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Meeting Ontario's Electricity Needs:

A Critical Review of the Ontario Power Authority's Supply Mix Advice Report

By Jack Gibbons
Ontario Clean Air Alliance

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Introduction

On December 9, 2005 the Ontario Power Authority (OPA) released its *Supply Mix Advice Report* which outlines its proposed blueprint for meeting Ontario's electricity needs to 2025.

According to the OPA, as a result of the actions taken to-date by the McGuinty Government, Ontario will have sufficient electricity supplies to meet the province's needs until 2013. However, the OPA believes that Ontario will need to add 15,000 megawatts (MW) of new generation capacity between 2013 and 2025. Furthermore, the OPA recommends that 63% to 83% of this new generation capacity should be nuclear.[1]

Our review of the OPA's Report reveals that it has:

- Over-estimated Ontario's rate of electricity load growth from 2005 to 2025;
- Under-estimated the potential for electricity productivity improvements to reduce our demand for electricity and raise our living standards;
- Under-estimated our renewable energy supply potential;
- Under-estimated the potential for biomass and natural gas-fired combined heat and power plants to meet our electricity needs and increase the competitiveness of Ontario's industries;
- Under-estimated the economic costs and risks of nuclear power; and
- Recommended a $70 billion resource acquisition budget that is biased against energy efficiency investments that would reduce demand and raise our living standards.

In the following pages we will provide our analysis of the OPA's Report and our recommendations for how Ontario can increase its electricity productivity and meet its electricity supply needs between today and 2025.

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Laidlaw Foundation

TORONTO Atmospheric Fund

Ontario Clean Air Alliance
625 Church Street, Suite 402
Toronto M4Y 2G1
Tel: (416) 926-1907 ext. 245
Fax: (416) 926-1601

E-mail: contact@cleanairalliance.org
Web Site: www.cleanairalliance.org

Increasing Electricity Productivity and Managing Electricity Demand

Fig. 1: OPA Estimate of Gap in 2025 After Procurements

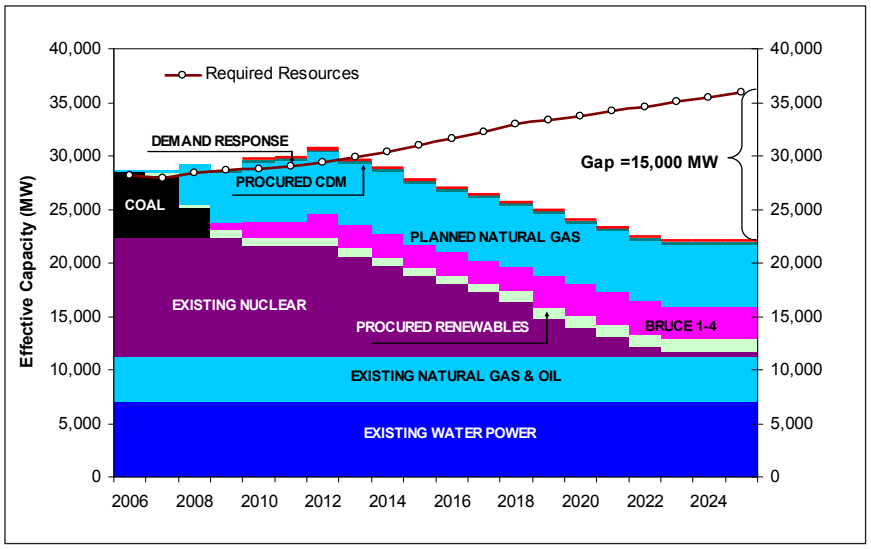


Figure 1 shows the OPA's estimate of the gap between Ontario's required resources and its supply of electricity from 2014 to 2025. [2] The gap between 2014 and 2025 is driven by two factors:

