October 7, 2005

Ontario Clean Air Alliance
Mr. Jack Gibbons, Chair
625 Church Street, Suite 402
Toronto, Ontario
Canada, M4Y 2G1

Dear Jack,

As a long-standing member, Energy Probe Research Foundation urges the Ontario Clean Air Alliance (OCAA) to reconsider its support for the phase-out of Lambton coal-fired generating units 3 and 4, now scheduled by the Ontario government for closure in 2007. We believe that cleaner coal – like these two units or better, as discussed below – can achieve emissions, power cost, public safety, and fuel diversity advantages over gas-fired generation, which the OCAA promotes and which the Ontario government is now developing. Furthermore, we believe that shutting down these two units – ranked in the top nine cleanest coal-fired generators in North America - would actually worsen air pollution in Ontario, not improve it. We also urge the OCAA to support new cleaner coal options for meeting most of Ontario's future electricity needs that cannot be served by cost-effective renewable energy alternatives and conservation.

I am sure you agree that environmentalists and public-health advocates should focus on emissions, not the choice of fossil fuels. Coal is generally a dirty fossil fuel (carbonaceous and contaminated with sulfur and metals), but facilities with the cleanest coal-burning technologies have emissions that are comparable, and in some cases better, than those of many that burn natural gas. Oversimplifications, like mistaking fuel choice for emission levels or lumping together cleaner and dirtier units that happen to be located at a single station, can lead to perverse results.

1. Preserving the Environmental Benefits of Ontario's Installed Cleaner Coal

Cleaner coal is operating successfully in Ontario today at Lambton units 3 and 4. Rated in terms of acid gas emissions per unit of electricity delivered, Lambton unit 4 is the fourth cleanest of all of the 403 large power coal-fired stations in United States, Canada and Mexico (NAFTA).[1] Lambton unit 3 is the ninth cleanest in NAFTA. Lambton units 3 and 4 are the cleanest coal-fired units in Canada. Except for NB Power's Belledune station (which like Lambton 3 and 4 has flue

[1] Ranking the Environmental Performance of North America's Coal-fired Power Stations (Working Papers), Energy Probe, October 2005, posted at <www.energyprobe.org>.

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gas desulfurization), nothing even comes close. Acid gas emissions at Alberta's Sundance station, the next cleanest after Belledune, are approximately twice those of Lambton 3 and 4.

The environmental performance of all of the coal stations in Canada ranked against the rest of the fleet of major coal-fired generators in NAFTA, comparing acid gas and mercury (Hg) emissions, is as follows:

percentile (cleanest to dirtiest)	rank of total acid gas/MWh	Total kg acid gas/MWh	NAFTA Hg rank (cleanest #1)	Coal-fired Power Plants
1%	4	1.6	N/A	Lambton 4
2%	9	1.9	N/A	Lambton 3
4%	15	2.2	17	NB Power Belledune
12%	48	3.5	162	Transalta Utilities Corporation - Sundance
22%	89	4.3	N/A	Nanticoke 7
22%	91	4.3	399	Manitoba Hydro Selkirk Gs
22%	92	4.3	76	OPG Lambton Tgs
23%	93	4.4	175	Manitoba Hydro Brandon Gs
24%	99	4.4	N/A	Nanticoke 8
24%	100	4.5	150	Transalta Utilities Corporation - Keephills
25%	101	4.5	5	Nova Scotia Power Inc., Pt. Aconi Plt.
25%	103	4.5	90	Epcor Utilities Inc. - Genesee
40%	165	5.6	66	OPG Nanticoke Tgs
56%	230	7.2	371	Transalta Utilities Corporation - Wabamun
58%	238	7.4	88	Alberta Power - Sheerness (Atco Power)
59%	239	7.4	216	Alberta Power - Battle River (Atco Power)
63%	256	7.8	163	OPG Lakeview Tgs
64%	260	7.9	365	OPG Atikokan Tgs
65%	266	8.1	368	OPG Thunder Bay Tgs
71%	288	8.9	N/A	Lambton 2
71%	290	9.0	33	Alberta Power - H.R. Milner (Atco Power)
72%	293	9.1	276	Sask Power -Shand Power
73%	296	9.2	N/A	Lambton 1
76%	310	9.9	327	Sask Power - Boundary Dam Ps
85%	346	12.2	271	Sask Power - Poplar River Ps
87%	356	13.1	82	NS Power- Point Tupper Gs
98%	399	20.0	231	NS Power - Lingan Gs
98%	402	22.2	193	NS Power – Trenton Gs
100%	409	93.4	398	NB Power Grand Lake Gs

