Beyond Coal:

Power, Public Health and the Environment

Ontario Public Health Association

November 2002

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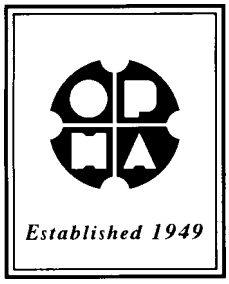
OPHA Air Quality Coordinator



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Executive Summary

Concerns Related To Ontario's Electrical Sector

This report has been prepared by the Ontario Public Health Association (OPHA), a non-profit organization that represents the staff and professionals who work in public health units and community health centres throughout Ontario. It focuses on Ontario's electrical sector, its impact on air quality, human health and the environment, because this sector is currently undergoing huge changes. In May of this year, Ontario's electrical market was opened to competition, a change that presents both risks and opportunities.

With a visionary regulatory framework, a competitive electrical sector could actually encourage the development of alternative energy sources, co-generation, and energy efficiency measures that would be beneficial to air quality, human health and the environment. However, without the proper regulatory framework, competition could lead to increased use of electricity and greater reliance on coal-fired power plants, which could result in further degradation of air quality and the environment, and greater harm to human health.

The increased use of coal-fired power plants is a concern because they are significant contributors of the air emissions that lead to: 1) global climate change, 2) smog, 3) acid rain and 4) mercury contamination of the aquatic food chain.

Global Climate Change

Scientists worldwide have documented a shift in the global climate over the last century that is unprecedented for its pace of change. Most believe that this change is due, in most part, to human activities. Of particular concern is the release of carbon dioxide (CO_2) that results from the burning of fossil fuels such as gasoline, oil, coal and natural gas. Consequently, global climate change is inextricably linked to the energy policies of nations around the world, as well as to their economic growth and population size.

Global climate change could have profound impacts on the health of whole populations in regions spanning the globe. The direct health impacts expected include those associated with increases in heat waves, air pollution, and extreme weather events such hurricanes and floods. The indirect health impacts expected include those associated with increases in drought, loss of water supplies, shifts in food supplies, and changes in the range of insect-borne and infectious diseases.

The Intergovernmental Panel on Climate Change (IPCC) has concluded that greenhouse gas emissions will have to be reduced to a small fraction of their current levels in order to stabilize atmospheric concentrations of CO_2 and retard global climate change. Under the Kyoto Protocol, Canada is committed to reducing greenhouse gas emissions to 6% below 1990 levels between 2008 and 2012. While this reduction represents a small percentage of the reductions that will ultimately be needed, ratification and implementation of the Kyoto Protocol is an essential first step in the international process required to properly address global climate change.

In Ontario, coal-fired power plants were responsible for 20% of greenhouse gas emissions in 2001, while in the United States, they were responsible for 33% of total greenhouse gas emissions.

Smog

Ontario's coal-fired power plants were responsible for about 23% of the sulphur dioxide (SO_2) and 14% of the nitrogen oxides (NOx) emitted in the province in 2001. Both air pollutants can harm human health when present in their gaseous form (e.g. as sulphur dioxide and nitrogen dioxide) and when converted to acid aerosols such as sulphates and nitrates that make up a significant percentage of the fine particulate matter in Ontario's air. NOx are also precursors for ground-level ozone, the air pollutant that triggers most of the smog alerts in Ontario.

The Ontario Medical Association (OMA) has estimated that the fine particulate matter in Ontario's air contributes to approximately 1,900 premature deaths each year, while researchers at Health Canada have demonstrated that the gaseous air pollutants such as nitrogen dioxide and ozone, are responsible for, on average, 7.7% of premature deaths each year in cities such as Toronto, Hamilton, London, Ottawa and Windsor.

Acid Rain

While huge improvements have been made on air emissions of SO_2 in both Canada and the United States since the 1970s, acid rain remains a serious environmental problem today. In 1997, a multi-stakeholder task group struck by the federal government concluded that SO_2 caps in Ontario, Quebec, and the mid-western and eastern States, would have to be reduced by an additional 75%, if most of eastern Canada were to be protected from acid rain. The task group has also called for reductions in NOx because of their contribution to acid rain.

As indicated above, Ontario's coal-fired power plants were responsible for about 23% of the SO_2 and 14% of the NOx emitted in the province in 2001, while the electrical sector in the United States was responsible for about 70% of the SO_2 and 25% of the NOx emitted in that country.

Mercury Contamination Of The Aquatic Food Chain

Mercury is a highly toxic element that is capable of accumulating in the aquatic food chain. In recent years, negative health impacts have been documented among children whose mothers ate fish during pregnancy. The National Academy of Science (NAS) has estimated that over 60,000 children per year in the United States are born at risk from adverse neuro-developmental effects due to prenatal exposure to mercury.

In 1994, under the *Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem*, mercury was targeted for a 90% reduction by the year 2000. While other sectors in Ontario have made significant progress towards this goal, Ontario's electrical sector has increased emissions of mercury. In 1999, coal-fired plants were responsible for about 23% of mercury emissions from human activities in the province.

Actions Needed

In order to ensure that a competitive electrical sector produces results that are beneficial to human health and the environment, regulations and policies must be developed that: 1) Encourage energy efficiency; 2) Promote renewable technologies; and 3) Phase-out the use of coal-fired power plants.

Encouraging Energy Efficiency

Ontario's Select Committee on Alternative Fuel Sources has concluded that energy efficiency measures are actually more important to meeting Ontario's future energy needs than are new energy supplies. In the 1990s, electricity demand in Ontario was reduced by 25,000 Gigawatt-hours (GWh) annually from the figure expected through increases in energy efficiency. This represents almost 17% of the total electricity generated for Ontario in 2001. The energy experts, Torrie Smith Associates, have estimated that electricity demand in Ontario could be reduced by up to an additional 35,000 GWh annually by 2012 with systematic efforts to increase energy efficiency in this province. In addition, they have estimated that another 10,000 GWh per year of electricity could be generated by industrial and commercial "co-generators". These estimates indicate that energy efficiency and co-generation combined, could displace about 30% of all the electricity generated in Ontario in 2001,

which is more electricity than was generated with coal-fired power plants in 2001 (i.e. 37,185 GWh).

The Commission for Environmental Cooperation (CEC), established under the North American Free Trade Agreement, has identified changes in building codes as the area with the greatest potential for energy efficiency in Canada and the United States. In 1999, the residential, commercial and institutional sectors in Canada were responsible for nearly 30% of secondary energy use and 28% of greenhouse gas emissions in the country. Changes in Ontario's Building Code are recommended to encourage energy efficiency, renewables and co-generation in new building stock, while a "shared savings mechanism" that rewards electrical utilities that effectively encourage reductions in energy consumption among their consumers, is recommended to increase energy efficiency in existing buildings.

Promoting Renewable Technologies

The CEC, Ontario's Select Committee on Alternative Fuel Sources, and the Federal Liberal Caucus Working Group on Environmental Technologies have all concluded that renewable energies have huge potential, from both technological and economic perspectives, to provide a significant share of clean and secure energy in North America. Torrie Smith Associates have estimated that new and renewable electricity, generated with wind, small hydro, and biogas, has the potential to provide 20,000 GWh of electricity per year in Ontario; 5,000 GWh of which could be developed by 2012.

Many believe that the introduction of renewable technologies has been hampered by government policies that are biased towards existing, conventional technologies. For example, the Federal Liberal Caucus Working Group on Environmental Technologies reported that, between 1970 and 1999, direct federal spending on fossil fuel based energy was $40.4 billion, while federal support for Canada's nuclear industry exceeded $16.6 billion over the last five decades. In countries that have revamped their public policies to support the development of renewable energies, the results have been impressive. For example, Germany, which began to invest in wind power in 1990, has developed 8,000 MW of wind-generated electrical capacity, and is also on track to meet its target of 22,000 MW of wind-powered electrical capacity by 2010. Germany's 2010 target is only 2,700 MW less electrical capacity than Ontario Power Generation currently has with its nuclear, hydro, coal-fired and oil-fired facilities combined (i.e. 24,700 MW).

The OPHA is recommending that the Ontario government establish a schedule of ambitious Renewable Portfolio Standards (RPS) to promote the development of renewable energies within Ontario, and that the Federal government provide financial support to renewable technologies that is equal to that provided to conventional energy sources.

Phasing Out Coal-Fired Power Plants

Ontario's Select Committee on Alternative Fuel Sources has recommended that Ontario eliminate its reliance on oil- and coal-fired power plants by 2015. Many organizations support the phase-out of coal-fired power plants because, while they are one of the most significant sources of greenhouse gases, there is currently no commercially available control technology that can be used to reduce their CO_2 emissions.

In Ontario, the greenhouse gases emitted from Ontario's five coal-fired power plants each year (i.e. about 35,000 kilotonnes in 2001) represent about 78% of the greenhouse gas emissions that Ontario would need to cut in order to achieve the 6% reduction envisioned by the Kyoto Protocol. A phase-out of coal-fired power plants, driven by the need to reduce greenhouse gases, would simultaneously produce a number of other public health and environmental benefits. It would reduce SO_2 emissions in Ontario by 23%, mercury emissions by 23%, and NOx emissions by up to 14%.

Recommendations:

At The Federal Level

The OPHA recommends that the Federal government:

- Ratify and implement the Kyoto Protocol as currently written, recognizing that it is only the first step towards the 60 to 80% reduction in greenhouse gases that will be required to retard global climate change;

- Provide municipalities with stable funding, that is not dependent upon participation by the province, with which to promote energy efficiency projects within their communities;

- Establish a schedule of ambitious and increasing renewable energy targets to guide the development of energy policies, environmental regulations, and budgetary commitments at the federal level for the coming years;

- Provide financial support to renewable technologies that is equal to that traditionally provided to conventional energy sources; and

- Establish regulations under the Canadian Environmental Protection Act (CEPA) that encourage the phase-out of coal-fired power plants by 2010.

At The Provincial Level

The OPHA believes that the Ontario government should move quickly on the recommendations of Ontario's Select Committee for Alternative Fuel Sources, and recommends that the Ontario government:

- Instruct the Ontario Energy Board (OEB) to establish a shared savings mechanism that rewards utilities for investing in energy efficiency programs that effectively reduce electricity consumption and their customers' bills;

- Move immediately to revise the Ontario Building Code to incorporate the most advanced science with respect to renewable energies, co-generation, and energy efficiency;

- Establish a schedule of increasing Renewable Portfolio Standards (RPS) that meets or exceeds the most ambitious program established in North America; and

- Ensure that the emission trading scheme developed for Ontario:

  - Is a cap and trade model consistent with that proven effective in the United States;
  - Significantly improves air quality and protects public health across the regional air shed on both sides of the border;
  - Is supported by air emission caps for the electrical sector that will result in the phase-out of coal-fired power plants by 2010;
  - Includes a hard cap of 25 kilotonnes (kt) for nitrogen oxide emissions from fossil-fuelled power plants in southern and central Ontario to be achieved by 2007; and
  - Limits imports and exports of electricity to generators that achieve emission performance rates for mercury, nitrogen oxides, sulphur dioxide, and carbon dioxide that are as good as, or better than, those achieved by high efficiency natural gas generators.

At The Municipal Level

The OPHA recommends that municipalities:

- Establish ambitious energy efficiency programs that include specific targets and timelines for their corporate operations and ensure that financial savings are re-invested in energy efficiency projects and/or used to support purchasing policies that favour renewable energies and low emission generators of electricity;

- Develop and implement corporate purchasing policies that favour renewable energies and low-emission generators of electricity;

- Establish programs to encourage large organizations within their communities to establish ambitious energy efficiency programs;

- Encourage large organizations within their communities to adopt purchasing policies that favour renewable energies and low emission generators of electricity; and

- Establish social marketing programs to encourage energy conservation efforts among individuals in their communities.

I Why Is This The Time To Talk About Coal?

Restructuring In The Electrical Sector

In Ontario, there are four major sectors that contribute to air pollution, acid rain and global climate change — the transportation sector, the electrical sector, the residential/commercial sector, and the industrial sector. This report focuses on Ontario's electrical sector because this sector is currently undergoing huge changes.