1.) the OPA's forecast of growth in the demand for electricity; and

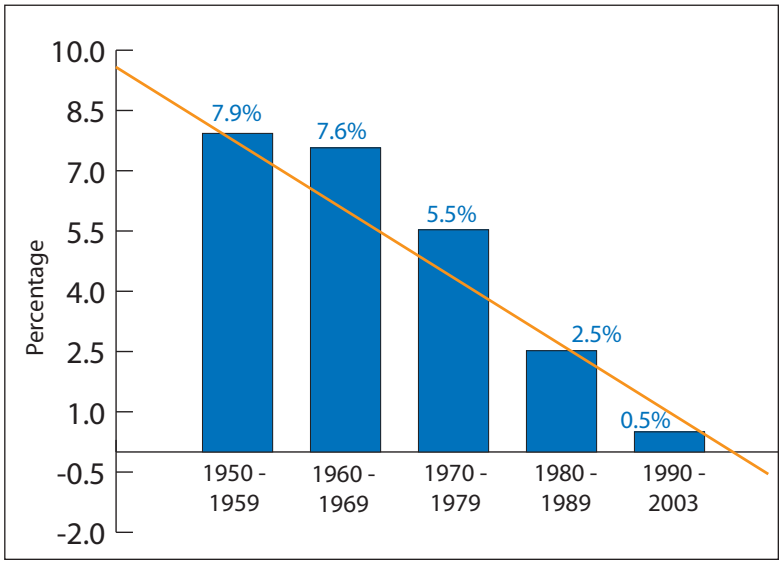
2.) the retirement of most of Ontario's existing nuclear capacity by 2025.

As Figure 2 reveals Ontario's actual electricity consumption growth rates have fallen from 7.9% per year in the 1950s to 0.5% per year between 1990 and 2003.[3] Nevertheless, despite this steady decline in Ontario's electricity consumption growth rates for over half a century, the OPA's analysis assumes that Ontario's rate of electricity growth between 2005 and 2025 (0.9% per year) will be almost *double* its actual rate of electricity growth between 1990 and 2003 (0.5% per year).[4]

The OPA's electricity consumption growth rate forecast is simply not credible for the following reasons.

- The OPA has provided no evidence to support its assertion that a 50-year trend of declining electricity growth rates will all of a sudden reverse itself.
- Toronto Hydro, which distributes 17% of the electricity consumed in Ontario, is committed to *reducing* its customers' peak day demands by 5% (250 MW) by 2007.[5] Ontario's other electric utilities have the ability to set and achieve similar targets.
- New York State's electricity productivity (GDP per kWh) is 2.3 times greater than Ontario's. The two major reasons for Ontario's low

Fig. 2: Actual Annual Electricity Consumption Growth Rates: 1950 – 2003



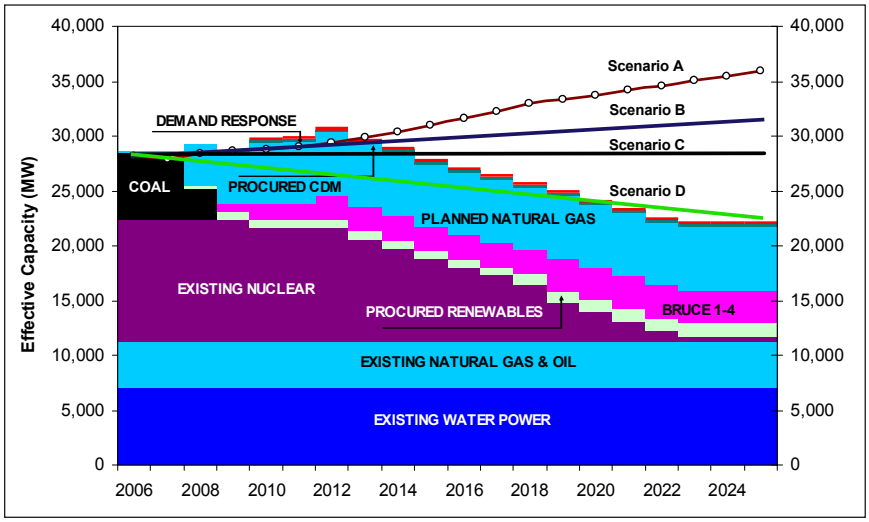
electricity productivity are Ontario's taxpayer-financed subsidies for electricity consumption and the former Ontario Hydro's "Go Electric" campaigns, which promoted the use of electricity for space and water heating. By eliminating the taxpayer-financed subsidies for electricity consumption and raising its price to its full cost, Ontario has the potential to dramatically reduce the demand for electricity and increase its standard of living.[6]

