The Role of Coal

Presented by the Power Workers' Union

February 2004

Key Messages

Ontario's coal-fired power plants provide essential capacity for both base and peak load, at far less cost than the only immediate alternative, natural gas conversion or replacement.

A wholesale switch to natural gas would drive up electricity costs for consumers and business by 15%. The shortage of gas means other users such as home heat and industrial processes will most likely see increases.

OPG and the Ontario government should support the installation of Selective Catalytic Reduction technology in the short term.

The government should also invest with the industry in the rapid commercialization of new clean coal technology, both for Ontario generation and to address the real source of Ontario's air quality problems, the U.S. electricity generation industry.

Introduction

The Power Workers' Union has represented a large majority of Ontario electrical system employees for nearly 60 years.

Our members, who work everywhere in Ontario, maintain transmission and distribution wires networks that would circle the earth four times.

We work in nuclear, hydroelectric, coal, natural gas and oil-fired generating stations, as well as in Ontario Power Generation's renewable energy portfolio which includes wind and small hydro facilities. Our members also work in regulatory, municipal, telecommunications and hospitality sectors.

Ours is a uniquely comprehensive view of Ontario's electricity system with no special loyalty to any particular form of generation. We also share with many others the goal of reducing, in economically sustainable ways, the environmental impact of electricity use in the province.

After a decade of turbulence in Ontario's electricity sector, a new provincial government creates an opportunity for a new start. We want to share our knowledge and our views so that the right choices can be made for the future.

The Issues – Price

The Value of Coal at the Market Margin

FIGURE 5.G

Price Setting Fuel in Ontario (since market opening)		
Fuel Type	Price Setting Fuel (% of time)	Average Price (cents/KWh)
Coal	56%	3.38
Gas	8.3%	7.64
Oil	22%	8.00
Uranium	0.03%	N/A
Water	15%	7.67

"Since the Ontario market opened in May of 2002, coal-fired generation has been the effective price setting fuel over half the time. That is roughly in line with the pattern that exists in the state of New York and the Midwest. The average market price in Ontario, when coal has been the last fuel dispatched, has been about 3.4 cents, less than half the price of peak power from natural gas, oil and peaking hydro sources."

Source - ***ECSTF, January 2004***

Coal Plants Replaced by Gas - A One Day Example

"Were the existing coal plants in Ontario to be replaced primarily by natural-gas fired generation, and the current pricing regime retained, natural gas would become the price setting fuel most of the time."

Scenario 1	**Scenario 2**
In this example, price is a weighted average of the lower prices when coal is the price-setting fuel at night and higher prices when oil, gas and peaking hydro are on the margin.	Fuel mix changed to replace all coal fired generation with gas-fired power.
$77/MWh or 7.7 cents per kWh	***$88/MWh or 8.8 cents per kWh***

Result - on randomly picked day gas would be 15% higher - "This (15 %) increase could erode the competitive position of Ontario industry relative to that of competing markets where gas-fired generation continues to be the price-setter less of the time."

Source - *ECSTF, January,2004*

Other Points from the ECSTF Report

The potential economic impact of a major increase in dependence on natural gas fired generation is magnified by the ongoing volatility in gas prices and growing concern about the availability of affordable natural gas supplies over the next ten years.

At current natural gas prices, the production cost of gas-fired electricity is about 1.5 cents per kWh higher than it was a year ago. In a market with gas on the margin the vast majority of the time and all generators paid on the basis of market clearing spot prices, this kind of volatility would be reflected in every kWh of power consumed in Ontario.

According to a US Department of Energy study to be released in January 2004, coal will remain the fuel of choice for electricity generation in the United States until at least 2025, accounting for 52% of US power production.

