal-fired 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.”<sup>1</sup>

On August 29, 2007 the OPA released its strategy to phase-out Ontario’s four coal-fired power plants by December 31, 2014.

The OPA’s coal phase-out strategy has the following three components:

1. **Energy Conservation:** The OPA is proposing to reduce Ontario’s demand for electricity by 2.7% between 2007 and 2015. That is, the OPA is proposing to reduce our annual peak day demand for electricity from 25,737 MW in 2007<sup>2</sup> to 25,049 MW in 2015,<sup>3</sup> a reduction of 688 MW.
2. **Renewable Energy:** The OPA is proposing to increase our effective renewable electricity generation capacity at the time of the Ontario system peak by 25% between 2007 and 2015.
3. **Natural Gas-Fired Generation:** The OPA is proposing to increase our natural gas-fired generation capacity by 154%.

Table 1 shows Ontario’s actual and forecast effective generation capacity in 2007, 2010 and 2015 at the time of peak demand.<sup>4</sup>

**Table 1: Ontario’s Effective Electricity Generation Capacity (MW) at Time of Peak Demand<sup>5</sup>**

	2007	2010	2015	Change from 2007 to 2015
Natural Gas	4,578	8,845	11,632	+7,054
Renewable	6,144	6,595	7,680	+1,536
Coal	6,434	6,434	0	-6,434
Nuclear	11,419	11,379	11,090	-329
<b>Total</b>	<b>28,575</b>	<b>33,253</b>	<b>30,402</b>	<b>+1,827</b>

According to the OPA’s coal phase-out strategy, Ontario’s natural gas-fired generation capacity will increase by 4,267 MW by 2010 and by an additional 2,787 MW between 2010 and 2015.

The OPA has already contracted for the 4,267 MW of new natural gas-fired capacity that is forecast to be in place by 2010. Table 2 provides a break-out of the OPA’s proposed mix of new natural gas-fired generation to be added between 2010 and 2015. The OPA is currently seeking approval from the Ontario Energy Board to enter into contracts with power producers for this new supply.

**Table 2: Proposed New Natural Gas-Fired Generation: 2010 – 2015<sup>6</sup>**

Project	Capacity
Northern York Region Simple-Cycle Gas Turbine	350 MW
Kitchener-Waterloo-Cambridge-Guelph Area Simple-Cycle Gas Turbine	450 MW
Greater Toronto Area Simple-Cycle Gas Turbine	550 MW
Greater Toronto Area Combined-Cycle Gas Turbine	850 MW
Combined Heat and Power	586 MW
<b>Total</b>	<b>2786 MW</b>

As Table 2 reveals, the OPA is proposing to contract for a total of 1350 MW of simple-cycle gas turbines to complete the coal phase-out. This proposal is problematic and imprudent for a number of reasons.

**Low Efficiency:** Simple-cycle gas turbines are the least efficient gas technology for electricity generation. According to the OPA, simple-cycle turbines have an energy efficiency of only 36%.<sup>7</sup>

Natural gas-fired combined-cycle turbines and combined heat and power plants are much more energy efficient than simple-cycle turbines. Specifically, natural gas-fired combined-cycle turbines can have an energy efficiency of 55 to 60%; and natural gas-fired combined heat and power (cogeneration) systems can have energy efficiencies of 80 to 90%.<sup>8</sup>

**High Fuel Costs:** As shown in Table 3 a simple-cycle gas turbine’s fuel cost per kWh of electricity produced is much higher than that of a combined-cycle or combined heat and power plant.

**Table 3: Fuel Costs per kWh of Electricity Produced<sup>9</sup>**

Simple-Cycle Gas Turbine	Combined-Cycle Gas Turbine	Natural Gas-Fired Combined Heat and Power Plant
7.6 cents per kWh	4.6 to 5.0 cents per kWh	3.0 to 3.4 cents per kWh

**High Greenhouse Gas Emission Rate:** As shown in Table 4, the greenhouse gas emission rate of a simple-cycle natural gas turbine is more than double that of a combined heat and power plant.

**Table 4: Greenhouse Gas Emission Rate per kWh of Electricity Produced**

Simple-Cycle Gas Turbine	Combined-Cycle Gas Turbine	Natural Gas-Fired Combined Heat and Power Plant
506 grams per kWh	303 to 331 grams per kWh	202 to 227 grams per kWh

---

## High Capital Cost and Very Low Capacity Utilization Factor:

According to the OPA, the capital cost of 1,350 MW of simple-cycle generation is \$898 million and these new power plants will be only operated for 2.5% of the year.<sup>10</sup>

That is, the OPA is recommending that the province invest almost \$900 million to build new, inefficient power plants simply to meet the spike in electricity demand that occurs between noon and 6 p.m. on the hottest summer days when our air-conditioners are running full out.