If Ontario's electricity consumption and peak-day demands grow at 0.5% per year between 2006 and 2025, Ontario's electricity gap in 2025 will fall by 37% from 15,000 to 9,378 MW (Scenario B in Fig. 3).[7]

Alternatively, if Ontario's peak-day demand in 2025 remains constant at its 2006 level, Ontario's electricity gap in 2025 will fall by 59% to 6,146 MW (Scenario C in Fig. 3).[8]

Finally, if Ontario matches New York State's level of electricity productivity by 2025, the electricity gap will be completely eliminated (Scenario D in Fig. 3).[9]

Fig. 3: Revised Estimates of Gap in 2025 After Procurements



Scenario A: OPA Supply Mix Report estimate
Scenario B: Growth continues at 1990-2005 rate
Scenario C: Demand remains constant at 2006 levels
Scenario D: Ontario matches New York electricity productivity rate

Obtaining More Renewable Supplies

The OPA is recommending that Ontario obtain an additional 6,720 MW of renewable electricity between 2006 and 2025 to help fill its forecasted 15,000 MW electricity supply gap.[10] In other words, the OPA is recommending that, on average, Ontario should add only 336 MW of additional renewable supplies per year between now and 2025.

The OPA's annual renewable procurement target is dramatically less than:

a) the McGuinty Government's 2005 renewable procurement targets; and

b) Ontario's renewable potential.

In 2005, the McGuinty Government issued requests for proposals (RFP) for a total of 1,200 MW of new renewable supplies. Specifically, in April 2005, Ontario issued an RFP for 1,000 MW of renewable energy from projects over 20 MW. In July 2005, it issued an RFP for 200 MW of renewable energy from projects under 20 MW.[11] This means that the OPA's proposed annual renewable target (336 MW) is 72% less than the McGuinty Government's 2005 renewable procurement target (1200 MW).

The OPA's renewable targets are also dramatically less than Ontario's renewable supply potential, as outlined in the following section.

Made-in-Ontario Renewable Electricity Options

Wind Power

According to a report prepared by Helimax Energy Inc. for the

OPA, Ontario has 12,894 MW of wind potential within 20 km of the major Hydro One electricity transmission network south of the 50th parallel; and 13,431 MW of wind potential within 20 km of the local utility electricity distribution network south of the 50th parallel. (An element of caution must be exercised when reading these results as overlaps occur between areas that are in proximity to both the distribution and transmission networks.)

According to Helimax, Ontario's total wind potential exceeds 600,000 MW.[12]

Water Power

According to the Ontario Waterpower Association, we have about 6,600 MW of Made-in-Ontario water power potential that is "probable, committed or practical".[13]

Biomass Power

According to the BIOCAP Canada Foundation, Ontario has the potential for the sustainable production of 63 mega-tonnes of dry biomass per year, with 49% from forests, 46% from agriculture and 5% from municipal waste streams. Assuming that half this amount would be used for liquid fuel production, 31.5 mega-tonnes of dry biomass could support 7,400 MW of power production capacity at an 80% utilization rate.[15]

Imported Renewable Electricity Options

Manitoba Water Power

Ontario has the potential to import very significant quantities of clean water-power from Manitoba. As a first step, Ontario could contract for 1,500 MW of Manitoba water-power at a cost of 6.7 to 7.8 cents per kWh. In the longer-term, Ontario could import more than 5,000 MW of water- power from Manitoba.[16]

Labrador Water Power

Ontario also has the potential to import water-power from Labrador. In March 2005, Ontario submitted a joint proposal with Hydro Quebec and SNC-Lavalin to the Government of Newfoundland and Labrador to support the development of 2,824 MW of water power on the lower Churchill River in Labrador. The joint proposal would assist with the development of the 2,000 MW Gull Island site and an additional 824 MW at Muskrat Falls. Under the proposal, Ontario would receive 670 MW from Gull Island and 275 MW from Muskrat Falls for a total of 945 MW.