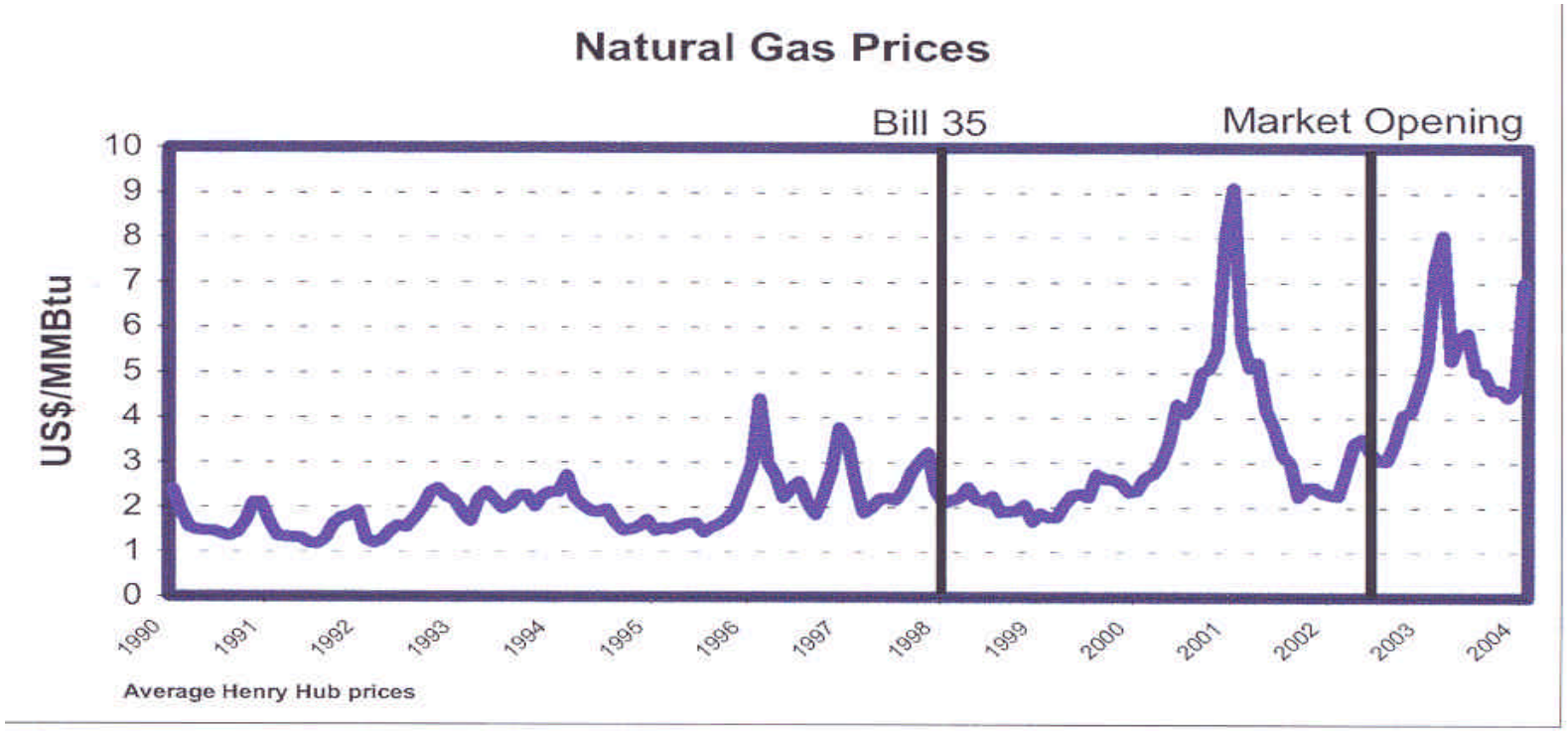
(NOTE – this is an increase of 2% from current levels).

The expected growth in natural gas-fired generation has been scaled back due to financing difficulties arising from the collapse of the energy trading, as well as increasing uncertainty about gas supplies and prices.

In the absence of major new base load capacity additions, or changes to the price-setting process, the phasing out of coal would likely lead to prices being effectively determined by the marginal cost of peaking plant. This would mean a price that is both higher and more volatile than prices in competing markets.