In May 2002, Ontario's electricity market was opened to competition. For many decades, electricity in Ontario had been generated and distributed by Ontario Hydro, a crown corporation owned by the provincial government and run by an arm's length Board of Directors. Other companies were not allowed to generate electricity for consumers in Ontario. This began to change in October 1998, when the Ontario government proclaimed Bill 35, the *Energy Competition Act*.

Ontario Clean Air Alliance

Under Bill 35, new companies have the opportunity to generate electricity for consumers in Ontario. The intent of the Bill, according to the Ontario government, is to provide cost savings to customers by providing a competitive market in electricity production.

Bill 35 also set the stage for the dismantling of Ontario Hydro into five new organizations:

- Ontario Power Generation (OPG) which generates electricity in competition with other companies;
- Hydro One which has responsibility for running the electricity transmission system;
- The Independent Electricity Market Operator (IMO) which manages the competitive electrical market on a not-for-profit basis;
- The Electrical Safety Authority (ESA) which has responsibility for setting safety standards for the industry; and
- The Ontario Electricity Financial Corporation (OEFC), a crown corporation that has responsibility for paying off the stranded debt of Ontario Hydro (OMOEE, 2002).

Competition Presents Risks And Opportunities

The introduction of competition presents both risks and opportunities. With a supportive regulatory framework, a competitive electrical sector could actually encourage the development of alternative energy sources, co-generation and energy efficiency that would be beneficial to air quality, the environment and human health. However, without a proper regulatory framework, competition could increase reliance on coal-fired power plants and result in further degradation of air quality and the environment, and increased harm to human health.

Competition Can Increase Pollution

In the United States, the introduction of competition to the electrical sector resulted in increased production from some of the "dirtiest" coal-fired power plants. A report prepared by the Northeast States for Coordinated Air Use Management (NESCAUM) indicated that several large electric power companies in the mid-western United States substantially increased their wholesale electricity sales between 1995 and 1996; that the increases in power were provided by the highest polluting coal-fired power plants belonging to each company; and that these increases resulted in substantial increases in emissions of NOx and other air pollutants (NRDC, 1998).

This trend is not surprising because the "dirtiest" coal-fired plants in the United States are the oldest plants that have not been required to upgrade emission controls. Consequently, these plants have the lowest capital costs and can produce electricity at very competitive rates.

Competition Can Discourage Energy Conservation

In a competitive electrical market, utilities tend not to offer energy efficiency programs unless there is a regulatory structure that provides financial benefits for doing so. In jurisdictions that have introduced competition to their electrical sectors, investments in energy efficiency have declined following market restructuring (CAEE, 2001). Most of these jurisdictions have since introduced funding mechanisms or energy efficiency centres to compensate for this tendency (CAEE, 2001). To date, these regulatory supports have not been provided in Ontario (Lourie, 2002).

Before the introduction of competition to Ontario, Ontario Hydro developed energy efficiency programs to reduce the expenses associated with building new electrical capacity. Since the introduction of competition, Ontario Hydro's successor company has withdrawn resources from energy efficiency programs in order to reduce costs (CAEE, 2001).

II Why Move Beyond Coal?

1. Four Concerns With Coal-Fired Power Plants

The primary concern with the introduction of competition to Ontario's electrical sector is that it could lead to greater reliance on coal-fired power plants. Coal is one of the oldest and dirtiest fuels used to generate electricity. There are four major reasons to be concerned about coal-fired power plants. They are among the most significant sources of air pollutants that contribute to:

1) Global climate change
2) Smog
3) Acid rain and
4) Mercury contamination in the aquatic food chain.

Coal-Fired Power Plants In Ontario

In the last few years, coal-fired power plants in Ontario have been used to produce almost one third of the electricity generated in Ontario, and were responsible for approximately:

- 23% of the sulphur dioxide (SO_2) emissions in this province in 2001;
- 14% of the nitrogen oxide (NOx) emissions; and
- 20% of Ontario's greenhouse gas emissions; and
- 23% of the mercury emissions in 1999 (OPG, 2002a;OMOE, 2001a)(see Table 1).

The Nanticoke Generating Station, located near Simcoe on Lake Erie, is one of the largest coal-fired power plant in North America. In 2001, it was responsible for about one half of the air emissions released from the five coal-fired power plants operating in Ontario (OPG, 2002a).

Coal-fired power plants also emit a large variety of other air pollutants including chromium, nickel, arsenic, dioxins, hexachlorobenzene, hydrochloric acid, hydrogen fluoride, cobalt and radon gas (OPG, 2001; TPH, 2002; USGS, 1997). Some of these pollutants are carcinogens, some are persistent in the environment and capable of accumulating in the food chain, and all are toxic to plant, animal and/or human life.

Table 1: Emissions from Ontario's Five Coal-Fired Power Plants, 2001

Plant	Sulphur Dioxide (tonnes)	Nitrogen Oxides (tonnes)*[1]	Mercury (kg) **	Carbon Dioxide (tonnes)
Nanticoke	86,500	22,400	246.6	20,260,000
Lambton	28,300	11,800	135.0	9,420,000
Lakeview	19,000	5,050	83.2	2,760,000
Thunder Bay	8,810	1,970	67.1	1,880,000
Atikokan	4,480	950	63.0	850,000
Total	147,090	42,170	629.9	35,170,000

(Data from OPG, 2002)
*Nitrogen oxides are reported as nitric oxide (NO)
** Mercury is reported for 1999 (OMOE, 2001a)

Ontario Power Generation (OPG)

Ontario Power Generation (OPG) is the successor company to Ontario Hydro responsible for generating electricity in Ontario. In 2001, OPG generated 85% of the total electricity used in Ontario. It generated approximately 127,200 Gigawatt-hours (GWh) of electricity: 40% with nuclear-powered generators, 33% with fossil-powered generators, 26% with water-powered generators, and less than 1% with new renewable energy sources (OPG, 2002).

Its fossil fleet includes five coal-fired power plants and one plant that can be fired with oil or natural gas (see Table 2 below). OPG has announced its intention to sell three of its five coal-fired power plants — Lakeview, Thunder Bay and Atikokan. In 2001, the Ontario government passed a Regulation requiring that the Lakeview Generating Station be converted away from coal if it continues to operate as a generating station after April 31, 2005 (OMOE, 2001a).

Table 2: Electricity Generation from OPG Fossil-Fired Power Plants, 2001

Plant	Location	Fuel	Capacity (MW)	Electricity Generated (GWh)	Original In-Service Date
Nanticoke	Lake Erie	Coal	3,920	21,124	1973-78
Lambton	Near Sarnia	Coal	1,974	10,472	1969-70
Lakeview	Mississauga	Coal	1,138	3,081	1962-69
Lennox	Kingston	Oil/Gas	2,140	3,243	1976-77
Thunder Bay	Lake Superior	Coal	310	1,670	1981-82
Atikokan	W. of Lake Superior	Coal	215	838	1985
Total			9,700	40,428	

(Data from OPG, 2002)

Why move beyond coal?

Coal-Fired Power Plants In The United States

In the United States (U.S.), where coal is used to generate about one half of that country's electricity, the electrical sector was responsible for approximately:

- 70% of the SO_2 released in 1998;
- 25% of the NOx;
- 35% of the carbon dioxide (CO_2); and
- 25% of the air emissions of mercury (CEC, 2002).

The northern hemisphere has warmed more in the 20th century than it has in the past 1000 years.

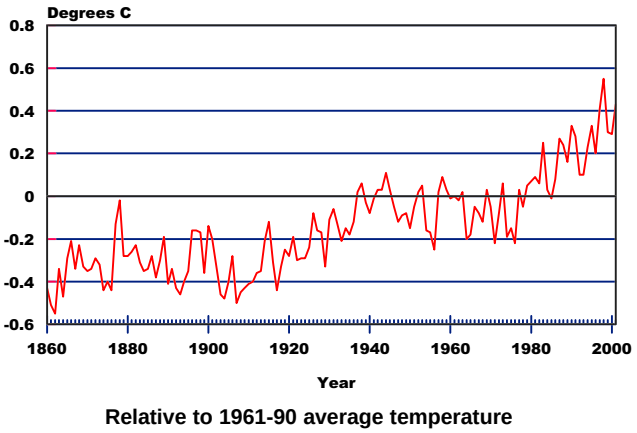
Many of the U.S. coal-fired power plants are located in the mid-western states that are upwind from Ontario due to prevailing wind patterns. As a result, these coal-fired power plants are significant contributors of the air pollution that affects human health and the environment across Ontario.

2. Coal Plants Contribute To Climate Change

Climate Change Has Already Begun

Global climate change is the most pressing environmental health issue of our day. It has been projected that global climate change will increase the temperature of air and water around the world, melt glaciers, increase sea levels, increase the number and intensity of extreme weather events that result in heat waves, droughts, flooding and soil erosion (IPCC, 2001a). These changes have already begun. The Intergovernmental Panel on Climate Change (IPCC) has concluded that:

Figure 1: Global Temperature Change, 1860-2001



Relative to 1961-90 average temperature

(Environment Canada, 2001d)

- Global mean air temperatures have increased by 0.4 to 0.8° C over the 20th century;
- Ocean temperatures have increased by 0.05° C since the 1950s;
- Summer sea ice over the Arctic has shrunk by 10 to 15% over the 20th century; and
- Warming of the northern hemisphere during the 20th century is likely to have been the largest in any century in the past 1000 years (IPCC, 2001a; NRC U.S., 2001).

Environmental Impacts Expected In Canada

In Canada, global climate change is expected to:

- Move the treeline significantly northward during this century;
- Increase the number and severity of forest fires;
- Affect the abundance of fish species by changing water temperatures and circulation patterns;
- Melt permafrost in the far north;
- Decrease water levels in the Great Lakes by more than a metre and move the shoreline of Lake St. Clair and Lake Erie up to six kilometres offshore;
- Increase droughts in the prairies; and
- Increase the frequency and intensity of heat waves (Canada, 2002).

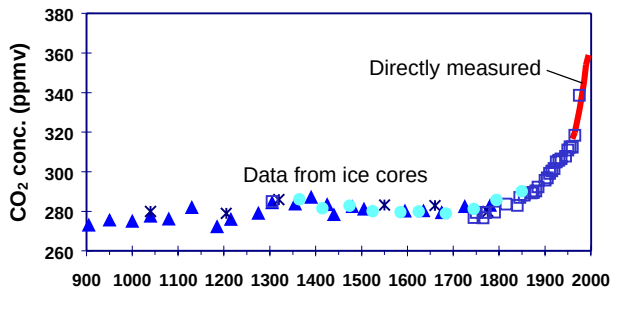
It is the rate and magnitude of these changes that are the cause for concern. Scientists worry that biological organisms, ecosystems, and human societies will not be able to adapt to the changes because of the speed at which they are occurring.

IPCC Attributes Climate Change To Human Influences

While there are a vocal minority who continue to question whether the human link to global climate change has been adequately proven, the majority of experts in this field agree that the global climate is changing at an unprecedented pace, and that those changes are, in large part, directly related to human activities. The IPCC jointly established by the United Nations Environment Programme and the World Meteorological Organisation, concluded in its third assessment report that:

> "Most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations;" and
>
> "Emissions of carbon dioxide due to fossil fuel burning are virtually certain to be the dominant influence on the trends in atmospheric CO_2 concentrations during the 21st century" (IPCC, 2001b).

Figure 2: CO_2 Concentrations Trends



(Environment Canada, 2001d)

U.S. NRC Concurs With IPCC

When the U.S. National Research Council (NRC U.S.) examined the science on climate change in response to a request from the White House, it concluded that:

> "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise;"
>
> "The changes observed over the last several decades are likely mostly due to human activities, but we cannot rule out that some significant part are also a reflection of natural variability;" and
>
> "The IPCC's conclusion that most of the observed warming of the last 50 years is likely to have been due to the increase in greenhouse gas concentrations accurately reflects the thinking of the scientific community on the issue" (NRC U.S., 2001).

Climate Change Will Have Negative Impacts On Health

During the 1995 heat wave in Chicago, there were 700 more deaths than were expected for this population during this period of time (McGeehin, 2001).