As part of the agreement, Hydro-Quebec would also advance construction of a 1,250 MW interconnection with Ontario, to be in service by 2009. In addition, Hydro Quebec has indicated a willingness to provide Ontario with 675 MW of power by 2011, which represents Ontario's expected share of the Gull Island's output.[17]

Quebec Water Power

Given that Quebec's electricity productivity is 50% lower than Ontario's,[18] Hydro Quebec has the potential to dramatically increase its profits by investing in domestic energy efficiency measures to make electricity available from its existing water power stations for export to Ontario and the U.S. Northeast. This would be one of the lowest cost options to meet Ontario's electricity supply needs.

Natural Gas

According to the OPA, Canada has 77 years of natural gas supplies at the 2002 level of production.[19] Nevertheless, it recommends that Ontario should obtain no more than an additional 1,500 MW of supply from natural gas in order to limit "exposure to price and supply risk."[20] According to the OPA, the main driver of higher risk to Ontario's electricity system is "natural gas price variability." According to the OPA, in general, investing in nuclear power is less risky than investing in natural gas-fired generation:

> "In general, portfolios that use less fossil fuel resources present lower costs and environmental impacts and are less exposed to risk; these portfolios are more robust, performing better under different possible futures except under a future with low gas prices."[21]

The OPA's assertions are not supported by the evidence.

1. While spot natural gas commodity costs are very volatile, the OPA can reduce this price volatility by entering into five-year natural gas supply contracts for Ontario's electricity generators. By developing a rolling portfolio of five-year natural gas supply contracts, the OPA can minimize natural gas price volatility risk.
2. According to a Canadian Energy Research Institute (CERI) report commissioned by the OPA, while an upward trend in natural gas prices "from 1997 is expected to last for a decade to 2007… prices are expected to fall in 2008 as the new set of LNG [liquified natural gas] terminals in North America come online. After 2010, demands and supplies in North America are expected to stay in balance and prices are expected to increase at a moderate rate of 1.5%."[22]
3. Furthermore, the OPA's analysis assumes that the real (net of inflation) cost of natural gas will remain constant at $8/MMBTU (2005 Cdn $)[23] from the present to 2025 despite the fact that ALL of the nine independent natural gas forecasts summarized in the CERI report predict that the annual average gas prices will be less than $8/MMBTU (2005 Cdn $) during this time period (see Table 2).[24]
4. Despite the OPA's assertion to the contrary, nuclear power has been a very costly and risky option for Ontario's economy. The lack of competitiveness of Ontario's nuclear assets was most clearly revealed in 1999 when Ontario Hydro was broken-up and its $15.1 billion of nuclear stranded debt was transferred to the Ontario Electricity Financial Corporation, not the new owner of its nuclear generation assets, Ontario Power Generation. According to the Ontario Electricity Financial Corporation, the stranded debt could not "reasonably be serviced and retired by commercial companies in the competitive electricity market."
5. According to the International Energy Agency, Canadian nuclear reliability for the period 1990 to 2002 has been the worst in the OECD. The annual utilization rates of Ontario's nuclear reactors declined from 80% between 1980 and 1983 to 51% in 2003.
6. As a result of Ontario's heavy dependency on unreliable CANDU nuclear reactors, it took Ontario more than eight days to fully recover from the August 14, 2003 blackout versus less than two days for New York State.[25]

Combined heat and power (CHP) plants use natural gas to simultaneously produce heat and electricity. CHP plants can have an overall energy efficiency of 80-90%; whereas the energy efficiency of Ontario's nuclear reactors is approximately 30%.[26]