The OPA's focus on building simple-cycle gas plants is most likely the result of a rationalization that while these plants will be expensive to operate, they are comparatively less costly to build. And since the OPA is forecasting that they will only be operated for brief periods each year, it has convinced itself that this is an acceptable trade off. But there are two important factors which are missing from this rationalization. First, the realization that there are far more cost-effective — and cleaner — solutions to meeting this fleeting peak demand. Second, if our nuclear plants do not perform as well as the OPA is forecasting, we will have to operate our new natural gas-fired power plants at much higher capacity rates to phase-out coal and keep the lights on.

Table 5 provides a break-out of Ontario's electricity demand at the time of the summer peak electricity demand. As Table 5 reveals, residential and commercial air-conditioning is responsible for 40.2% of our electricity consumption at the time of the summer peak. Lighting is responsible for 13.1% of our total electricity use.

**Table 5: Break-Out of Ontario's Summer Peak Hour Electricity Demand By End-Use**

Electricity Use	Percentage of demand
Commercial air-conditioning	28.5%
Industrial process machine drive	12%
Commercial lighting	11.5%
Residential air-conditioning	9.9%
Minor residential appliances	7.2%
Major residential appliances	6.9%
Commercial electric auxiliary	6%
Industrial heat production	4.2%
Commercial ventilation	3.5%
Residential water heating	2.4%
Residential furnace fans (for cooling)	1.8%
Residential lighting	1.8%
Industrial lighting	1.6%
Industrial HVAC	1.4%
Commercial water heating	0.5%

---

Instead of spending almost \$900 million to build inefficient, simple-cycle natural gas-fired power plants, we can meet our peak day electricity demands at a much lower cost by investing in energy conservation and demand management. For example, the *peaksaver* program, which was pioneered by Toronto Hydro in 2006, reduces peak demand by cycling residential air-conditioners, water heaters and pool pumps on and off on peak-demand days.

In addition, large commercial, institutional and industrial customers should be paid to shift some of their electricity consumption from peak to off-peak hours. For example, large office towers could use electricity during off-peak hours to produce ice or chilled water to provide cooling during the peak. Industrial customers can adjust their production processes to reduce some of their electricity consumption during the peak demand hours which typically occur on hot summer days between 12 and 6 p.m.

If additional generation capacity is still needed to phase-out coal, the OPA's first choice for new supply should be renewable energy, followed by combined heat and power, and then combined-cycle generation.

For example, solar photo-voltaic generation located on the rooftops of homes, schools, office towers and factories in the GTA, Kitchener, Waterloo, Guelph or Cambridge can help meet these municipalities' summer peak day electricity demands with zero emissions and fuel costs.

In addition, virtually every building in these regions uses natural gas to provide just one service, namely, heating. It is much more efficient to use natural gas to simultaneously produce two services, namely, heat and power. We need to increase our energy productivity by converting our schools, recreation centres, shopping malls, condos, office towers and factories into small-scale combined heat and power plants.

If the OPA aggressively pursues conservation and demand management, clean renewables and high-efficiency natural gas-fired generation, there will be no need for inefficient, simple-cycle power plants.

---

## Ontario's Electricity Demand, Supply and Exports in 2010

Table 6 provides the OPA's forecast of Ontario's maximum electricity demand and non-coal effective electricity supply in 2010.

**Table 6: Ontario's Electricity Demand and Non-Coal Electricity Supply in 2010<sup>11</sup>**

Supply	Megawatts (MW)
Natural Gas-Fired Generation Capacity	8,845
Renewable Generation Capacity	6,595
Nuclear Generation Capacity	11,379
<b>Total Generation Capacity</b>	<b>26,819</b>
<b>Peak Day Electricity Demand</b>	<b>25,576</b>

As Table 6 reveals, the OPA is forecasting that Ontario's total supply of non-coal-fired generation capacity will exceed Ontario's total demand for electricity in 2010.<sup>12</sup> That is, if the OPA's forecasts are accurate, Ontario will not have to generate any coal-fired electricity in 2010 to keep its lights on.

Nevertheless, the OPA is forecasting that Ontario Power Generation will continue to operate its coal-fired power plants in 2010 and that approximately 50% of this coal-fired generation will be exported to the United States. See Table 7 below.