Global climate change could have profound impacts on the health of whole populations in regions spanning the globe. The direct health impacts expected include those associated with increases in heat waves, air pollution, and extreme weather events such as floods, landslides, and hurricanes. The indirect health impacts expected include those associated with: increases in drought; changes in food and water supplies; changes in the range of insect-borne diseases, water-borne diseases, and infectious diseases; and population displacement and economic disruption (McMichael, 1996; IPCC 2001c).

More Heat Waves Expected

Global climate change is expected to result in a significant number of heat-related deaths in both developed and developing countries as heat waves become more frequent and more severe (IPCC, 2001). Analyses from around the world indicate that overall death rates rise during heat waves, particularly when temperatures rise above those to which the population has adapted (Smoyer, 1999; McGeehin, 2001). For example, during a five-day heat wave in 1995 in which maximum temperatures ranged from 34 to 40° C, the number of deaths in Chicago, Illinois, increased by 85% while the number of hospital admissions increased by 11% (McGeehin, 2001).

A study conducted by Kalkstein and Smoyer indicated that several large cities in Canada (i.e. those that currently experience hot, humid air masses during the summer season such as Montreal, Toronto and Ottawa) could be very negatively impacted by the increased temperatures expected with climate change. For example, it was estimated that, with a doubling of CO_2 in the earth's atmosphere, heat-related death rates could increase to between 9.63 and 33.65 per 100,000 in the Toronto area (Kalkstein and Smoyer, 1993). With these rates, a city with Toronto's current population, could experience between 239 and 835 premature deaths each year from heat alone (Chiotti et al, 2002).

The most common cause of death during heat waves is heatstroke where the body temperature exceeds 105° F. However, other causes of death include strokes, heart attacks, respiratory diseases, accidents, homicide and suicide (McGeehin, 2001). Young children and the elderly are particularly vulnerable to heat waves because their bodies do not have the ability to regulate their body temperatures under extreme conditions.

Central Canada could experience a 5-fold increase in smog episodes and heat waves.

Those living in urban areas are also at greater risk during heat waves because urban areas retain heat throughout the night more than rural and suburban areas. A Missouri study found that the deaths from all causes increased by 57 and 64% respectively in two major urban centres during a 1980 heat wave, while they rose by only 10% in the rural areas (McGeehin, 2001). The poor can also be at greater risk because of substandard housing conditions, medical conditions that increase vulnerability to heat, or because they lack access to air conditioners, pools or cool recreational areas (McGeehin, 2001; IPCC, 2001).

More Air Pollution Expected

Climate change is expected to increase morbidity and mortality by decreasing air quality in areas currently experiencing air pollution problems (IPCC, 2001c). Increased temperatures are expected to increase the average and peak levels of ground-level ozone in the air by both, enhancing the chemical reactions that give rise to ozone, and by increasing the release of volatile organic compounds from natural sources (IPCC, 2001; Bernard, 2001; Mills, 1999). In urban environments, high humidity and low wind speeds are expected to increase the concentration of air pollutants such as fine particulate matter that will stay in the air longer in high humidity (Bernard, 2001). Increased temperatures could also encourage greater use of electricity for air conditioning, which could in turn result in a greater release of pollutants into the atmosphere.

Why move beyond coal?

Kalkstein and Smoyer have predicted that, with a doubling of CO_2 concentration in the atmosphere, central Canada could experience a five-fold increase in offensive air masses that bring smog episodes, high temperatures and high humidity. This means that smog episodes could increase in frequency from 4.7% of summer days to 23.3% of summer days in Ontario (Chiotti et al., 2002). This increase in smog episodes is expected to significantly increase the number of air pollution-related mortality and morbidity rates.

More Extreme Weather Events Predicted

Global climate change is expected to significantly increase deaths, disease and injury by increasing the frequency and magnitude of extreme weather events such as tornados, hurricanes, snowstorms, floods and cyclones. Extreme weather events can be costly to human health. Between 1972 and 1996, on average, about 123,000 people a year were killed by natural disasters around the world (IPCC, 2001). The morbidity for natural disasters rises substantially when one includes the indirect health effects such as respiratory infections from living in crowded shelters, gastrointestinal infections that can occur when water and sewage systems are disrupted, and trauma-induced mental disorders (Greenough, 2001). Populations in developing countries are much more affected by extreme weather events because they do not have the social infrastructures needed to mitigate their impacts or to respond to them when they occur (IPCC, 2001).

Yearly economic losses from extreme weather events have increased from $4 billion (U.S funds) in the 1950s to $40 billion in the 1990s.

Extreme weather events are also costly in economic terms. For example, the floods and drought associated with the El Nino event in 1982-83 led to losses of about 10% of the gross national product (GNP) and about 50% of the annual public revenue in countries such as Bolivia, Chile, Ecuador and Peru (IPCC, 2001). The costs of extreme weather events have increased rapidly in recent decades in both developed and developing countries. The yearly economic losses from large events have increased 10 fold from $4 billion in U.S. funds in the 1950s to $40 billion in U.S. funds in the 1990s. While these cost increases are influenced by socio-economic factors such as population growth and urbanization in vulnerable areas, they are also linked to observed changes in flooding, precipitation and drought events (IPCC, 2001).

Insect-Borne Diseases Could Spread

Climate change is expected to affect the range, intensity and seasonality of many diseases. There are concerns, for example, that insect-borne diseases such as malaria, dengue fever, lyme disease could spread in range and intensity with climate change (McMichael 1996; IPCC, 2001). While insect-borne diseases will likely have a disproportionate effect on populations in tropical climates, populations in northern climates will not be immune.

Environment Canada projects that insect-borne diseases such as malaria, dengue fever, yellow fever and viral encephalitis could move into Ontario as temperatures and humidity increase (Mortsch and Mills, 1996). West Nile virus is an example of an insect-borne disease that, once introduced to New York in 1999, has extended its range northward and westward due, in part, to the milder winters and longer summers being experienced in North America (TPH, 2001).

While the range of insect-borne diseases are highly dependent upon climatic conditions such as temperature, rainfall and humidity, they are also dependent upon living conditions (eg. access to air conditioning and window screens), building materials, and social infrastructure. In wealthy nations such as Canada, it is expected that the impacts of these diseases can be minimized with a public investment in disease surveillance, education, habitat reduction and mosquito control (Gubler, 2001; TPH, 2001).

Food Supplies Could Be Threatened

Global climate change is expected to alter regional temperatures, rainfall and soil moisture, all of which could impair the growth of many crops in many regions of the world (IPCC, 2001). In Canada, climate change is expected to have a net negative effect on agriculture because, while temperatures will be higher, the growing season will also be dryer (Env Can, 1997). Agricultural output could also be affected by extreme weather events and altered patterns of plant diseases and infestations.

An extra 40 to 300 million people could be at risk of hunger by the year 2060 because of the impact of climate change.

Climate change is also expected to change water temperatures in oceans, which could influence ocean currents and nutrient upwelling. These changes could alter the distribution, migration and productivity of fish species upon which humans are dependent for food supplies (McMichael,1996; IPCC, 2001).

One analysis predicts that an extra 40 to 300 million people could be at risk of hunger by the year 2060 because of the impact of climate change. This number is in addition to the 640 million who are expected to be at risk in the absence of climate change (McMichael, 1996).

Social Justice Issue

There are also social justice aspects to the climate change issue. While there are great uncertainties related to the extent and severity of the predicted health impacts, there is a growing consensus that many of the anticipated adverse effects will be greater in poorer regions of the world that lack food supplies and/or well developed public health infrastructures with which to

respond to the changes (IPCC, 2001; NRC U.S., 2001). On the other hand, it is clearly understood that those living in the wealthiest nations, particularly those who live in North America, are the greatest emitters of the greenhouse gases that are contributing to this shift in climate.

Canada, with 0.5% of the world's population, is responsible for an estimated 2% of the net global greenhouse gas emissions (Canada, 2002). Canada is the ninth largest emitter nation in the world and among the highest emitters per capita (Canada, 2002). On average, each Canadian citizen is responsible for greenhouse gas emissions that are almost 8 times higher than the global average (CIELAP, 1996). While to some extent, this pattern of energy use reflects the size of the county and its climate; it also reflects the inefficient use of energy in a country that has developed in an era of cheap and abundant energy.

Huge Reductions Required

In 1996, the IPCC indicated that greenhouse gas emissions would need to be reduced by 50% of 1990 levels in order to stabilize concentrations in the atmosphere and retard global climate change. In the third assessment report published in 2001, the IPCC concluded that greenhouse gas emissions may need to be reduced to a small fraction of current levels in order to stabilize atmospheric concentrations of CO_2 and retard global climate change (IPCC, 2001b). This suggests that greenhouse gas emissions may need to be reduced by 60 to 80% within a number of decades if climate change is to be retarded (Dauncy, 2001; David Suzuki Foundation, 1998).

Greenhouse gas emissions may need to be cut by 60 to 80% in order to retard climate change.

Under the Kyoto Protocol, Canada is committed to cutting its greenhouse gas emissions by 6% below 1990 levels between 2008 and 2012. While this reduction represents a small percentage of the cuts believed necessary to retard climate change, some Canadian political leaders continue to argue against ratification of the Kyoto Protocol, citing unacceptable economic costs.

Cost Estimates Of Kyoto And Climate Change

Estimates of the costs associated with the implementation of the Kyoto Protocol for Canada vary depending upon the assumptions applied in those analyses. The Analysis and Modeling Group (AMG), a federal-provincial-territorial working group created as part of the National Climate Change Process (NCCP), estimated in 2000 that the Kyoto Protocol would reduce the GDP in 2010 by between 0 and 3% (Canada, 2002). Assessments conducted by a number of academic economists and independent consultants since then, have estimated that, with a global emissions trading framework in place, the

implementation of Kyoto would have a minor impact on the Canadian economy. Their estimates range from –0.7% to +0.2% on Canada's GDP in 2010 (Env Can, 2002a).

It is important to note however, that while these estimates may take into account Kyoto's costs to industry and consumers and Kyoto's benefits in terms of increased energy efficiency, they tend not to calculate the positive economic opportunities that could be created by the Kyoto Protocol including those associated with the development of renewable energy technologies (Env Can, 2002a). It is also true that most economic analyses fail to account for the costs associated with the disruption of the natural ecosystem, and the human health impacts that will result from that disruption (David Suzuki Foundation, 2002a).

Coal Plant Emissions: 78% Of Ontario's Share Of Kyoto

Total greenhouse gas emissions in Canada are currently 700,000 kilotonnes per year, up from 606,000 kilotonnes in 1990 (Torrie Smith Associates, 2002). Ontario is responsible for about one quarter of Canada's emissions and coal-fired power plants are responsible for one fifth of Ontario's emissions (OPG, 2002a). The greenhouse gases emitted from Ontario's five coal-fired power plants (i.e. about 35,000 kilotonnes each year) represent about 78% of the greenhouse gas emissions that Ontario would need to cut (i.e. about 45,000 kilotonnes per year) in order to achieve the 6% reduction envisioned by the Kyoto Protocol (data from OPG, 2002 & OMOE, 2002a). This suggests that Ontario could go a long way towards meeting its Kyoto commitment if it phased out coal-fired power plants.

Ontario could go a long way towards meeting its Kyoto commitment if it phased out coal-fired power plants.

3. Coal Contributes To Smog Formation

Coal-fired power plants are significant contributors of five of the air pollutants most clearly linked to smog — ground-level ozone, fine particulate matter, sulphates, nitrogen dioxide and sulphur dioxide.

Smog Increase Premature Deaths And Hospitalizations

Hundreds of studies, conducted in countries around the world, have demonstrated that poor air quality can have a profound impact on human health. Numerous studies have demonstrated that short-term spikes in air pollution result in short-term increases in the number of deaths and hospital admissions for lung and heart diseases (NAAQO, 1999a/b). One study has demonstrated that deaths from strokes also increase consistently with rising concentrations of the common air pollutants (Hong, 2002). Others have established that

temporary increases in air pollution can reduce lung function, aggravate asthma, and increase the number of respiratory infections in the population (NAAQO, 1999a/b). These health effects have been demonstrated at air pollution levels that are common in Ontario today.