According to the Association of Major Power

Consumers of Ontario, CHP is one of the best electricity supply options for Ontario:

> "There is a significant opportunity for more cogeneration projects, but this would require mechanisms that bring to the developer more of the benefits that are realized by the customer population as a whole when these projects go ahead. For example, cogeneration projects typically improve system stability, release transmission capacity and reduce line losses. Cogeneration should be near the top of the list in terms of its attractiveness as a source of energy for Ontario, since these projects tend to be CHP, provide benefits throughout the system and represent commitments by users to continued operation in Ontario."[27]

In June 2005 the Government of Ontario directed the Ontario Power Authority to procure up to 1,000 MW of combined heat and power.[28] According to a report prepared for the Ontario Ministry of Energy, Ontario's total CHP potential in 2020 will be 16,514 MW.[29]

Nuclear Power

According to the OPA, nuclear power and natural gas-fired generation are both reasonable candidates for meeting Ontario's base-load electricity needs.[30] The OPA compares the cost of a CANDU 6 nuclear reactor with a natural gas-fired combined-cycle power plant in Figure 1.2.10 of the first volume of its report using the following assumptions:

- The capital cost of a CANDU 6 nuclear reactor is $2600/kW exclusive of its $245/kw heavy water costs;
- The CANDU 6 reactor and the natural gas-fired combined-cycle power plant will both be able to operate at 85% capacity utilization rates over their economic lives;
- The real (net of inflation) cost of natural gas is $8/MMBTU; and
- Three alternative pre-tax real rates of return on capital (equity plus debt): 5%, 8.5% and 11%.[31]

According to OPA, Figure 1.2.10 "highlights that gas is much more likely to be a more expensive option for base-load needs."[32] In fact, however, as a close inspection of Figure 1.2.10 and a careful review of the second volume of the OPA Report reveals, this assertion is only true if one is willing to make the additional assumptions that the capital cost of the CANDU 6 nuclear reactor will come into service at 30% under-budget (which has never occurred in Ontario) and that gas costs will be 50% greater than the OPA's base case forecast of $8/MMBTU (which no expert forecasting agency is predicting).

Rate of Return on Capital

Table 1 shows the OPA's estimates of the costs of a CANDU 6 and a natural gas-fired combined-cycle plant (from Volume 2 of the report) assuming its base-case assumptions noted-above (i.e., $2845/kw capital cost for nuclear, 85% capacity

Table 1: Cost Comparison: CANDU 6 vs. Natural Gas-Fired Combined-Cycle[33]

	CANDU 6	Natural Gas-Fired Combined-Cycle
Real Pre-Tax Rate of Return on Capital = 5%	5.2 cents/kWh	6.3 cents/kWh
Real Pre-Tax Rate of Return on Capital = 8.5%	6.8 cents/kWh	6.7 cents/kWh
Real Pre-Tax Rate of Return on Capital = 11%	7.9 cents/kWh	7.0 cents/kWh

factors, and $8/MMBTU gas cost) and its three alternative pre-tax real rates of return on capital.

As Table 1 reveals, given the OPA's base-case assumptions, natural gas-fired combined-cycle power plants are the lowest cost options to meet Ontario's base-load needs under two (8.5% and 11%) of its three scenarios for rates of return on capital.