Cost of Fuel

"Although gas-fired generation has a major role to play in Ontario's future electricity market, recent price volatility suggests that overly heavy reliance on gas-fired generation carries risk for Ontario ratepayers." ***ECSTF Report***



Source - ***ECSTF, January 2004***

Cost of Fuel (cont'd)

Industry experts acknowledge steep increases in gas prices, nearly 200% over the last five years (Paul Massara, President of Canadian Operations for Direct Energy, Direct Energy Press Release, March 2003).

In 2001 natural gas exports from Canada to the US slightly exceeded domestic consumption. Since 1986, Canadian gas exports to the US have quadrupled, primarily due to the deregulation of prices (Statistics Canada-Energy Supply and Demand, Dec. 2001).

February (natural gas) futures contracts are trading at $7 US per million BTUs or about 7 times that of coal (UtiliPoint IssueAlert, 2004).

According to the US Department of Energy (2001 data), of North America's proven hydrocarbon reserves, coal represents 85%, natural gas 10% and oil 5%.

Cost of Fuel (cont'd)

Analysts believe North America is running out of natural gas and that untapped reserves will take 8-10 years to bring on line. For at least the next 5-7 years, a growing mismatch between natural gas supply and demand will mean drastic shortfalls in meeting escalating demands during peak heating and cooling seasons (A. Weissman, Energy Consultant Jan. 2003, Washington).

Although about 90% of new power plants have been fueled with gas and despite a record amount of drilling activity since 2001, the Cambridge Energy Research Associates say that output levels have stagnated because wells are being depleted. With demand up and supply level, prices are rising. CERA projects gas prices to increase by 15% at the Henry Hub in 2004.

The US Geological survey - 230 billion tons of coal, enough for 230 years - natural gas has a 50-year reserve but $658 billion in capital needed over next 15 years for exploration and delivery (UtiliPoint IssueAlert, 2003).

Replacing all of Ontario's coal stations with gas would increase the province's natural gas use by 31%, resulting in a 10%+ increase in Canada's total domestic supply

Although well completions have more that doubled since 1996, Canadian reserves are down by 10%

A shortfall of Canadian gas production compared to domestic use ranging from .75Tcf to 2.4Tcf is possible by 2025

Economic Impacts - Conversion/Replacement with Natural Gas

Using natural gas (conversion or replacement) *will not create a single kilowatt of the new generation capacity Ontario needs* to fuel our continuing economic growth.

There is ample evidence to show that replacing coal with natural gas generation would have numerous negative economic results such as:

High Capital Costs – Converting OPG's existing coal-fired stations to gas would cost approximately $5 billion, assuming such financing was even available at acceptable interest rates. Replacement costs are the same or more.

Natural gas is significantly more expensive than coal and its price is highly volatile.

Negative Impact on Ontario's Economy - Most of these additional billions of dollars in costs would be paid by business and industry, which uses about 70 % of all power in the province. The manufacturing sector relies on natural gas for over 50% of its energy requirements.

The expected Ontario natural gas consumption increase of as much as 31% will strain infrastructure and send prices skyward when industry, electricity generation and residential gas–heated customers all compete for the commodity during a typical cold Ontario winter.

If coal were removed, Ontario will be at competitive disadvantage to neighbouring US states - Ohio, Illinois and Indiana (80+% of electricity from coal and are among lowest electricity costs in US) and these sources will continue to impact Ontario's air quality.