Smog Increases Chronic Heart And Lung Disease

In some U.S. cities, air pollution presents a health risk comparable to that presented by long-term exposure to second hand smoke.

While the majority of air quality studies have been directed at short-term health effects, more recent studies of long-term health impacts suggest that air pollution may also contribute to the development of chronic heart and lung diseases including lung cancer. For example, a team of researchers that followed 1.2 million adults in the United States over a 16-year period, found a strong and consistent link between air levels of fine particulate matter ($PM_{2.5}$), sulphates and sulphur dioxide (SO_2), and deaths from lung cancer, cardiopulmonary illnesses, and all causes. They concluded that air pollution in some U.S. cities presents a health risk comparable to that presented by long-term exposure to second hand smoke (Pope, 2002).

Children And The Elderly At Greatest Risk

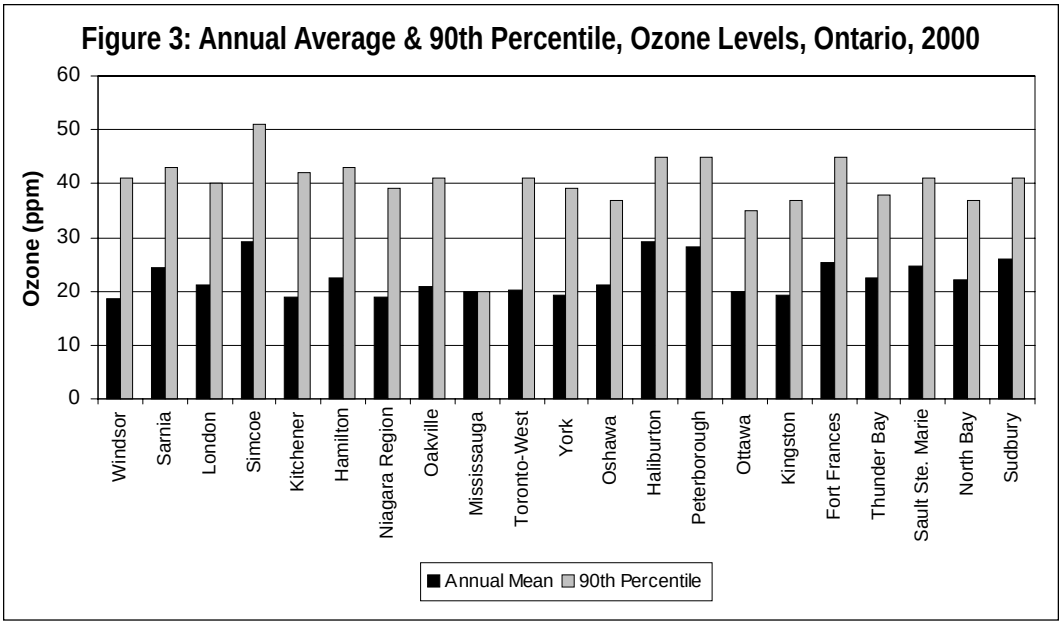
While a mounting body of evidence suggests that air pollution can affect all members of society, children, the elderly and those with predisposing respiratory conditions (such as asthma) or heart conditions (such as congestive heart failure) appear to be most vulnerable (OMA, 1998; Burnett et al., 2001).

Ozone Irritates The Lungs

Ground-level ozone is the air pollutant responsible for most of the smog alerts declared in Ontario. It is a secondary air pollutant formed in the air by a reaction between NOx and volatile organic compounds (VOCs) in the presence of sunlight. Because sunlight is needed for the reaction, air levels of ozone are also related to the weather, and are higher in the summer months in Canada.

Child with inhaler: Pat McGrath, Ottawa Citizen

Ozone has been linked to reduced lung capacity in healthy adults and children, an increased rate of respiratory infections such as bronchitis and pneumonia particularly among young children, increased hospitalizations for lung disease, and increased rates of non-traumatic deaths (TPH, 2000; OMA, 1998). While it has long been understood that ozone can aggravate asthma symptoms, it is only recently that studies have suggested that ozone may actually contribute to the development of the disease. For example, a ten year study conducted by the University of Southern California has found that children who live in high ozone communities and play three or more sports develop asthma at a rate three times higher than those in low ozone communities (CARB, 2002).



Ozone Levels Frequently Excessive

Clear and consistent increases in non-traumatic deaths and hospital admissions for respiratory illnesses have been documented at 1-hour ozone levels as low as 20 parts per billion (ppb) and 25 ppb respectively (NAAQO, 1999a). As illustrated in Figure 3, these air levels are exceeded on a regular basis in most communities in Ontario (data from OMOEE, 2001).

Levels Of Fine Particulate Matter Frequently Excessive

Fine particulate matter ($PM_{10/2.5}$) is the name given to the tiny airborne particles that are small enough to be inhaled into the lungs. These particles, which can include acid aerosols, metal fumes, organic chemicals, pollen and smoke, are divided into categories according to their size. Inhalable particulate matter (called PM_{10}) is less than 10 microns in diameter while respirable particulate matter (called $PM_{2.5}$) is less than 2.5 microns in size and enters the lungs more deeply than PM_{10}.

Estimates suggest that sulphates, the acid aerosol that is formed in the air from SO_2, represent about 25% of the PM_{10} and 40% of the $PM_{2.5}$ in Ontario's air. Coal-fired power plants are one of the most significant sources of SO_2 in the province (about 23% in 2001)(OPG, 2002).

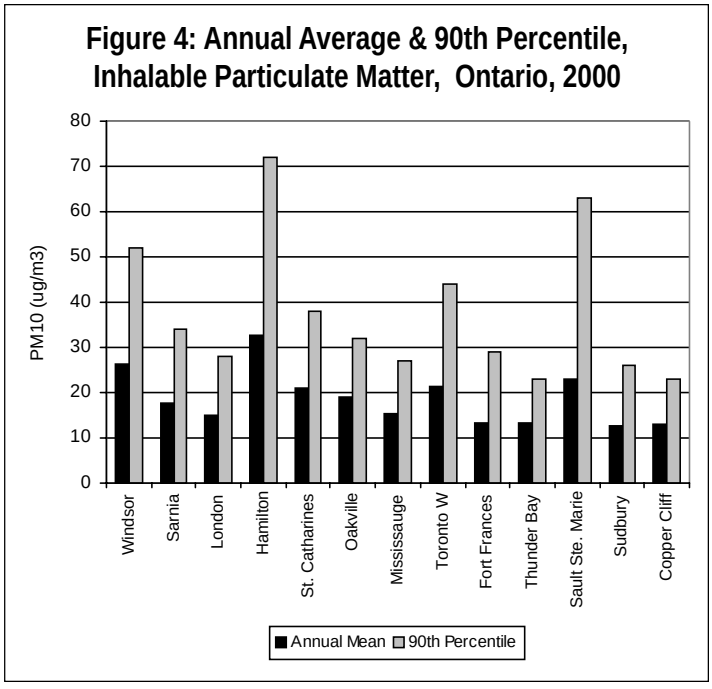
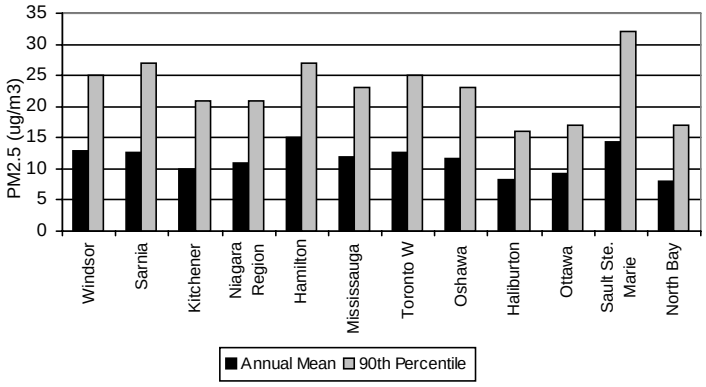


Figure 5: Annual Average & 90th Percentile, Respirable Particulate Matter, Ontario, 2000



Clear and consistent increases in non-traumatic deaths and hospital admissions have been documented at daily PM_{10} and $PM_{2.5}$ levels as low as 25 and 15 micrograms per cubic meter (ug/m^3) respectively (NAAQO, 1999b). As figures 4 and 5 illustrate, these air levels are exceeded on a fairly frequent basis in many communities in Ontario (data from OMOEE, 2001).

The Ontario Medical Association (OMA) has estimated that fine particulate matter in Ontario's air contributes to approximately 1,900 premature deaths in Ontario each year (OMA, 2000).

Gaseous Air Pollutants Harm Health As Well

Several studies conducted on different continents in recent years have suggested that the gaseous air pollutants also have a significant direct impact on human health (Pengelly et al., 2000). For example, a 1998 study demonstrated that nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and ozone were responsible for 4.1%, 1.4%, 0.9% and 1.8% respectively of all premature deaths in eleven different cities in Canada including Toronto, Ottawa, Hamilton, London and Windsor. Combined, these gaseous air pollutants were responsible for, on average, 7.7% of all premature deaths in these eleven cities (Burnett, 1998).

A 1999 study of the population in Toronto, suggested that the gaseous air pollutants, particularly NO_2 and CO, may even have a greater impact on hospital admissions than fine particulate matter (Burnett, 1999). The researchers have concluded that studies directed at fine particulate matter alone may significantly underestimate the overall impact of air pollution on human health.

U.S. Coal-Plants Have A Significant Impact On Ontario's Air

In northeastern North American, air pollutants tend to flow from the mid-western United States and the Ohio valley, across southern Ontario to southern Quebec, and into the northeastern United States (IJC, 1998). Computer modelling suggests that a significant percentage of the ozone and sulphates (and therefore fine particulate matter) that affects southern Ontario originates as NOx and SO_2 in the United States (OMOE, 2001a). A significant portion of these air pollutants is emitted from coal-fired power plants operating in the mid-western United States.

Progress On Transboundary Ozone

In December 2000, Canada and the United States signed the Ozone Annex, an agreement under the *Canada-U.S. Air Quality Agreement* that addresses the precursors of ozone — NOx and VOCs. Under this agreement, the U.S. has committed to cutting total NOx by 36% of 1990 levels by 2010 in the region of the United States that is responsible for transboundary air pollution in Canada (Env Can, 2001b). The U.S. expects that much of its commitment will be met with the NOx SIP Call (State Implementation Plans), regulations introduced by the U.S. EPA that require 22 jurisdictions to cut summertime emissions of NOx by about 35% by 2007. Under the Ozone Annex, Ontario is committed to cutting NOx emissions from all fossil-fuelled power plants and generators in southern Ontario by 50% of 1998 levels to 25 kt by 2007 (Canada, 2000).

Why move beyond coal?

A significant portion of the air pollution that affects Ontario is emitted from coal-fired power plants in the United States.

Progress Still Needed On Transboundary Pollution

Canada hopes to obtain a commitment from the United States for a reduction in sulphur dioxide emissions of 50% or more under a Particulate Matter (PM) Annex to be negotiated sometime in the next three years (Canada, 2001). In order to gain significant reductions in SO_2 emissions from coal-fired power plants on the U.S. side of the border, many believe that it is essential for Ontario to make deep cuts in SO_2 emissions from coal-fired power plants in Ontario's electrical sector. Experience with the acid rain debate two decades ago suggests that Canada has the greatest chance of success in negotiations with the United States when it moves first to reduce air emissions within its own borders. With the opening of the electrical markets to competition on both sides of the border, this strategy may be more important than ever.

4. Coal Plants Produce Acid Rain

Acid Rain Is Still A Problem

While huge improvements have been made on the levels of acid rain by both Canada and the United States since the 1970s, acid rain remains a serious environmental problem today. In 1997, a multi-stakeholder task group, the Acidifying Emissions Task Group (AETG), struck by the federal government to assess the acid rain issue concluded that:

> "Even in 2010, with full implementation of the Canada and U.S. programs, almost 800,000 km^2 in south-eastern Canada — an area the size of France and the United Kingdom combined — will receive harmful levels of acid rain……As a result, 95,000 lakes in south-eastern Canada will remain damaged by acid rain" (AETG, 1997).

Why move beyond coal?