**Table 7: Ontario's Electricity Production, Consumption and Exports (TWh) in 2010<sup>13</sup>**

Electricity Generation, Consumption and Exports	TWh*
Natural Gas	18
Coal	27
Renewables	41
Nuclear	80
Total Supply	166
Ontario Consumption	152
<b>Net Exports</b>	<b>14</b>

\*A TWH (terawatt hour) equals a billion kWh (kilowatt hours)

---

## Rate Impact of Phasing Out Coal in 2010

If the OPA's electricity demand and supply forecasts are accurate, Ontario can phase-out its dirty coal plants in 2010 by: a) banning non-emergency coal-fired electricity exports to the U.S.; and b) operating its natural gas-fired power plants at higher capacity factors in order to displace the need for coal-fired generation for domestic consumption.

### *a) Rate Impact of Phasing out Coal-Fired Electricity Exports in 2010*

In 2006 Ontario Power Generation (OPG) earned a profit of approximately 0.912 cents per kWh from its coal-fired electricity exports.<sup>14</sup> Assuming the same profit rate in 2010, 14 billion kWh of coal-fired electricity exports would earn OPG a profit of \$127.6 million. Therefore, phasing-out coal-fired electricity exports in 2010 could raise Ontario's electricity rates by up to 1%.<sup>15</sup>

### *b) Rate Impact of Phasing out Coal-Fired Electricity Production for Domestic Consumption in 2010*

The OPA is forecasting that Ontario will generate 13 billion kWh of coal-fired electricity for domestic consumption in 2010. The incremental cost of phasing out this coal-fired electricity can be calculated by multiplying 13 billion kWh times the difference between the fuel and operating costs of Ontario's natural gas and coal-fired power plants. According to the OPA, the fuel and operating costs of our combined-cycle gas-fired power plants is 5.875 cents per kWh.<sup>16</sup> The fuel and operating costs of our coal plants is approximately 3.5 cents per kWh. Therefore phasing out our domestic coal-fired electricity consumption in 2010 would cost \$308.75 million and would raise electricity rates by approximately 2.3%.<sup>17</sup>

### *c) Rate Impact of Phasing Out Coal in 2010*

Phasing out Ontario's total coal-fired production for domestic consumption and exports in 2010 would raise electricity rates by up 3.3%.

## Benefits of Phasing out Ontario's Coal-Fired Power Plants in 2010

Phasing out Ontario's coal-fired power plants in 2010 would provide the following public health and environmental benefits:

- a) save 668 lives per year in Ontario alone;
- b) prevent up to 333,660 asthma attacks per year;<sup>18</sup> and
- c) 50 to 80% of the total greenhouse gas emission reductions that Ontario needs to achieve compliance with its Kyoto Protocol greenhouse gas emission reduction target for 2010.<sup>19</sup>

---

## Summary of Findings and Recommendations

1. Instead of investing \$900 million in inefficient, simple-cycle natural gas fired power plants that would remain idle for 97.5% of the year, the OPA should meet our peak day electricity service needs by investing in conservation and demand management.
2. If Ontario needs to procure additional electricity supply capacity to phase-out coal, the OPA's first choice for new supply should be renewable energy, followed by natural gas-fired combined heat and power, and then combined-cycle generation.
3. Ontario should immediately ban non-emergency coal-fired electricity exports to the United States.
4. If the OPA's electricity demand and supply forecasts are accurate, by 2010, Ontario will not need to operate its coal-fired power plants to keep the lights on.
5. Phasing out coal-fired generation in 2010 would raise Ontario's electricity rates by up to 3.3% (up to 13 cents per day for an average residential electricity ratepayer<sup>20</sup>); save 668 lives per year; prevent up to 333,660 asthma attacks per year; and provide 50 to 80% of the total greenhouse gas emission reductions that Ontario needs to achieve compliance with its Kyoto Protocol greenhouse gas emission reduction target for 2010.