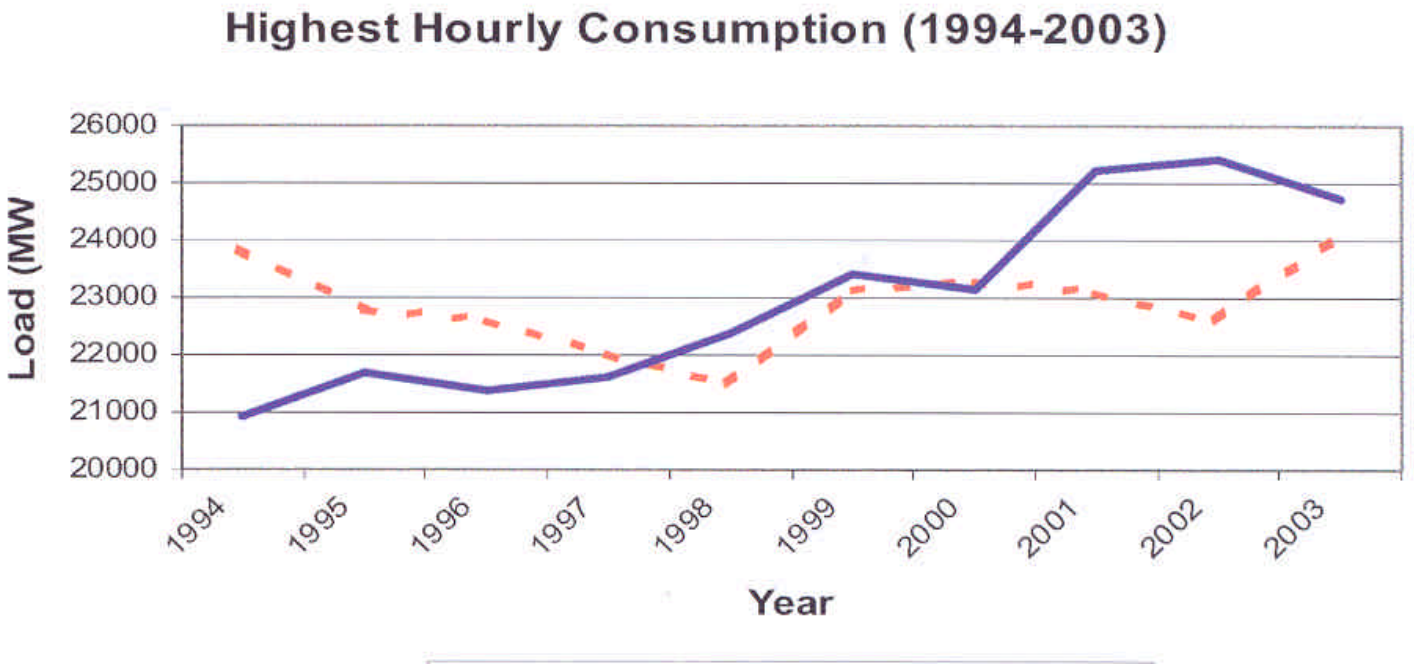
Reduced Energy Independence for Ontario – Renewable generation represents increasing energy independence for Ontario (we don't need to import wind, sunshine or biomass). Gasification would have the reverse effect, since Ontario must compete for natural gas availability with the massive and energy-hungry United States.

Diversion of natural gas from industrial and residential applications to electricity production – The diversion of natural gas to electricity production would lead to substantial cost increases in home heating and industrial processes where its use is most strategically critical. Over 4 million homes, representing more than 50% of Canadian households rely on natural gas for space and water heating needs and other household applications. That number rises to 70% of

Ontario homes that already heat with natural gas. The manufacturing sector relies on natural gas for over 50% of its energy requirements. When everybody wants to use gas, likely in winter when heat needs will strain gas supply for home heat and electrical generation fueled by gas, fuel prices will jump.