Acid rain occurs when acids or acid aerosols that have formed in the air from SO_2 and NOx, fall to earth as rain, snow, fog or dry particulate matter. (These are the same air pollutants that make up a significant percentage of the fine particulate matter that is known to harm human health when airborne.) Since 1991, when the Canada-U.S. Air Quality Agreement was signed, Canada has reduced total SO_2 emissions by 40% of 1990 levels, and the U.S. has cut emissions by 30% of 1990 levels. When the U.S. program is fully implemented in 2010, SO_2 emissions will be cut by 40% of 1990 levels as well (AETG, 1997). With full implementation of both programs, U.S. emissions will still be five times greater than emissions from Canadian sources, and will still be responsible for more than half of the acid rain in eastern Canada (AETG, 1997).

Acid rain still threatens 95,000 lakes in south-eastern Canada.

Acid Rain Needs To Be Cut By 75%

The task group indicated that SO_2 caps in Ontario, Quebec, and the mid-western and eastern states, would have to be cut by an additional 75% if most of eastern Canada was to be protected from acid rain. It also identified the need to reduce emissions of NOx that are contributing to acid rain by forming acidic nitrates in the atmosphere (AETG, 1997).

In January 2000, the Ontario government announced its intention to reduce its acid rain cap for SO_2 emissions by 50% — from 885 kt/year to 442.5 kt/year — by 2015 (Canada, 2001). In order to achieve this 442.5 kt cap, SO_2 emissions from all sources in Ontario will have to be cut by 160.5 kt/year beyond current day emissions which are 603 kt (OMOE, 2002a).

Coal-fired power plants in Ontario are responsible for about 23% of Ontario's SO_2 emissions and 14% of the province's NOx emissions, while fossil-fuelled power power plants in the U.S. are responsible for approximately 70% of that country's SO_2 emissions and 25% of its NOx emissions (CEC, 2002).

5. Coal Is A Major Source Of Mercury

Mercury Is Toxic And Persistent

Mercury is a highly toxic element that is capable of accumulating in the aquatic food chain. While mercury is naturally present in the air, water, soil and living organisms, releases from human activities have increased substantially with industrialization and may now be responsible for one-half or more of total emissions to the air each year (CEC, 1997). Coal-fired power plants

are one of the leading sources of mercury emissions in North America (CEC, 1997; IJC, 1998).

In high doses, mercury can kill, produce sensory and motor impairments in adults, and produce serious developmental defects such as mental retardation and blindness in children who are exposed prenatally (NAS, 2000; EPA, 1997). Mercury has been clearly associated with population poisonings in Japan and Iraq where hundreds died and thousands became seriously ill as a result of the exposure (NAS, 2000). Mercury poisoning has resulted from high-level occupational exposures as well.

Mercury Presents Developmental Risks To Children

In recent years, negative health impacts have been documented in a number of populations exposed to low-levels of mercury from environmental sources. In several studies, subtle neuro-developmental effects such as deficits in attention, verbal memory, fine-motor skills, and language development, have been seen among children whose mothers ate fish during pregnancy (NAS, 2000)(EPA, 1997). The National Academy of Science (NAS) has estimated that over 60,000 children per year in the United States are born at risk from adverse neuro-developmental effects due to prenatal exposure to mercury (NAS, 2000). The Centre for Disease Control puts the number closer to 300,000 children per year (NAS, 2000).

Between 60,000 and 300,000 children per year in the United States are born at risk from adverse neuro-developmental effects due to prenatal exposure to mercury (NAS, 2000).

Fish Consumption Restricted Because Of Mercury

In Ontario, mercury is responsible for almost one quarter of the consumption restrictions placed on fish caught in Lake Ontario and for 99% of the consumption restrictions placed on fish from inland lakes (OMNR, 1998). The U.S. Food and Drug Administration (U.S. FDA) has issued an advisory, warning pregnant women and women of childbearing age who may become pregnant, to avoid eating fish species that typically have higher levels of mercury such as shark, swordfish, king mackerel and tilefish (U.S. FDA, 2001). The Food Advisory Panel to the U.S. FDA has recommended that the FDA extend its advisory to include tuna. The Panel is suggesting that pregnant women eat no more than two six-ounce servings of tuna each week (Sullivan, 2002).

Health Canada has issued an advisory, encouraging Canadians to limit their intake of shark, swordfish and fresh and frozen tuna, to one meal per week because of the mercury levels in these fish. Pregnant women, women of childbearing age, and young children are encouraged to limit their consumption of these fish to one meal per month. Health Canada's advisory does not apply to canned tuna that is supposed to have lower levels of mercury because of the age of the fish used for canning (Health Canada, 2002).

Mercury is responsible for 99% of consumption restrictions placed on fish from inland lakes.

Progress Needed On Mercury

Mercury has been the subject of several international agreements in North America. In 1994, under the *Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem*, mercury was targeted for a 90% reduction by the year 2000. While other sectors in Ontario have made significant progress towards this goal, Ontario's electrical sector has actually moved further away from it. In 2000, mercury emissions from other sectors in Ontario had been reduced by 82% of 1988 levels, while mercury emissions from Ontario's electrical sector had increased by 18% from 500 kg/year to 590 kg/year (OCAA, 2000).

A mercury standard for coal-fired power plants is being developed under the Canada-Wide Standards (CWS) process, and is on the agenda of the fall 2002 meeting of the Canadian Council of Ministers of the Environment (CCME) (Env Can, 2002).

The U.S. EPA has also been involved in a standard-setting process for mercury emissions from coal-fired power plants. The EPA has been directed by the U.S. Congress to develop a mercury rule that is based on Maximum Achievable Control Technology (MACT) (Env Can, 2002). This limit is supposed to be proposed in 2003, finalized in 2004, and implemented in 2007 (OMOE, 2001a).

However, the standard-setting process in the United States is complicated by the fact that a number of Bills have been proposed by various politicians with greatly varying requirements for mercury emissions. For example, Senator Jeffords has proposed a 4-pollutant Bill called the *Clean Power Act* that would require coal plants to cut mercury emissions by 90% by 2008, while President Bush has proposed the *Clear Skies Act* that, while setting a cap for mercury emissions, would eliminate the mercury MACT Rule (Lazaroff 2002; Env Can 2002).

III What Needs To Be Done?

1. A Three-Pronged Approach Required

A report commissioned by Environment Canada on policy options and tools that could be employed to reduce air emissions from the electricity sector, concludes that any strategy directed at emissions reductions from the electricity sector must aim for three goals simultaneously:

1) Reduce overall demand for electricity by increasing energy efficiency;
2) Encourage generators directly, and indirectly through consumers, to switch to cleaner fuels and emission-free technologies; and
3) Establish or maintain standards to protect public health and the environment from specific air pollutants emitted from coal-fired power plants in both the local and regional air sheds (Stratos, 2001).

The Commission for Environmental Cooperation (CEC), an agency established under the North American Free Trade Agreement (NAFTA), agrees with this assessment. In its report, *Environmental Challenges and Opportunities of the Evolving North American Electricity Market,* four of the seven major recommendations are directed at the promotion of energy efficiency and renewable energies, while one is directed at the need to maintain and/or develop regulatory standards to protect human health and the ecosystem in all regions of North American (CEC, 2002).

"Conservation measures and related technologies can also positively impact upon employment, technology and manufacturing capacity in Ontario" (Select Committee, 2002).

2. Energy Efficiency Has To Be Encouraged

Huge Potential In Energy Efficiency

Many believe that there is huge potential in energy conservation and energy efficiency measures to decrease demand for electricity. Ontario's Select Committee on Alternative Fuel Sources, a three-party committee established by the provincial legislature, and chaired by Conservative MPP, Doug Galt, has concluded that the reduction of energy demand is more important to Ontario's energy supply than is the creation of new supply (Select Committee, 2002).

In Ontario, electricity demand in the 1990s was reduced by 25,000 GWh annually from the figure expected through increases in energy efficiency (CIELAP, 2002). Energy experts, Torrie Smith Associates, have estimated that electricity demand in Ontario could be reduced by another 35,000 GWh annually by 2012 with systematic efforts to realize those reductions (CIELAP, 2002;

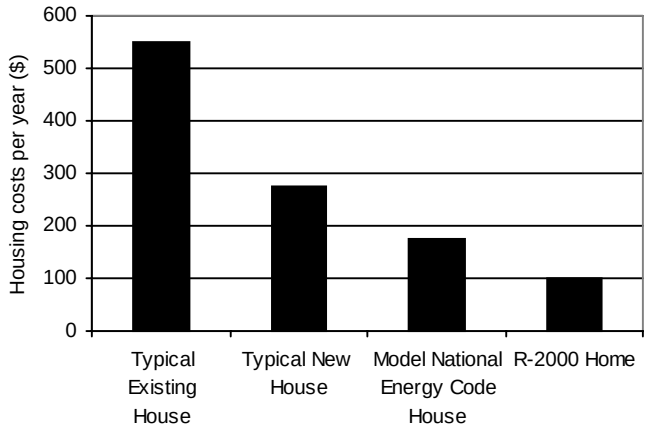
Energy costs associated with the operation of a building over its lifetime can easily exceed the initial capital cost of the structure (Middlesex-London Health Unit, 2001).

Torrie Smith, 2002). In addition, they have estimated that another 10,000 GWh per year of electricity could be generated by industrial and commercial co-generators[2] (Torrie Smith, 2002). These estimates indicate that energy efficiency and co-generation combined, could displace about 30% of all the electricity generated in Ontario in 2001, which is more electricity than was generated with coal plants in 2001 (i.e. 37,185 GWh).

Great Potential In Building And Appliance Standards

The CEC has identified changes in residential and commercial building codes as the area with the greatest potential for energy efficiency improvements in both Canada and the United States (CEC, 2002). In 1999, the residential sector in Canada accounted for 17% of secondary energy use and 15.5% of related greenhouse gas emissions while the commercial/institutional sector accounted for 12.5% of secondary energy use and 12% of greenhouse gas emissions (NRC, 2001a).

Figure 6: Annual Residential Heating Costs, Various Housing Standards



(Data from NRC, 2001a).

Energy use in the residential and commercial sectors is greatly affected by the building standards applied to their construction. For example, Figure 6 illustrates the huge variation in heating costs for homes built under different building standards. This speaks both, to the need to improve upon existing building codes, and to encourage retrofits for existing buildings.

Energy use in the residential, commercial and institutional sectors also reflects the energy efficiency of the appliances used in them. In the residential sector, space heaters, air conditioners and water heaters are the appliances responsible for the greatest share of energy use, while in the commercial/institutional sectors, space heaters, air conditioners, lights, and auxiliary equipment are the most significant appliances (NRC, 2001a).

Shared Savings Mechanism Promotes Energy Efficiency

With the changes in Ontario's electrical market, the Ontario Energy Board (OEB) has been given the mandate of regulating the municipal electric utilities that have responsibility for the distribution of electricity in the province. It has also been given the mandate to encourage electric utilities to promote energy efficiency. In practice however, the OEB has been discouraging utilities from promoting energy efficiency by linking their profits to their sales (OCAA, 2000).

The OEB's policy with respect to electric utilities is at odds with the regulatory regime that it applies to natural gas utilities that are privately owned. For example, Enbridge Consumers Gas has been allowed by the OEB to establish a "shared savings mechanism" that rewards both the utility and the customers when energy consumption is reduced through energy efficiency programs. In 1999, Enbridge's energy efficiency programs reduced its customers' bills by $57.1 million while providing its shareholders with a profit bonus of approximately $4.8 million (OCAA, 2000). By ensuring that utilities profit from energy savings, shared savings mechanisms encourage them to invest in energy efficiency programs that are both ambitious and effective (CIELAP, 2002; CEEA, 2001).

Select Committee's Recommendations

Ontario's Select Committee on Alternative Fuel Sources has made twelve recommendations on the policy changes needed to encourage energy efficiency measures in Ontario. For example, it recommends that:

- The OEB require all local distribution utilities to develop energy efficiency programs……and develop a system of incentives and penalties identical to those applied to the natural gas sector to encourage them [i.e. shared savings mechanisms];
- The OEB require all local distributors to establish "time-of-use" rates to encourage conservation among their costumers;
- Ontario government review, update and expand the application of the *Ontario Energy Efficiency Act* to a broader range of electrical appliances and equipment within 12 months; and
- Ontario government revise the *Ontario Building Code* to incorporate the most advanced science with respect to energy generation and energy conservation (Select Committee, 2002).