Acid gas emissions per unit of output for the Northland Power wood waste-fired power station located at Kirkland Lake, Ontario's largest non-hydroelectric renewable generator, were 2.1 Kg/MWh in 2003, higher than the overall acid gas emissions rates of Lambton 3 or 4.[2]

Closing Lambton units 3 and 4 and replacing them with imported coal-fired power from the United States, a likely outcome due the heavy coal reliance of our main electricity trade partners, will exacerbate adverse environmental and human health impacts to Ontarians.

[2] Northland Power's Kirkland Lake unit produced 671,732 MWh according the IESO Monthly Generation Summary reports and released 1412.227 tonnes of NO2 according the National Pollutant Release Inventory.

Some of the dirtiest coal-fired generators in the U.S. are located in states neighboring Ontario. Examples include;

- Picway in Ohio,
- Richard Gorsuch in Ohio, and
- AES Greenidge in New York.

To illustrate the environmental implications of Ontario's indiscriminate coal phase-out policy, consider the result if a unit of electricity production is transferred from Lambton 4 to Picway: overall acid gas emissions associated with that unit of production would increase over 17 times and mercury emissions would increase almost 7 times.

Even if it were practical, banning the imports of coal-fired power may not help;

- 3,549 MW of the gas-fired power plants in Michigan, Ohio, Pennsylvania and New York have total acid gas emissions rates worse than Lambton 4, and
- 2,224 MW of this gas capacity has emissions worse than Lambton 3.[3]

Some have accepted the Ontario Ministry of Energy's study "Cost benefit analysis: Replacing Ontario's coal-fired Electricity generation," issued in April 2005, as demonstrating that all coal-fired power is harmful. This study's environmental analysis is flawed. The study lumps together Ontario's cleaner and dirtier coal. Obviously, this approach exaggerates the harm from our cleanest units – Lambton 3 and 4 and Nanticoke 7 and 8. In correspondence with the Ministry of Energy, Energy Probe Research Foundation asked why the authors did not consider separately assessing our cleaner units from the dirtier. The Ministry's reply might make sense to a politician but makes no environmental sense, "The objective of the study was to assess the costs and benefits of replacing coal-fired generation as a whole not to look at individual coal-fired generation units."[4]

2. Harmful Coal Emissions Are Controllable

Health hazards from coal-fired power are largely controllable. The acid gas pollution rate for particular stations and individual units across all of NAFTA varies by over two orders of magnitude. The cleanest station, a coal gasification station called Polk located in Florida, has acid gas emissions of about half those of Canada's best, Lambton 4 and less and 1% of North America's worst – NB Power's Grand Lake.

There are a variety of options for controlling mercury emissions as well. Some plants with flue gas desulfurization or plants based on fluidized bed technology, such as Nova Scotia Power's Point Aconi station, have demonstrated very low mercury emissions as well. The Point Aconi station is the 5th cleanest in North America and has a mercury emission rate of only 0.8 Kg/TWh, whereas the median emission rate in North America is 22.6 Kg/TWh. Another mercury mitigation

[3] Starting from the dirtiest, these stations are Brunot Island Power PA (417.4), Deray MI (164 MW), Greenwood MI (1115.4 MW), East River NY (356.2 MW), and Edgewater OH (171 MW) Bowline Generating S NY(1155 MW), Livingston MI (170 MW).
[4] Ontario Ministry of Energy, Email, June 8, 2005.

option that appears promising is some form of pre-combustion cleaning of the coal to reduce metal concentrations.