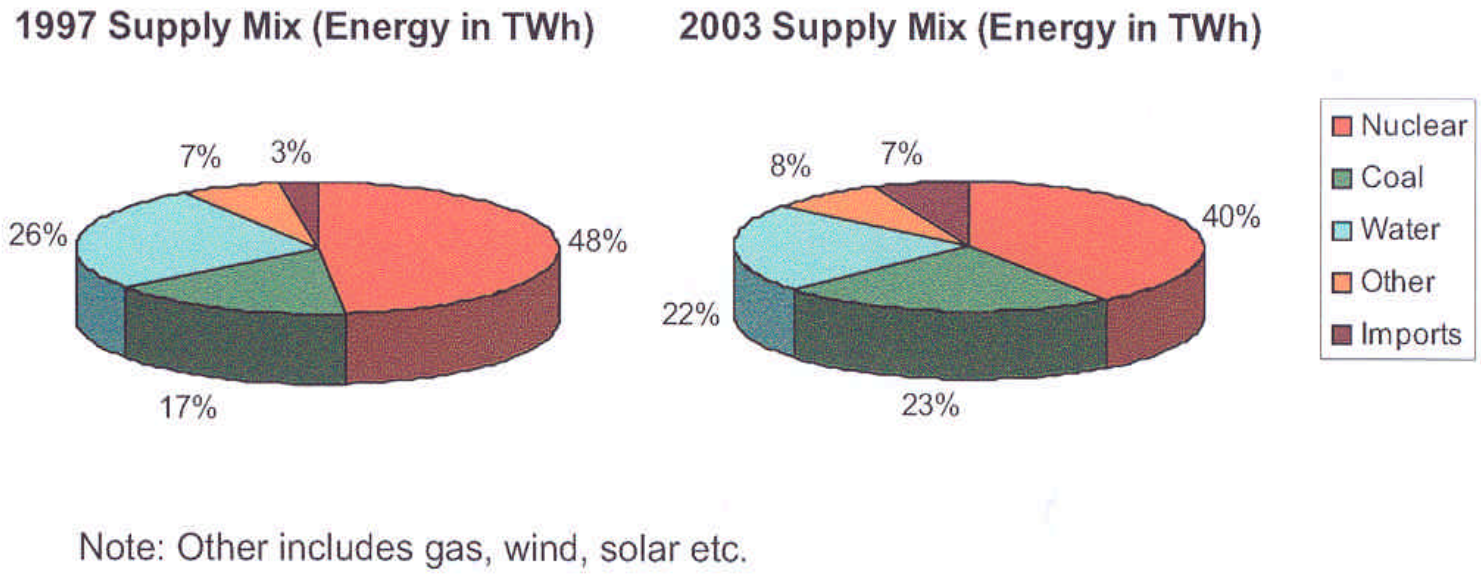
The Supply Crunch

Ontario's peak demands now exceed 25,000 MW - forecasted to increase to 26,000 MW by 2012 (IMO 10 Year Forecast April 3, 2002).



Source - ***ECSTF, January 2004***

The Supply Mix



Source - ***ECSTF, January 2004***

Coal-fueled generation plays a critical role meeting the electricity demands of Ontario consumers - Ontario's average annual and peak electricity demand is forecast to grow at about 1% per year from 151 terrawatt hours (TWh) in 2003 to 164 TWh in 2012. One TWh is enough to supply the electricity needs of one million households for one month. (IMO 10 Year Forecast, April 3, 2002). During this time, assuming the current coal stations are operating at the same levels, coal production would be expected to decline by 10 TWh or about 25% to meet acid gas limits.

It would require about 6,000 one megawatt wind turbines operating at full capacity (half of that is more likely) to produce 25% of Ontario's summer peak requirements. As well as representing 150% of the total installed wind generation in the United States, this 6,000 megawatts would require a significant capital investment of C$1.5 million per megawatt[1], for a total capital cost of $9 billion.

While there is hydroelectric potential beyond the current 25% level, much of the new development potential is a considerable distance from existing load centres and often located on sensitive land, such as provincial parks, that will require considerable infrastructure development and sensitivity to potentially conflicting land use issues. Also, like wind, the elements play a large role in production and low water levels (as has been the case in Ontario for several years now) constrain generation potential.

The amount of power we can import from neighbouring jurisdictions is limited and most of the province's interconnections are with the US Midwest and Northeast, where coal is the dominant generation fuel - as much as 80% in nearby states. (This is why Ontario's aggregate energy unit air emissions are much lower than in the US). In 3 of the last 4 years, Ontario has been a net importer. Last summer the IMO imported more than 4,300 MW to help meet a record summer peak demand. Depending more on imports will require substantial transmission lines upgrading and much greater regulatory enforcement as the recent blackout highlights.

[1] Source: American Wind Energy Association; www.awea.org.

Air Quality Issues

1. **Prevailing wind patterns make American pollution sources the largest contributors to air pollution in Ontario (Source: Ontario Ministry of Environment - "Coal-Fired Electricity Generation in Ontario-March 2001").**

   "On average more than half of the ozone and particulate matter in Ontario's air is the result of precursor gases which are blown across the border from US sources by prevailing wind patterns" (Page 7-Ibid).