"But unlike conventional energy, renewable energy can increase energy security, foster rural development, improve human health, and decrease our emissions of greenhouse gases"
(Federal Liberal Caucus Working Group, 2002).

3. Renewable Energies Have To Be Encouraged

Renewable Energies Have Huge Potential

The CEC, Ontario's Select Committee on Alternative Fuel Sources, and the Federal Liberal Caucus Working Group on Environmental Technologies have all concluded that renewable energies have huge potential, from both a technological and economic perspective, to provide a significant share of clean and

secure energy in North America (CEC, 2002a; Select Committee, 2002; Federal Liberal Caucus, 2002).

The CEC has determined that the technology currently exists to generate electricity from wind, geothermal, solar, hydro and biomass on both a small-scale decentralized basis and on a large-scale centralized basis (CEC, 2002a).

Torrie Smith Associated have estimated that the new, renewable technologies, wind, small hydro (i.e. less than 20 MW of electrical capacity), and biogas, have the potential to produce about 19,000 GWh of electricity per year; 5,000 GWh of which could be on line by 2012 (CIELAP, 2002; Torrie Smith, 2002).

Environmental Costs Not Reflected In Price

At this time, it is estimated that it would cost 9 to 12 cents per kilowatt-hour (kWh) to develop the wind powered capacity described above and 5 to 8 cents per kWh to develop the small hydro electrical capacity described above. This is considerably more than the 3.5 cents per kWh that consumers used to pay for electricity in Ontario (CIELAP, 2002). The low cost of electricity from coal-fired power plants in Ontario reflects several realities:

Ontario Clean Air Alliance

1) Ontario's coal-fired plants have had many years (i.e. between 17 and 40 years) to pay off their capital costs;
2) The renewable technologies, because they are new, currently have low manufacturing volumes and poor economies of scale; and
3) The conventional technologies have benefited from long-term government subsidies that have not been available to renewable technologies.

However, the cost advantage of coal-fired power plants also reflects the reality that their environmental costs have been externalized. With coal-fired power plants, the public health and environmental costs associated with global climate change, smog, acid rain and mercury contamination that result from their emissions, are not borne by the generators, nor reflected in the price charged to customers.

These costs are born collectively by all of us — in terms of poor health, increased health care costs, depleted natural resources, a degraded natural environment, and a disrupted global climate. They are also borne more heavily by those whose health and livelihoods are particularly impacted by acid rain (e.g. loggers and fishers), mercury contamination (e.g. aboriginals and fishers), smog (e.g. the young and the elderly) and climate change (e.g. those in poorer nations and/or tropical climates).

A study published in the journal, Science, in 2001, estimates that the real price of coal generated electricity, when health and environmental costs are built in, is 5.5 to 8.3 U.S. cents per kWh, which is equivalent to 8.25 to 12.5 cents per kWh in Canadian funds (CIELAP, 2002).

Establish Policies That Support Renewables

Many believe that the introduction of the alternative technologies has been hampered by government policies and regulations that are biased towards existing, conventional technologies (CEC, 2002a). The Federal Liberal Caucus Working Group on Environmental Technologies, chaired by Liberal MP, Julian Reed, has reported that conventional energy sources have benefited from a range of long-standing government subsidies that have not been made available to renewable or new low-impact energy sources.

Between 1970 and 1999, direct federal spending on fossil fuel based energy was $40.4 billion, while federal support for Canada's nuclear industry has exceeded $16.6 billion over the last five decades

(Federal Liberal Caucus Working Group, 2002).

In countries that have revamped their public policies to support the development of renewable energies, the results have been impressive. For example, Germany, which began to invest in wind power in 1990, has developed 8,000 MW of wind-generated electrical capacity, and is on track to meet its target of 22,000 MW of wind-powered electrical capacity by 2010 (CEC, 2002a).

The Federal Liberal Caucus Working Group on Environmental Technologies has recommended that:

- Given the tremendous benefits of renewable energy, the federal government must level the playing field and provide the same support and leadership we have traditionally provided for the conventional energy sector.

Establish Renewable Energy Portfolio Standards (RPS)

A number of countries around the world have used a Renewable Energy Portfolio Standard (RPS) as a regulatory tool to encourage the development of renewable energy capacity. An RPS requires energy producers to supply a certain percentage of their energy from renewable sources. In the U.S., four-

teen States have established RPS that dictate the percentage of electricity that must be generated with renewable technologies by specified target dates.

Massachusetts has one of the most ambitious standards; it is requiring that 7% of total electricity sales come from new renewables by 2012 (STRATOS, 2001). Texas also has an aggressive program to promote renewables. It indicates that generation capacity from renewables must be increased by between 400 and 2000 MW each year between 2002 and 2019 (see Table 3). In the Texas rule, renewable energy technologies include those derived from the sun, wind, geothermal, hydroelectric, waves or tides, or biomass-based waste products, including landfill gas (STRATOS, 2001). California has recently signed a Bill that will require utilities to ensure that 20% of their electricity is generated with renewable sources by 2017 (Associated Press, 2002).

Table 3: Texas, Schedule for Increase in Renewable Generating Capacity per Year

Year	Megawatts/Year
2002/2003	400
2004/2005	850
2005/2005	1,400
2006 - 2019	2,000
Cumulative Increase	33,300

(STRATOS, 2001)

Ontario's Select Committee on Alternative Fuel Sources has recommended that:

- Ontario establish a Renewable Portfolio Standard that is "among the most aggressive in North America" and which includes provisions to "eliminate carbon-based electricity generation in Ontario by 2015" (Select Committee, 2002).

Ontario Power Generation

Establish Tax Policies That Support Renewables

Ontario's Select Committee on Alternative Fuel Sources has also recommended that the Ontario government adopt tax policies to encourage the development of renewable energies. For example, in December 2001, the Federal government announced that it will be establishing a Wind Power Production Incentive of up to 1.2 cents per kWh to support the installation of 1,000 MW of new wind energy in Canada over a five-year period. Ontario's Select Committee has recommended, among other things, that the Ontario Government:

- Match the Federal Wind Power Production Incentive and consider expanding this program to include renewable technologies such as solar, biomass and small hydraulic projects within Ontario;

- Grant tax holidays to wind farms similar to the 10-year tax holiday offered for new, rebuilt or expanded hydro-electric stations (Select Committee, 2002); and

❖ Instruct the Ontario Energy Board to establish a Systems Benefit Charge of 0.1 cents per kilowatt-hour (kWh) on electricity bills to fund a renewable energy trust fund to support the development of renewable energy programs (Select Committee, 2002).

What needs to be done?

4. Coal-Fired Power Plants Should Be Phased Out

No Emission Controls For CO_2

Ontario's Select Committee on Alternative Fuel Sources has recommended the phase-out of all coal- and oil-fired power plants in Ontario by 2015 and the closure of the Atikokan and Thunder Bay Generating Stations by 2005. It has also recommended that the Ontario Government establish stringent emissions limits for the operation of all current coal- and oil-fired power plants that are equal to, or less than, the emissions limits for natural gas fired generators (Select Committee, 2002).

There is no commercially available technology that can be used to capture CO_2 emissions from coal plants.

A large number of organizations have called for the phase-out of Ontario's coal-fired power plants because: a) they are huge contributors of greenhouse gases; and b) there is currently no commercially available technology that can be used to reduce their CO_2 emissions. There are a few emission control technologies that can be used to remove a significant portion of the other air pollutants (i.e. SO_2, NOx and mercury) from the stacks of coal-fired power plants, but none of these technologies reduce CO_2 emissions. In fact, some of these technologies actually increase CO_2 emissions because they require energy to operate (OMOE, 2001a).

As can be seen in Table 4 below, even when highly efficient emission control devices are installed on coal-fired power plants, their emissions are still much greater than those that can be achieved with other available options. This is particularly true for CO_2 emissions.

Table 4: Emission Reductions Comparison Between Coal-Plants with Emission Control Devices and Other Options

Pollutant	Existing OPG Coal Plants (kg/MWh)*	OPG Plants & Emission Controls (% Red'n)*	Combined Cycle Natural Gas Turbines (% Red'n)**	Wind Turbines (% Red'n)	Energy Efficiency Measures (% Red'n)
Nitrogen Oxide	1.2	63-80 (I)	90	100	100
Sulphur Dioxide	4.6	84 (II)	99+	100	100
Mercury	0.017 (g/MWh)	70 (III)	99+	100	100
Carbon Dioxide	890	Slight increase with I&II	60	100	100

(I) Selective Catalytic Reduction (SCR) & Low-NOx Burners
(II) Flue Gas De-Sulphurization (FGD) with high-sulphur coal
(III) Expected capability of technologies under development
(* data from OMOE, 2001a; ** data from TPH, 2000)

Multiple Benefits From Phasing Out Coal

While CO_2 may be the air pollutant that drives the phase out of coal-fired power plants, there will be many other public health and environmental benefits besides those associated with climate change. If coal based electrical capacity were displaced with renewable technologies and energy efficiency measures, total emissions of $SO_{2,}$ NOx, and mercury in this province could be cut by up to 23%, 14% and 23% respectively, while CO_2 emissions could be cut by up to 20%. If coal based electrical capacity were displaced with a low emissions alternative such as high efficiency natural gas generators, total emissions of $SO_{2,}$ NOx, and mercury in the province could be reduced by up to 23%, 12% and 23% respectively, while total CO_2 emissions could be reduced by up to 12%.

Minor Increases In Cost To Phase-Out Coal

An economic analysis conducted for the Ontario Clean Air Alliance (OCAA), a non-governmental organization, indicates that, if a significant portion (i.e. 83%) of Ontario's coal-generating capacity were converted to high efficiency natural gas generation by 2014, electricity prices for the typical residential customer would increase by only $1.86 per month (OCAA, 1998). An economic analysis conducted for Ontario Power Generation (OPG) suggests that it should be possible to offer electricity from new, high efficiency natural gas turbines in 2012 without raising electricity prices above the rate expected for that year (OCAA, 2001). These economic analyses indicate that coal-fired power plants could be phased out of use in this province within a fairly tight time frame with a relatively small increase in the cost of electricity for consumers with some use of cost competitive low emission technologies such as high efficiency natural gas generation.[3]

Transitional Technologies

While high efficiency natural gas generators represent a huge improvement over coal-fired power plants, the fact that they do emit large quantities of $CO_{2,}$ combined with the fact that natural gas is a non-renewable resource, suggests that these generators should be viewed as a transitional technology that must eventually be replaced with renewable technologies.

In the State of Oregon, they have established a mandatory CO_2 standard that encourages the development of energy efficiency, co-generation and renewable energies while allowing the establishment of new gas-fired power plants. Under this standard, all new power plants must achieve a net emission rate for CO_2 that is 17% below the rate achieved by the most efficient gas-fired plants currently operating in the United States (Oregon, 2002). This standard can be achieved by:

- Increasing the efficiency of the proposed plant;
- Implementing co-generation so that waste heat is used for some productive purpose;
- Implementing projects off-site such as renewable energy or energy efficiency projects that "offset" excess CO_2 emissions; or
- Contributing funds to The Climate Trust that will in turn buy CO_2 "offsets" elsewhere.

The rules define "offsets" as any action that will avoid, sequester, or displace CO_2 emissions (Oregon, 2002).

This approach could be adopted in Ontario to allow the development of cost competitive low emissions alternatives as transitional technologies while actively encouraging the development of energy efficiency measures and renewable energies that would ultimately replace them.

Nuclear Energy Is A Transitional Technology

While nuclear energy is recognized by some as an alternative to coal because it does not present the air pollution and climate change concerns that coal does, neither the Select Committee on Alternative Fuel Sources, nor the CEC have recommended it as an alternative to coal-fired power plants. This can be attributed to a number of factors.

First of all, while nuclear energy does not contribute to smog or climate change, it does present other health, safety and security issues for workers, the public and the environment (CEC, 2002a). These concerns are particularly acute at the front end of the process, during the mining and processing of uranium oxide, and at the back end of the process, during the transportation and storage of highly hazardous radioactive wastes that can take thousands of years to decay (McKay, 1983).