3. Reliability Advantages of Cleaner Coal

Cleaner coal has reliability advantages for customers over the new renewable generation options Ontario is now developing and also over existing or new nuclear generation. The vast majority of renewable generation capacity that the Ontario government has so far entered into contracts to procure, namely wind power and a small amount of run of the river hydro-electric generation, can be characterized as intermittent and non-dispatchable generation. These generators produce power less reliably than coal-fired generation because they only work when the wind blows or the water flows. More important, there is a negative correlation or "coincidence" between when wind power or run-of-the-river hydro-electric are most productive and when consumers desire the most power – during the summer season. On the other hand, coal-fired generators are dispatchable, in that they can generate when called upon.

Nuclear generators are similar to intermittent renewable generation in that they produce only when technical conditions are suitable, not when consumers require electricity. Planned and unplanned nuclear outages, some of which have extended for periods of up to seven years, have reduced Ontario's overall nuclear reliability from planned levels of 85-90% to a level of about 57% in 2004. While this average reliability number is still roughly twice as high as that of a typical wind generator, the average hides an enormous diversity of reliability data – including entire multi-reactor nuclear stations generating nothing at all for years in a row, a result that is itself unusually threatening of grid security.

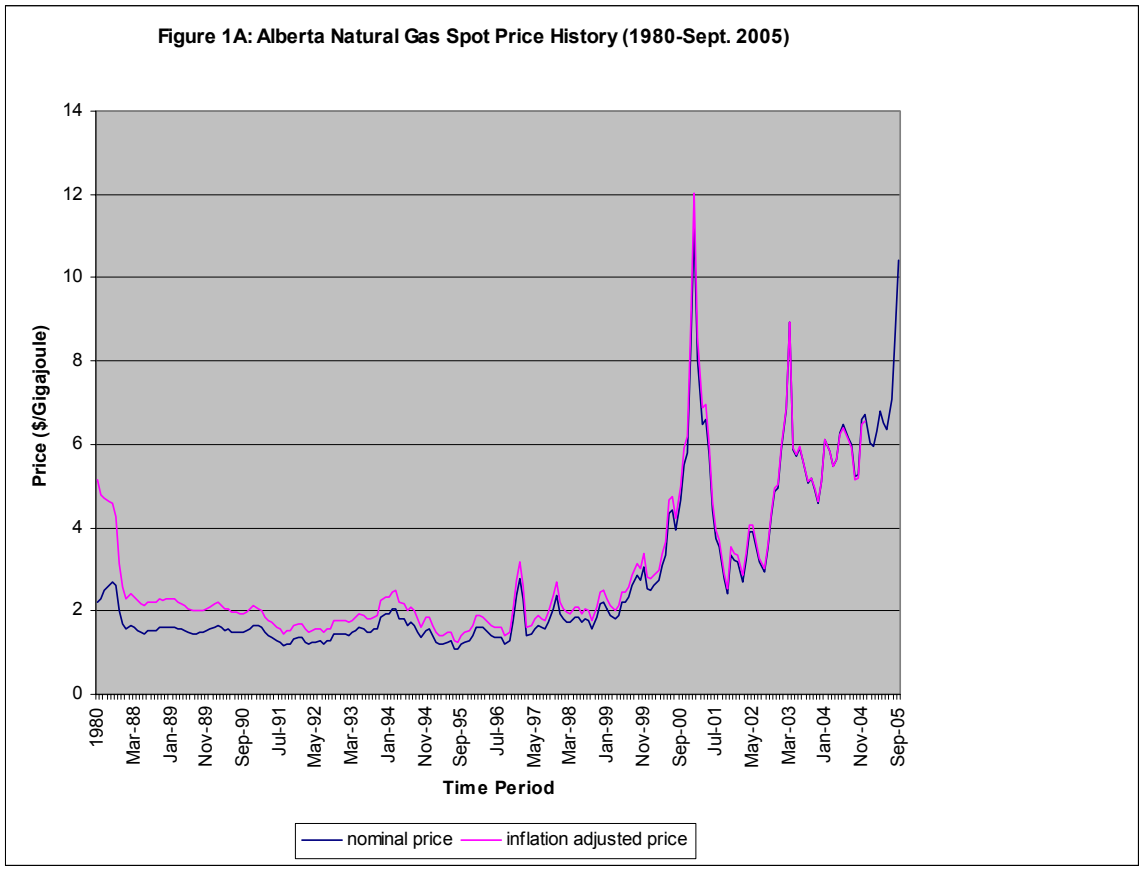
Intermittent renewable generation is suitable for replacing somewhat less intermittent nuclear generation but is not suitable for replacing Ontario's coal generators, which are able to increase or decrease output on demand. Ontario's grid can accommodate a significant capacity of intermittent wind or nuclear capacity, as long as it has enough reliable and dispatchable capacity like coal or peaking hydroelectric to keep the lights on when the wind dies, or the reactors do. But we cannot replace reliable and dispatchable capacity with intermittent capacity, and still expect the lights to stay on.