---

## Endnotes

- 1 Letter from Dwight Duncan, Minister of Energy, to Jan Carr, CEO, Ontario Power Authority re: Integrated Power System Plan, (June 13, 2006).
- 2 [http://www.ieso.ca/imoweb/media/md\\_peaks.asp](http://www.ieso.ca/imoweb/media/md_peaks.asp). Downloaded August 7, 2007.
- 3 Ontario Power Authority, *Integrated Power System Plan*, (August 2007), Exhibit D, Tab 1, Schedule 1, Attachment 2, p. 1; and Exhibit D, Tab 4, Schedule 1, p. 16.
- 4 The OPA's analysis assumes that only 20% of Ontario's installed (nameplate) wind capacity and only 62 to 80% of Ontario's installed water power capacity will be operating at the time of our annual peak demand. Therefore, its effective capacity value for these resources is 20 to 80% lower than their installed capacity. OPA, *Integrated Power System Plan*, Exhibit D, Tab 2, Schedule 1, Attachment 1, pp. 9 & 12.
- 5 For simplicity of exposition we have included Ontario's 74 MW of oil-fired combustion turbines in the natural gas generation category. *Integrated Power System Plan*, Exhibit D, Tab 8, Schedule 1, p. 8; and Exhibit D, Tab 9, Schedule 1, p. 19.
- 6 *Integrated Power System Plan*, Exhibit D, Tab 8, Schedule 1, p. 16.
- 7 Ontario Power Authority, *Integrated Power System Plan*, (August 2007), Exhibit G, Tab 2, Schedule 1, p. 7.
- 8 Danny Harvey, "Clean building: contribution from cogeneration, trigeneration and district energy", *Cogeneration and On Site Power Production*, (September-October 2006), pp. 108, 110; and Ontario Power Authority, *Supply Mix Analysis Report*, Volume 2, (December 2005), p. 210 & 212.
- 9 We have used the OPA's natural gas commodity cost assumption of \$8 per million BTUs to calculate the fuel costs of electricity generation. OPA, *Integrated Power System Plan*, Exhibit D, Tab 3, Schedule 1, Attachment 1, page 11.
- 10 According to the OPA, the capital cost of simple-cycle turbines is \$665,000 per MW and the 1350 MW of proposed simple-cycle generation capacity will produce 300,000 MWh of electricity in 2015. See, *Integrated Power System Plan*, Exhibit D, Tab 8, Schedule 1, page 21; and Exhibit G, Tab 2, Schedule 1, page 7.
- 11 Ontario Power Authority, *Integrated Power System Plan*, (August 2007), Exhibit D, Tab 1, Schedule 1, Attachment 2, p. 1; Exhibit D, Tab 4, Schedule 1, p. 16; and Exhibit D, Tab 9, Schedule 1, p. 19.
- 12 The OPA is also forecasting that, in northwestern Ontario, non-coal-fired effective electricity generation capacity will exceed demand at the time of the Ontario summer system peak. *Integrated Power System Plan*, Exhibit D, Tab 1, Schedule 1, Attachment 2, p. 7; Exhibit D, Tab 3, Schedule 1, p. 28; and Exhibit D, Tab 4, Schedule 1, p. 18.
- 13 *Integrated Power System Plan*, Exhibit D, Tab 1, Schedule 1, Attachment 2, p. 1; Exhibit D, Tab 4, Schedule 1, p. 16; and Exhibit D, Tab 9, Schedule 1, p. 23.
- 14 According to the Independent Electricity Operator (IESO) in 2006 Ontario's revenue from exporting 11.4 billion kWh was \$503 million. [IESO, *IESO Releases 2006 Generation and Consumption Figures*, (January 16, 2007); and email from Peter Lafoyiannis, Market Information Services, IESO to Jack Gibbons (June 11, 2007)] The fuel and operating costs of Ontario's coal plants is approximately 3.5 cents per kWh. Therefore Ontario Power Generation's profits from its exports was approximately 0.912 cents per kWh.
- 15 In 2006 the total cost of electricity for Ontario consumers was \$13.566 billion. IESO, *2007 Ontario Market Outlook*, Volume 1, pp. 3 & 10; and Ontario Energy Board, *2006 Yearbook of Electricity Distributors*, (August 31, 2007), p. 7.
- 16 OPA, *Integrated Power Supply Plan*, Exhibit D, Tab 3, Schedule 1, Attachment 1, page 9.

- 
- 17 In 2006 the total cost of electricity for Ontario consumers was \$13.566 billion. IESO, *2007 Ontario Market Outlook*, Volume 1, pp. 3 & 10; and Ontario Energy Board, *2006 Yearbook of Electricity Distributors*, (August 31, 2007), p. 7.
  - 18 DSS Management Consultants Inc. and RWDI Air Inc., *Cost Benefit Analysis: Replacing Ontario's Coal-Fired Electricity Generation*, Prepared for Ontario Ministry of Energy, (April 2005), pp. iv and 5.
  - 19 Sarah Rang, *More Than Hot Air: Greenhouse Gas Emissions from Ontario Power Generation's Coal-Fired Power Plants*, (February 2005), p. 13.
  - 20 According to the Ontario Energy Board, the average monthly bill of residential consumers served by Ontario's municipal electric utilities is \$119.85. [http://www.oeb.gov.on.ca/html/en/consumers/understanding/bill\\_comparison.htm](http://www.oeb.gov.on.ca/html/en/consumers/understanding/bill_comparison.htm). Downloaded September 20, 2007.