Secondly, nuclear energy is expensive. Ontario Hydro accumulated $38 billion in debt in the 1980s and 1990s, when much of its activity was directed at the building and repairing of nuclear generating stations. This debt, and the high electricity prices that accompanied it, are the main reasons that the Ontario Government decided to introduce competition to Ontario's electrical sector (OMOE, 2002). In fact, in order to ensure that Ontario Hydro's successor company, Ontario Power Generation, would be viable, the Ontario government "stranded" approximately $22 billion of Ontario Hydro's debt. This stranded debt will have to be paid off by Ontario consumers as a surcharge paid on all electricity that enters the distribution system for years to come (OMOF, 1998).

While the OPHA recognizes that nuclear energy will serve an important role as a transitional technology in Ontario during the years in which renewable energy capacity and energy efficiency are being developed, it does not believe that nuclear energy should divert resources or regulatory support away from that needed to develop renewable energy capacity and energy efficiency standards in Ontario in the coming years.

IV How Do We Get There?

1. Action Needed From The Federal Government

The Federal government has responsibility for air pollution that crosses provincial or international borders. As such, it has responsibility for some aspect of all four environmental problems presented by coal-fired power plants. Ontario's coal-fired power plants contribute to acid rain in Quebec and smog from Ontario to Maine. They contribute to global climate change that is affecting the entire planet and mercury that contaminates food supplies from the Great Lakes to Canada's far north.

The Federal government must keep bi-national and multi-national commitments on acid rain, mercury and smog. It has also been actively involved in the multi-national negotiations related to climate change with the Kyoto Protocol. In addition, it will have responsibility for negotiating a PM Annex with the United States in the next few years to address U.S. sources of SO_2 that threaten the health of Ontario residents and the environment of all of eastern Canada.

By phasing out coal plants, the federal government could make progress on climate change, smog, acid rain, and mercury while setting the stage for the next round of negotiations with the United States.

By encouraging a phase-out of coal-fired power plants in Canada, the federal government could make progress on a number of environmental issues simultaneously. It would be making significant progress on climate change, mercury pollution, smog and acid rain directly, while setting the stage for the next round of negotiations with the United States on SO_2. If the federal government can also tie these emission reductions to investments in renewable energies, energy efficiency programs and co-generation, it would also be encouraging the energy shift required to address climate change in the long-term.

Newly Revised Guidelines For Coal-Fired Power Plants

In November 2001, the federal government released revisions to the National Guidelines on Thermal Power Generation Stations for consultation. Unfortunately the proposal is lacking in a number of significant ways. First of all, the revisions are directed at new fossil-fuelled power plants; they are not directed at existing plants. Consequently, they will have little impact on the near-term situation in Ontario because there are no current proposals for new plants or for major modifications to existing plants. Secondly, the proposal involves revisions to National Guidelines that have no force in law. Neither the electrical utilities, nor the provinces have to abide by the provisions contained in

these Guidelines. Thirdly, the reductions proposed for SO_2 (at least a 70% reduction) and NOx (60% reduction), while significant, will do little to discourage the on-going use of coal. Finally, no emission performance rates have been proposed for mercury or for CO_2.

Recommendations To The Federal Government

It is recommended that the Federal government:

- Ratify and implement the Kyoto Protocol as currently written, recognizing that it is only the first step towards the 60 to 80% reduction in greenhouse gases that will be required to retard global climate change;
- Provide municipalities with stable, long-term funding, that is not dependent upon participation by the province, with which to promote energy efficiency projects within their communities;
- Establish a schedule of ambitious and increasing renewable energy targets to guide the development of energy policies, environmental regulations, and budgetary commitments at the federal level for the coming years;
- Provide financial support to renewable technologies that it equal to that traditionally provided to conventional energy sources; and
- Establish regulations under the Canadian Environmental Protection Act (CEPA) that encourage the phase out of coal-fired power plants in Canada by 2010.

The province has a multitude of avenues by which it can encourage a shift away from coal towards energy efficiency and renewables.

2. Action Needed From The Province

The province, as the jurisdiction with primary responsibility for public health, education, environment and natural resources, clearly has an interest in the public health and environmental impacts presented by coal-fired power plants. The Ontario government is also very aware of the continued contribution of U.S. sources to air pollution and acid rain in this province. By moving to phase out coal-fired power plants in Ontario, the Ontario government strengthens it position on the electrical sector for the next round of Canada-U.S. negotiations on transboundary air pollution.

The province is also the jurisdiction with primary responsibility for energy issues within its jurisdiction, building standards, planning acts and municipal legislation. This means that the province has a multitude of opportunities and avenues by which it can encourage a shift away from coal-fired power plants towards energy efficiency, renewable energies, and other practices that protect human health and the environment.

Ontario's Select Committee and the CEC have both concluded that, in addition to environmental benefits, investments in renewable energies and energy efficiency present many economic benefits for society.

Emissions Trading As A Regulatory Framework

The Ontario government has introduced an emissions trading scheme as the framework within which to reduce air emissions from Ontario's electrical sector, and eventually from all industrial sectors in Ontario. When properly designed, emissions trading schemes can effectively reduce emissions to an air shed, while giving the regulated organizations some flexibility in their response. In the United States, where emissions trading was used to reduce SO_2 emissions under the acid rain program, emissions trading was found to be a cost-effective regulatory tool.

If an emissions trading scheme is not properly designed, it can fail to produce the emission reductions desired, or worse, increase air pollution on a region-wide basis.

Because emissions trading schemes provide the regulated organizations with greater flexibility, there is often less resistance to them than to the more traditional regulatory approaches. If, however, an emissions trading scheme is not properly designed, it can fail to produce the emission reductions desired, or even worse, increase air pollution on a region-wide basis.

Emissions trading schemes also have the potential to create environmental justice inequities; areas that already have air pollution problems can become burdened with more. These "air pollution havens" are more likely to occur in areas that are socio-economically disadvantaged.

Cap And Trade Versus Emissions Reduction Trading

There are two basic forms of emissions trading:

- A closed-market trading system called "cap-and-trade"; and
- An open-market trading system called "emission reduction trading".

With a cap-and-trade system, the regulator establishes a cap on the total volume of an air pollutant that can be emitted by all the regulated sources in a common air shed, and divides that cap into emission allowances that can

either be auctioned to the emitters or assigned to the regulated sources on the basis of historic or permitted emissions. Companies must keep their air emissions within the volume allowed them, or purchase allowances from other companies. The emissions trading system used successfully by the U.S. government to reduce acid rain was a cap-and-trade scheme (STRATOS & GCSI, 2001).

Emission reduction trading programs establish a reference level of emissions for each air pollutant for every source in a common air shed. The reference level may be the volume of emissions for a selected year. When one of the sources in that air shed reduces its emissions below that reference level, it creates emission reduction credits that can be "banked" for future years or sold to other sources in the air shed. The effectiveness of this system depends upon the reference levels established and the reliability of the emission estimates (STRATOS & GCSI, 2001).

Flaws In Ontario's Emissions Trading Scheme

The emissions trading program introduced by the Ontario Government combines features of the closed and open market trading systems. It caps Ontario's electrical sector for SO_2 and NOx while allowing the electrical sector to buy emission reduction credits from uncapped sources, when the uncapped sources emit less pollution than they are allowed to emit, based on other regulations that currently exist or that are subsequently introduced (STRATOS & GCSI, 2001).

Environment Canada and the U.S. EPA have both expressed serious concerns with Ontario's emissions trading scheme.

A number of organizations have expressed serious concerns with Ontario's scheme including Environment Canada and the U.S. Environmental Protection Agency. Of particular concern to many is the fact that Ontario is allowing the electrical sector, to which emission caps apply, to buy emission reduction credits from sectors for which there are no emission caps. Organizations are concerned that this practice could make the program ineffective, or worse, lead to an increase in emissions to the overall air shed (U.S. EPA, 2001; Env Canada, 2001).

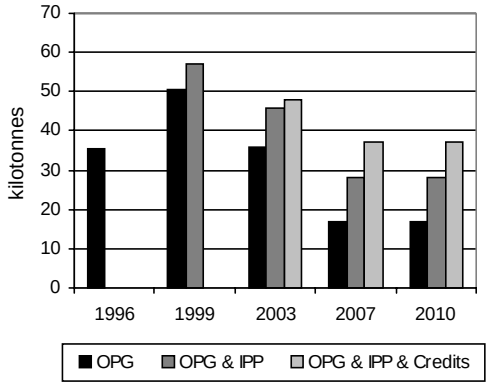
Caps For NOx Too Modest

In addition to a properly designed emissions trading scheme, aggressive and declining air emission caps are needed to drive the desired outcome. The caps established by the provincial government are far from aggressive. In fact, they appear to encourage a continued reliance on coal-fired power plants.

The NOx cap established for the electrical sector is far too modest. The Ontario government has established a cap of 28 kilotonnes (kt) for NOx from all electrical generators by the year 2007. However, the Ontario Government will also allow each organization to exceed its cap by 33% provided that it has purchased emission reduction credits from other organizations. When the allowances are added to the caps, it becomes apparent that emissions from this sector can remain as high as 37.24 kt until 2010 (see Figure 7).

While a 33% reduction in emissions sounds substantial, it must be put in perspective. When fully implemented, Ontario's regulatory program will allow higher emissions of NOx from Ontario's electrical sector in 2010 than actual emissions from Ontario Hydro's five coal-fired power plants in 1996 (35.4 kt). Given the health concerns associated with ozone levels in the province, these caps are far from satisfactory.

Figure 7: Nitrogen Oxide Emissions from Ontario's Electrical Sector, Past, Present & Projected



Notes:
OPG is Ontario Power Generation
IPP represents Independent Power Producers
(Data drawn from OMOE, 2001a; TPH, 1999; OMOEE, 2001a)

Caps Do Not Ensure Ozone Annex Commitment

With the NOx cap established, it is not clear how the government will meet its commitment under the Ozone Annex to cut NOx emissions from all fossil-fuelled generators in central and southern Ontario to 25 kilotonnes by 2007 (Government, 2000). Table 5 illustrates how the provincial government envisions NOx emissions being allocated over time under its Emissions Trading Regulation. With the 33% allowance added to the caps for each region of Ontario, it appears that NOx emissions from generators in southern and central Ontario could exceed the 25 kt cap set under the Ozone Annex by nearly 8 kt.

Table 5: NOx Emissions Allocation Timetable Under Ontario's Emissions Trading Regulation

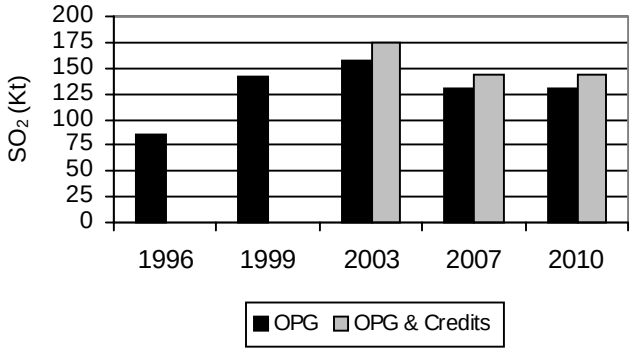
	Overall Cap (kt)	OPG's Cap (kt)	OPG Cap & 33% Allowance (kt)	Cap for Other Generators (kt)	Cap for Others & 33% Allowance (kt)
2002-3	36	35	46.6	no cap	
2004	36	25	33.3	10	13.3
2005	36	22.4	29.8	12.6	16.8
2006	36	21.1	28.1	13.9	18.5
	Overall Cap (kt)	**Cap for S. & Central Ontario (kt)*****	**Cap & 33% Allowance for S. & Central Ontario (kt)*****	**Cap for Rest of Ontario (kt)**	**Cap & 33% Allowance for Rest of Ontario (kt)**
2007	28	*15.5 /**9.1	32.7	*1.5/**0.9	3.2
2008-10	28	24.6	32.7	2.4	3.2

(Data derived from OMOEE, 2001c)
*OPG generators
**Other generators
*** Identifies generators affected by Ozone Annex.