Gas-fired generation is typically very reliable. It is also dispatchable. Some gas-fired units also have the attractive ability to vary their output significantly over short time periods, which can help the delicate process of exactly matching the amount of electricity generated to ever-changing consumer demands for electricity. Where its reliability advantages can outweigh its high costs, gas-fired generation can make a beneficial contribution to the Ontario grid. However, the amount of gas-fired power that consumers are prepared to pay for is limited by the uncompetitive price of gas.

4. Cost of Cleaner Coal vs. Gas-Fired Options

Energy Probe believes that cleaner coal is now more competitive than gas for meeting a significant fraction of Ontario's electricity requirements. Prices in the futures markets suggest that cleaner coal power is likely to retain a large cost advantage over gas-fired power for the foreseeable future.

The following chart shows annual average prices for the period 1980-1987 and monthly average prices from January 1988 to September 2005.



Note: Data from Canadian Association of Petroleum Producers Handbook, the Alberta government, and NGX.

In the 1990s, natural gas was an attractive fuel for power generation and Energy Probe was a supporter. Since late 1999, the price has become much higher and much more volatile. Current prices suggest that natural gas is best used for high-value uses such as home heating and cooking.

Some appear to have accepted the Ontario Ministry of Energy's study "Cost benefit analysis: Replacing Ontario's coal-fired Electricity generation," issued in April 2005, as demonstrating our coal-fired power can be replaced with gas affordably. As with its environmental analysis, the study is flawed. The gas price analysis used in the study was based on a range of gas prices. However, the highest gas price considered possible in the study is about two thirds of the current price.

Futures markets are suggesting that high prices for gas may be here to stay. As of October 6, 2005, January 2010 gas contracts were trading on NYMEX for $8.28 (US) per million BTU – about four times prices that were typical in the late 1990s.

At the present price of natural gas, we estimate that new gas-fired power would cost approximately 11 cents per kilowatt-hour or greater – double the current frozen residential price. Gas-fired power appears to be uncompetitive.

OPG's investments in pollution control have produced benefits. Modern flue gas desulfurization pollution control equipment was installed on Lambton 3 and 4 in 1994. Selective catalytic

reduction equipment was installed on Nanticoke 7 and 8 and Lambton 3 and 4 in 2002 and 2003 at a cost of approximately $250 million.

Coal prices relevant to Ontario's power needs have increased since their lowest point in recent decades, which was 1999, but coal's price advantage over gas has grown. Lower value solid fuels, not as versatile as gas for high value energy applications like home heating and cooking, appear better suited for new power generation.

Excluding any politically-ordered writedowns, we estimate the cost of power from Lambton 3 and 4 to be about 4 cents/kWh.[5] The cost of Nanticoke 7 and 8 power appears to be somewhat lower due to its ability to use lower cost Powder River Basin coal.

We estimate that power from a new coal-fired station cleaner than Lambton 3 and 4 could be delivered for 7 cents/kWh.[6]

If waste heat from a coal station is effectively utilized for district heating or industrial operations, the cost of power might be substantially lowered, particularly in today's market of high natural gas heating costs. In addition to potential cost savings, the displacement of acid gas and greenhouse gas emissions associated with natural gas heating provides a strong justification to aggressively develop solid fuel-based district-heating options.