---

# OCAA Members

AIM PowerGen Corporation  
Algoma Manitoulin Environmental Awareness  
Algoma Manitoulin Nuclear Awareness  
Allergy/Asthma Information Association  
Association of Local Public Health Agencies  
Breathe Smog Masks Inc  
Bullfrog Power  
Canadian Association of Physicians for the Environment  
Canadian Institute for Environmental Law and Policy  
Canadian Institute of Child Health  
Canadian Unitarians for Social Justice-South Peel Chapter  
Cashmere Avenue PS EnviroClub  
CAW Canada  
CAW Durham Regional Environment Council  
CAW Windsor Regional Environment Council  
Citizen's Advisory Committee On Air Quality - Waterloo  
Citizens Advocating Renewable Energy  
Citizens Environment Watch  
Citizens Environmental Alliance - Southwestern Ontario  
Citizens For Renewable Energy  
Citizens Network on Waste Management  
City of Guelph  
City of Hamilton  
City of Kitchener  
City of Peterborough  
City of Stratford  
City of Toronto  
City of Windsor  
Community Action Parkdale East  
Community Environmental Alliance  
Conservation Council of Ontario  
Conserver Society/Hamilton Chapter  
Consumers Assn. of Canada  
Earth Day Canada  
Earth Works  
Echo Lake Association  
EnerACT  
Enviro-Energy Technologies Inc.  
Environment North  
Environmental Defence Canada  
Enwave Energy Corporation  
Evergreen Foundation  
Federation of Ontario Cottagers' Associations  
For a Safe Environment  
GASP  
Greenest City  
Hearthmakers Energy Cooperative  
The Humane Society of Canada  
Hydro 2000  
Indigo Wind Energy Systems  
Lakeshore Area Multiservice Project  
Learning Disabilities Association of Ontario  
Mississippi River Power Corporation  
North Toronto Green Community  
One Change – Project Porchlight  
Ontario College of Family Physicians  
Ontario English Catholic Teachers Assn.  
Ontario Forestry Association  
Ontario Highlands Friends of Wind Power  
Ontario Lung Association  
Ontario Public Health Association  
Ontario Society for Environmental Education  
OPIRG-Guelph  
OPIRG-McMaster  
OPIRG-Queen's  
OPIRG-Toronto  
Oshawa Power and Utilities Commission  
Peel Environment Network  
Pesticide Action Group-Waterloo  
Pollution Probe  
Prince Edward County Wind Co-Op Inc.  
Regional Municipality of Durham  
Regional Municipality of Peel  
Regional Municipality of Waterloo  
Selectpower  
Sky Generation  
South Riverdale Community Health Centre  
Sudbury Hydro  
Thames Region Ecological Association  
Toronto Hydro  
Town of Markham  
Tree Canada  
Unitarian Fellowship of Sarnia-Port Huron  
United Church of Canada  
Wastewise-Halton Hills  
Wellington Electric Distribution Company  
Wildlands League  
Women's Healthy Environments Network  
World Wildlife Fund Canada

---

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.



**Ontario Clean Air Alliance**

625 Church Street, Suite 402  
Toronto M4Y 2G1

Tel: (416) 926-1907 ext. 245

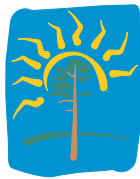
Fax: (416) 926-1601

E-mail: [contact@cleanairalliance.org](mailto:contact@cleanairalliance.org)

Web Site: [www.cleanairalliance.org](http://www.cleanairalliance.org)

Thanks to The EJLB Foundation, the Laidlaw Foundation and the Toronto Atmospheric Fund for their financial support.





**Ontario Clean Air Alliance**

625 Church Street, Suite 402

Toronto M4Y 2G1

Tel: (416) 926-1907 ext. 245

Fax: (416) 926-1601

E-mail: [contact@cleanairalliance.org](mailto:contact@cleanairalliance.org)

Web Site: [www.cleanairalliance.org](http://www.cleanairalliance.org)