Caps For SO_2 Allow Increased Emissions

The SO_2 caps established for the electrical sector will actually allow SO_2 emissions from this sector to increase. The provincial government has established a cap of 157.5 kt for SO_2 that will apply until 2006. It will allow companies in the electrical sector to exceed this cap by 10% by purchasing emission reduction credits from other organizations. This means that the actual cap will be 173.5 kt until 2006. This cap is 32.8 kt greater than actual emissions in 1999 and 88.6 kt greater than actual emissions in 1996 (see Figure 8).

Figure 8: Sulphur Dioxide Emissions from Ontario's Electrical Sector, Past, Present & Projected



(Data from OMOE, 2001a; TPH,1999; OMOEE, 2001a)

After 2007, the cap for SO_2 is reduced to 131 kt. With the 10% allowance added to it, this translates to an actual cap of 144.1 kt. This cap represents a 59.2 kt increase over actual emissions by this sector in 1996. This cap is most distressing for two reasons:

- It appears to ignore the advice of the Acidifying Emissions Task Group that recommended a 75% cut in SO_2 emissions; and
- It disregards the numerous health impacts associated with air levels of fine particulate matter in this province.

It also demonstrates that, far from discouraging the use of coal-fired power plants in this province by establishing aggressive air emission caps, the provincial government appears intent upon encouraging on-going reliance on coal-fired power plants.

No Caps Provided For Mercury Or CO_2

The province's Emissions Trading Regulation provides no caps for emissions of mercury or CO_2. Given the significant contribution of coal-fired plants to emissions of both mercury (23%) and greenhouse gases (20%) in this province, this is a very disturbing omission. Furthermore, without caps for mercury and CO_2, it may be possible for generators to achieve the air emission caps established for this sector by installing emission control devices that will do little if anything to reduce emissions of mercury and other air toxics, while possibly increasing emissions of CO_2.

Recommendations To The Province

The OPHA believes that the Ontario government should move quickly on the recommendations of Ontario's Select Committee for Alternative Fuel Sources, and recommends that the Ontario government:

- Instruct the OEB to establish a shared savings mechanism that rewards utilities for investing in energy efficiency programs that effectively reduce electricity consumption and their customers' bills;
- Move immediately to revise the Ontario Building Code to incorporate the most advanced science with respect to renewable energies, co-generation and energy efficiency;
- Establish a schedule of increasing Renewable Portfolio Standards (RPS) that meets or exceeds the most ambitious program established in North America;
- Ensure that the emission trading scheme developed for this province:
  - Is a cap and trade model consistent with that proven in the United States; and
  - Significantly improves air quality and protects public health across the regional air shed on both sides of the border;
  - Is supported by air emission caps for the electrical sector that will result in the phase-out of coal-fired power plants by 2010;
  - Includes a hard NOx cap of 25 kt for fossil-fuelled power plants in southern and central Ontario to be achieved by 2007; and
  - Limits imports and exports of electricity to generators that achieve emission performance rates for mercury, NOx, SO_2 and CO_2 that are as good as, or better than, those achieved by high efficiency natural gas generators.

Since 1996, Toronto's Better Buildings Partnership has reduced CO_2 emissions by 72,000 tonnes/ year and created about 3,000 contract jobs within the city.

3. Action Needed From Municipalities

There are 447 municipalities in Ontario providing services to citizens across the province. Municipalities are well positioned to encourage a shift in energy use both as consumers and as service providers.

Municipalities Can Promote Energy Efficiency

A number of municipalities in Ontario have established energy efficiency programs within their corporate operations both to reduce greenhouse gas emissions and to produce energy savings. These programs have proven quite effective. For example, in the former City of Toronto, $15 million was invested to retrofit street lighting from incandescent lamps to metal halide lamps. This investment has reduced CO_2 emissions from the City's operations by 20,000 tonnes/year while producing energy cost savings of $1.9 million/year (EEO, 2002).

In the City of Greater Sudbury, a $7 million retrofit of 30 public works buildings, including the water and sewage treatment plants, has cut energy use by 30%, and produced energy savings of approximately $1 million a year. Sudbury is also preparing a second "Strategic Energy Plan" that will target other building stock including pools, arenas, transit garages, libraries, and fire halls. This second plan is expected to produce further energy savings worth $800,000 per year (Sudbury, 2002).

The City of Greater Sudbury has cut energy use by 30% and produced energy savings of $1 million per year.

A few municipalities have also established programs to encourage energy efficiency within their communities. In the City of Toronto, for example, the City's Energy Efficiency Office encourages retrofits for all publicly and privately owned buildings in the City through a program called the Better Buildings Partnership (BBP). Since the program's inception in 1996, over $100 million of private and public funds have been invested in the retrofitting of 155 buildings. This investment has reduced CO_2 emissions in the City by 72,000 tonnes/year and reduced the operating costs of the participants collectively by $6 million/year. The project has also created about 3,000 contract jobs within the city (BBP Program, 2002).

Municipalities can also encourage energy conservation efforts among individuals in their communities by working with the Green Communities Association. This Association represents community-based local organizations that promote energy conservation by delivering residential energy efficiency ssessments and providing links to contractors that can complete the retrofits recommended. The Green Communities Association reports that homeowners who follow the advice of its member organizations reduce their energy use by, on average, 25% (Green Communities Association, 2002).

Municipalities Can Promote Renewable Energies

Municipalities can also use their clout as consumers to promote the development of renewable energies and low emission generators of electricity. For example, Chicago and 48 city government agencies, have signed a contract with a local utility, ComEd, to purchase 10% of their electricity from renewable sources. This figure will increase to 20% in five years (Fischlowitz-Roberts, 2002).

Within Ontario, sixteen municipalities have directed their staff to examine the possibility of phasing-out the purchase of electricity generated in coal-fired power plants. The Friends of the Earth (FOE), with funding provided by Environment Canada, has produced a report called the *Green Electricity Buyer's Guide,* to assist corporations, municipalities and institutions to develop and implement purchasing policies that favour renewable energies (FOE, 2002). The Ontario Clean Air Alliance has posted the names of coal-free electricity providers on its website at www.electricitychoices.org/coalfree.

Recommendations To Municipalities

The OPHA recommends that municipalities:

- Establish ambitious energy efficiency programs that include specific targets and timelines for their corporate operations and ensure that financial savings are re-invested in energy efficiency projects and/or used to support purchasing policies that favour renewable energies and low emission generators of electricity;
- Develop and implement corporate purchasing policies that favour renewable energies and low-emission generators of electricity; and
- Establish programs to encourage large organizations within their communities to establish ambitious energy efficiency programs;
- Encourage large organizations within their communities to adopt purchasing policies that favour renewable energies and low emission generators of electricity; and
- Establish social marketing programs to encourage energy conservation efforts among individuals in their communities.

Endnotes

[1] Nitrogen oxides (NOx) can be expressed as nitric oxide (NO) or nitrogen dioxide (NO_2) which can affect the volumes. NO_2 can be converted to NO by multiplying by 30 and dividing by 46. In this report, nitrogen oxides will be reported as NO unless indicated otherwise.

[2] Co-generation occurs when waste heat from the generation of electricity is used as process steam, for space heating, or for water heating in nearby buildings or structures. Co-generation can increase the fuel efficiency of a generator from 35 or 52% to 80%, which means that 80% of the fuel energy is being converted into electricity.

[3] A significant amount of work is currently being directed towards the development and establishment of technologies such as plasma gasification that could be used to generate electricity from coal without releasing large quantities of carbon dioxide and other air pollutants. If these technologies should become commercially available and can meet or exceed the emission performance rates of high efficiency natural gas generators, they should be viewed as acceptable transitional technologies as well.

Glossary of Terms and Abbreviations

Note: *Many of the definitions below have been derived from the 2002 report of the Select Committee on Alternative Fuel Sources*

AETG stands for Acidifying Emissions Task Group.

Alternative Energy is the phrase used for non-conventional energy sources and includes renewable energies and low emissions electrical generators.

Capacity is the maximum power output that a generating station can supply, and is commonly measured in kilowatts (kW) and megawatts (MW).

Biogas is natural gas produced from biological processes (e.g. methane released from landfill or sewage systems).

Co-generation involves the simultaneous production of electricity and thermal energy for heating air or water.

CCME stands for Canadian Council of Ministers of the Environment.

CEC stands for the Commission for Environmental Cooperation.

CEPA stands for the Canadian Environmental Protection Act.

CIELAP stands for Canadian Institute for Environmental Law and Policy.

CO stands for carbon monoxide.

CO_2 stands for carbon dioxide.

Coal-Fired Power Plant is an electrical generating station that burns coal to to produce steam that is fed into a turbine and generator to produce electricity.

CWS stands for Canada-Wide Standards.

Fossil-Fuelled Power Plant or Thermal Generating Station is an electrical generating station that burns coal, oil or natural gas to produce steam that is fed into a turbine and generator to produce electricity.

Gigawatt (GW) is one thousand megawatts or one million kilowatts of electrical energy.

Gigawatt-hours (GWh) is the unit used to express the amount of electrical energy consumed or generated (see KWh).

High Efficiency Natural Gas Generators is the phrase used for combined cycle natural gas turbines that are used to generate electricity.

IPCC stands for the Intergovernmental Panel on Climate Change.

Kilowatt (kW) is one thousand watts of electrical energy.

Kilowatt-hour (kWh) is the unit used to express the amount of electrical energy consumed or generated. For example, 100 kWh means that that electrical energy used or generated was equivalent to100 kilowatts of electrical energy used or generated for one hour.

Kilotonnes or kt is 1000 tonnes.

Megawatt (MW) is one thousand kilowatts of electrical energy.

Megawatt-hour (MWh) is the unit used to express the amount of electrical energy consumed or generated (see kWh).

NAS stands for National Academy of Science.

Natural Gas is a mixture of hydrocarbon gases and vapour consisting primarily of methane.

Net Metering is the practice of using a bi-directional meter to measure consumption and generating of electricity by a small generation facility. The net energy produced or consumed is purchased from, or sold to, the generator.

NRC stands for Natural Resources Canada.

NRC U.S. stands for National Research Council, United States.

Nuclear Power plants use uranium oxide to produce a controlled atomic chain reaction that produces heat. This heat is used to make steam that is used to turn a turbine that generates electricity.

NO_2 stands for nitrogen dioxide, a gas.

NOx stands for nitrogen oxides, a number of nitrogen-based compounds.

OEB stands for the Ontario Energy Board.

OMA stands for the Ontario Medical Association.

OMNR stands for Ontario Ministry of Natural Resources.

OMOE stands for Ontario Ministry of the Environment.

OMOEE stands for Ontario Ministry of the Environment and Energy.

OMOF stands for Ontario Ministry of Finance.

OPG stands for Ontario Power Generation, one of the successor companies to Ontario Hydro.

OPHA stands for the Ontario Public Health Association.

$PM_{2.5}$ stands for respirable fine particulate matter; particles in the air that are 2.5 microns or less in diameter.

PM_{10} stand for inhalable fine particulate matter; particles in the air that are 10 microns or less in diameter.

Renewable Energy is derived from sources that cannot be depleted and are self-replenishing. They will always be available, can be sustained indefinitely, and are essentially non-polluting.

RPS stands for Renewable Portfolio Standard.

Solar Energy includes: 1) passive solar designs that optimize the amount of energy that can be derived from the sun without mechanical means; 2) solar thermal technologies that use the sun to heat liquids which can provide heat energy for the heating of air and water; and 3) solar photovoltaic technologies that convert sunlight directly into electricity through the use of semi-conductors built into solar panels or roofing materials.

SO_2 stands for sulphur dioxide.

Small Hydro are water powered generators with 20 MW or less electrical capacity.

Wind Turbines are systems that use air foils or blades to capture the kinetic energy of the wind. The foils or blades are attached to a drive shaft that moves a generator to produce electricity.

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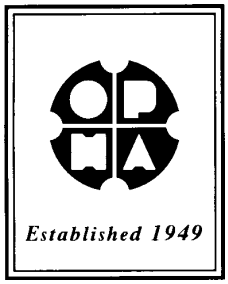

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