Like it has before, Ontario is jumping into another electricity fad after other jurisdictions have discovered its weakness. Partially-built gas-fired power plants are available in the U.S. for cents on the dollar. A recent example is Duke Energy's sale of its loss-making gas-fired generation assets in California. One analyst commenting on that sale noted, "Natural gas has become so costly and power prices have not gone up as much. Duke and many others who own gas-fired plants are caught in a squeeze."[7]

5. Coal: Bridge to Biofuels

One coal station operating today that appears to have emissions lower than the gas-fired power stations that the Clean Air Alliance is demanding is Denmark's Avedore #2. Commissioned in early 2002, that station has natural gas-fired turbines, a coal/oil/Orimulsion boiler, and a biomass boiler consuming wood waste and straw. Emission controls include flue gas desulfurization and selective catalytic NOX control. Avedore #2 can be fueled up to 70% on biofuels.[8] This configuration offers high operational flexibility, plant availability and emissions considered acceptable for its urban Copenhagen location. In cogeneration mode, the new plant's owners claim it is capable of using up to 94% of the input fuel's energy content.[9] While in actual

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[5] Assuming bituminous coal at $58US/ton, $1CND=$0.85US, a heat rate of 9550 BTU/kWh, non-fuel operating costs of 1.5 cents/kWh, and capital recovery of $0.003/kWh.

[6] Lambton 3 and 4's emissions of fine particulate are about 25% above those of Northland Power's Kirkland Lake wood-fired generator and about four times those of typical Ontario gas generators like West Windsor Power and Lake Superior Power. Coal plant particulate emissions can be cut significantly with available reverse baghouse technologies. For cost estimation, we assume bituminous coal for $65/ton, $1CND=$0.85US, heat rate 9100 BTU/kWh, non-fuel O&M at 1.5 cents/kWh, capital costs at 2.6 cents/kWh.

[7] http://www.signonsandiego.com/news/business/20050915-9999-1b15power.html

[8] http://www.lowcvp.org.uk/uploaded/documents/Biofuels%20Under%20Development%20-%20May%20051.pdf

[9] http://www.power-technology.com/projects/avedore/, 3 August 2005. http://www.cres.gr/biocogen/pdf/All%20Flagships.pdf

operations Avedore's efficiency is below its theoretical potential, it should be remembered that Ontario's coal-fired stations achieve an overall efficiency not including line losses of less than 38%. Greenhouse gas emissions from Avedore 2 are about one quarter those of a conventional coal station without taking into account any carbon dioxide credits for biofuels consumed.[10]

Another coal technology that we believe should be considered for meeting Ontario power requirements is gasification. Gasification is a process that pyrolyses solid fuels into an energy rich mixture of gases prior to their use for industrial or power generation purposes. As noted, the cleanest coal-fired station in North America uses gasification technology.

Royal Dutch Shell's Buggenum facility in Holland has successfully demonstrated the gasification of coal and biofuels.[11]

As the operational experience of Holland and Denmark shows, coal utilization can be a bridge to more extensive reliance on biofuels in future as relative fuel costs and environmental rules change. This successful demonstration bridging from coal to biofuels contrasts with any claims that natural gas is a bridge to a hydrogen energy future. There are no utility-scale power supplies fueled by hydrogen operating or proposed anywhere in the world.

6. Other Environmentally Responsible Coal Options in Ontario

Energy Probe believes that there are other environmentally responsible options for coal power in Ontario as well. One example is in the steel industry. Based on interviews with technical staff of Stelco, we have learned that 130 MW of base load electricity could be generated by using high-pressure boilers to capture the blast-furnace gas and coking-oven gas currently flared at Stelco's Lake Erie Works in Nanticoke and Hilton Works in Hamilton. Most of this waste gas is derived from coal. Diverting the waste gas now flared would reduce toxic emissions released by Stelco while requiring no additional fuel. Stelco is today one of the largest electricity consumers in the province. It is at risk of bankruptcy, due in large part to inefficient energy usage. Examples of steel mills using waste coal gases for large-scale power generation today include ISPAT Inland in East Chicago and Baoshan in Shanghai.