   "The regional impacts of imported US pollutants for the most populated areas of Ontario can climb even higher. If the wind blows from Detroit, Michigan smog episodes in neighbouring Windsor are almost entirely the result of transboundary pollution. The rest of southwestern Ontario still receives 70 to 90 % of its sulphate due to precursor gases blown in from the US" (Page 7-Ibid).

2. **"Overall air quality in Ontario improved significantly during the past 30 years, despite significant increases in Ontario's population, gross domestic product and vehicular travel over the same time" (Source: Ontario Ministry of Environment "Air Quality in Ontario 2000 Report").**

   "Levels of most major pollutants decreased significantly during the 30 year period. Averaged levels of sulphur dioxide were reduced by 83 % and carbon monoxide by 81 %. During the

past 26 years, nitrogen oxides were reduced by 49 % and nitrogen dioxides by 23 %, and over the past 10 years, total sulphur compounds have decreased 33%" (Page 1-Ibid).

"As in previous years, ground level ozone and inhalable particles, the major ingredients of smog, continued to exceed ministry criteria levels in 2000. A major portion of Ontario's smog is a direct result of emissions from the U.S" (Page 1-Ibid).

A recent Air Quality Progress Report, highlights significant progress is being made with Canada reporting sulfur dioxide (SO_2) emission levels that are 20 % below the national emissions cap commitment, while the United States reports reductions in emissions of 35 % compared to 1980 levels.

"Eastern Canada SO_2 emissions were approximately 1.6 million tonnes (29% below the cap). National SO_2 emissions were approximately 2.5 million tonnes (20% below cap). National NOx emissions from stationary sources have been reduced by over 100 kilotonnes from forecast levels" (Source: 2001 Annual Progress Report on the Canada-Wide Acid Rain Strategy for post-2000).

3. **"Transportation is the largest single human produced source of outdoor air pollution in Canada. On average, each of the 16.8 million vehicles registered across the country (8 million in Ontario) emits approximately five tonnes of air pollutants and gases annually, mainly CO, NOx, VOCs and carbon dioxide" (Page 7-The Smog Primer, Pollution Probe).**

Nitrogen Oxides (NOx) - "Ontario Power Generation's fossil fuel plants were responsible for 14.7 % of Ontario's NOx emissions" (Source: Page 8 Ministry of Environment-"Coal-Fired Electricity Generation in Ontario-March 2001").

"All combustion in air produces nitrogen oxides (NOx), of which NO_2 is a major component. Approximately 63 % of NOx comes from the transportation sector in Ontario" (based on domestic sources only) (Page 20-Ibid).

Sulphur dioxides (SO_2*)* - "In 1999, non-iron smelters in the province accounted for 43.2 % of Ontario's SO_2 emissions. OPG's fossil fuel power plants were responsible for 23.7 %, while petroleum refineries and manufacturing and primary industry added another 10.5% and 13.2% respectively" (Source: Page 10 Ministry of Environment "Coal-Fired Electricity Generation in Ontario-March 2001").

"Emissions of SO_2 from sources in the US are responsible for 50-60 % of the airborne sulphate in the greater Toronto and Hamilton areas" (Source: Page 10 Ministry of Environment "Coal-Fired Electricity Generation in Ontario-March 2001").

Mercury (Hg) - "The sources of mercury deposition in Ontario are transboundary and natural (75%), incinerators (12.5%), thermal generating stations (2.5%) and other sources (10%) (Source: Page 24 Ontario's Ministry of Environment's "Air Quality in Ontario 2000 Report").

“As of 2000, Ontario had reduced provincial mercury emissions by 78 % of 1988 levels” (Source: Page 11 Ministry of Environment “Coal-Fired Electricity Generation in Ontario- March 2001”).

“There are over 5.3 tonnes of mercury in vehicles on the road in Ontario (used to control convenience lighting, anti-lock brakes, and ride-control systems)” (Source: Pollution Probe website - MERC Switch Out Program.).

“Compared with the 19 jurisdictions in the US Pollution Emission Management Area (PEMA) (under the Canada/US Ozone Annex Agreement) Ontario is the eighth largest emitter of NOx and the seventh largest emitter of SO_2” (Ibid).

“Ohio is the largest source of both pollutants, emitting almost double Ontario’s emissions of NOx and nearly triple the amount of SO_2” (Ibid).

Improving Air Quality with Coal Plant Upgrades

Selective Catalytic Reduction (SCR) technology is being installed by Ontario Power Generation at both Nanticoke and Lambton fossil generating stations at a cost of $250 million.

SCR on a unit will reduce nitrogen oxide (NOx) emissions by 80% from levels in 2000, a record year for fossil power plant production in Ontario. Gas conversion would, according to the Ontario Clean Air Alliance, reduce the smog-creating N0x emissions by an additional 10%.

But since OPG fossil generation accounts for only 14.7% of all N0x emissions originating in Ontario, gas conversion would reduce aggregate Ontario-source N0x levels by only about 1.5% more than the SCR technology.

Because 50% of N0x emissions originate in other jurisdictions, the impact of conversion to gas would be less than 1%.

This is simply not a large enough difference to warrant putting Ontario's economy at risk because of the inherently greater volatility of natural gas versus coal.

Clean Coal Technology

Ontario Power Generation's Emission Reduction Program (representing an investment of 1.8 billion dollars since 1984) recently announced an additional $250 million dollar investment for the installation of selective catalytic reduction abatement technology that will reduce nitrogen oxide (NOx) emissions from the affected generating units by 80%.

The value and stability of coal-fired generation is clearly recognized in the Government of Canada's investment to retrofit an existing coal-burning power plant by 2007 to produce at least 50% fewer CO_2emissions.

The full-scale demonstration facility will be used to test the technical, environmental and economic viability of new clean coal-burning technology. By 2010, the Canadian Clean Power Coalition (CCPC) hopes to develop a new plant, capable of reducing emissions by up to 90%, that will serve as a prototype for future plant construction.

The US administration has budgeted $2 billion over 10 years to help plant operators implement the latest equipment in an effort to reduce emissions. Projects include:

> installing an advanced air pollution control system on a 524-megawatt generation unit to reduce sulfur dioxide (SO_2) emissions by 99.5% while nitrogen oxide (NOx) and mercury by 90% each.

Combining an advanced coal-burning system called a “circulating fluidized bed combustor” with a fully integrated emission control technology. The 150 megawatt plant is expected to reduce SO_2 and mercury emissions by 98 % and 90 %, respectively.

Summary - Benefits of coal-fueled generation

Ontario's coal-fueled electricity generation provides reliable and affordable electricity when it is needed - coal-fueled generation is flexible - meets base and intermediate load - can be quickly ramped up to meet peak demands (Page 15-MOE's Coal-Fired Electricity Generation in Ontario, March 2001).

Coal-fueled electricity generation is increasingly clean

According to the Ontario Ministry of the Environment's 2000 Air Quality Report "overall air quality in Ontario improved significantly during the past 30 years despite significant increases in Ontario's population, gross domestic product and vehicular travel over the same period."

Investments in low sulphur fuels and pollution control technologies have achieved significant reductions in acid gas and smog emissions from Ontario's coal-fueled stations (Page 17-MOE's Coal-fired Electricity Generation in Ontario, March 2001).

Millions of dollars in new investments continue to be made in these plants to further reduce emissions and meet tough new regulations.

Coal-fueled generators across Canada and the US are supporting research and development on the next generation of clean coal technologies.

Coal-fuelled electricity generation has an essential role to play in Ontario's energy future

The magnitude of North America's coal reserves offers energy security. In light of today's international crisis and the pressures this has on oil and natural gas supplies and prices, these coal reserves are even more attractive.

Recommendations

Support the installation of Selective Catalytic Reduction technology on existing Ontario coal plants as the much more cost effective method of reducing smog-related emissions.

Support clean coal research and implementation of new technologies at Ontario's coal stations.