7. Hazardous and Dirty Alternative to Cleaner Coal: Liquefied Natural Gas

If Ontario proceeds with the massive gas-fired generation expansion that OCAA has championed, it appears likely that the proponents of liquefied natural gas (LNG) delivery in Eastern North America will expand and accelerate their plans. Energy Probe is concerned about the inherent explosion hazard reliance on LNG creates, whether by way of accident or malicious action.[12]

Some analysis suggests that LNG may not offer any significant environmental advantage relative to coal. U.S. Department of Energy (DOE) analysts have recently examined the relative carbon dioxide emission intensity of LNG vs. coal, both for conversion to hydrogen. [13] The DOE study,

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[10] http://news.scotsman.com/scitech.cfm?id=1146472003
[11] http://www.gastechnology.org/webroot/downloads/en/IEA/IEARomeWSKiel.pdf
[12] http://www.fas.org/spp/civil/crs/RL32205.pdf, http://timrileylaw.com/LNG.htm.
[13] http://www.netl.doe.gov/otiic/pubs/sardenia%2005%20text%20Rev%204.pdf

although not directly on topic, supports the general conclusion that LNG is about equal to coal with respect to carbon dioxide emissions if both are used for power generation.

8. Nuclear Power Outlook

Ontario's currently operable nuclear fleet is likely to lose at least 2000 MW of capacity by 2010. Bruce Power has previously indicated that Bruce 3 is expected to close in 2009. In 2004, the Manley review assumed that the Pickering B reactors would begin reaching their end of life in 2012. Based on OPG's report of newly discovered corrosion in Pickering A's steam generators[14], new feeder pipe problems in many Candus, and publicly known information about pressure tube degradation, it is reasonable to assume that Pickering 5 and 6 may become inoperable around 2010. Early in the next decade, a large amount of existing nuclear capacity appears to be at risk of closure.

Offsetting this, the potential refurbishment of about 1500 MW of capacity at Bruce units 1 and 2 might be completed at approximately the same time. But, the poor production record of Pickering 4 this spring and summer illustrates the risk to reliability of relying on refurbished Candus.

Without a reliable, reasonably priced source of power capable of providing several thousand megawatts of firm capacity soon, it appears that the Ontario government will commit Ontarians to the unacceptable ecological and financial risks of constructing additional nuclear power stations to replace the aging nuclear units. Ironically, given the long lead-times and low reliability of Ontario's nuclear stations, we expect such an announcement to increase the vulnerability of Ontario's electrical grid rather than assuring reliability.

9. Accurately Presenting Emission Information

The OCAA has made many public statements to the effect that pollution controls added to coal stations to cut their emissions of sulfur dioxide and nitrogen oxides only reduce total emissions by one-half of 1%.[15] As Norm Rubin, Energy Probe Research Foundation's Director of Nuclear Research and I presented to you during April in email correspondence, we believe that this statement is misleading. Your statement treats all emissions, including carbon dioxide, as equivalent. From a human health perspective, there is no justification to equate acid gas, particulate, or mercury emissions with carbon dioxide emissions.

Conclusion

Given the short lead-time to the announced shutdown of Lambton 3 and 4, "new nuclear build" is totally beside the point, new renewable generation options are somewhat limited, and even efficiency gains will be limited. Failure to get it right will not only threaten Ontario's electrical reliability and increase power prices, but it will decrease our air quality too. Ontario needs a

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[14] Ontario Power Generation, Second Quarter 2005 Financial report.

[15] See for example "Air Quality Issues Fact Sheet #15: Clean Coal: An End-Of-Pipe Band-Aid Solution" September 26, 2005.

reasoned debate addressing environmental and cost implications of our electricity supply alternatives.

For all of these reasons, we urge the OCAA to endorse the continued operation of Lambton Units 3 and 4 and to support a complete and open review of cleaner coal alternatives.

Sincerely,

Tom Adams
Executive Director

Cc: Dwight Duncan, Minister of Energy
Jan Carr, Chairman Ontario Power Authority
Laurel Broten, Ontario Minister of the Environment