The required rate of return for an investment project depends on its risk. The greater the risk, the greater the required rate of return on capital. In 2005, the OPA signed a deal with Bruce Power for the re-start of its Bruce A Unit 1 and 2 nuclear reactors, the refurbishment of Bruce A Unit 3 and the replacement of Bruce A Unit 4's steam generation equipment. Unlike the OPA's electricity supply contracts with renewable and natural gas-fired power producers, this deal transfers a significant proportion of the project's capital cost and operating risks back onto the OPA and hence Ontario's electricity ratepayers.[34] *Nevertheless, according to CIBC World Markets, Bruce Power's required* ***nominal after-tax*** *rate of return on capital for this project is still high, namely, 10.6% to 13.8%.*[35] Moreover, Bruce Power's required nominal after-tax rate of return on capital is *greater* than the highest real pre-tax rate of return on capital used by the OPA to compare the economics of nuclear and natural gas. (According to the OPA, a real pre-tax rate of return on capital of 11% is equivalent to a ***nominal after-tax*** *rate* of return on capital of 8%.[36]) Therefore, the OPA's analysis indicates that the real cost of nuclear power is greater than 7.9 cents per kWh (i.e., the cost of nuclear power at an 11% pre-tax real rate of return on capital or an 8% nominal after-tax rate of return on capital.)

In short, the OPA's analysis shows that on a risk adjusted-basis, natural gas-fired combined-cycle power plants are a lower cost option to meet Ontario's electricity needs than nuclear power.

Capital Costs

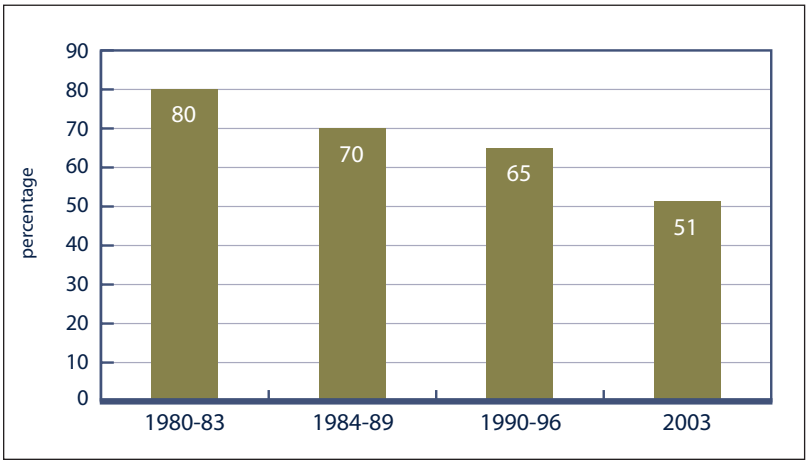
The OPA's economic analysis assumes that the capital cost of a new CANDU 6 nuclear reactor would be only $2,845/kW including heavy water costs.[37] This assumption is not credible for the following reasons.

- The actual cost of the Darlington Nuclear Station, the last nuclear power plant to be built in Ontario, was $4058/kw.[38]
- All of the post-Darlington nuclear retrofit projects have been significantly over-budget.
  - In August 1999, OPG estimated that the cost of returning Pickering A Unit 4 to service would be $457 million. The actual cost was $1.25 billion.
  - In August 1999, OPG estimated that the cost of returning Pickering A Unit 1 to service would be $213 million. The actual cost was $1.016 billion.[39]
  - Bruce Power estimated that it would be able to re-start Bruce A Units 3 and 4 for $375 million. The actual cost was approximately $725 million.[40]

Capacity Utilization Rates

The OPA's analysis assumes that a new CANDU 6 nuclear reactor will be able to operate at an 85% annual capacity utilization rate for its entire economic life. This optimistic assumption is not supported by Ontario's actual experience with CANDU reactors. As Figure 4 shows, the average capacity utilization rates of Ontario's nuclear reactors fell from 80% between 1980 and 1983 to 51% in 2003.[41]

Fig. 4: Average Ontario nuclear capacity utilization rates



Natural Gas Commodity Costs

The OPA's analysis assumes that real (i.e., net of inflation) natural gas commodity prices will average $8 per MMBTU (2005 Cdn $)[42] between now and 2025, despite the fact that ALL of the nine independent natural gas forecasts summarized in the Canadian Energy Research Institute (CERI) report commissioned by the OPA predict that annual average gas prices will be less than $8/MMBTU during this time period.[43]

Natural Gas-Fired Combined Cycle Power Plants vs. Combined Heat and Power

The OPA's analysis of the economics of nuclear versus natural gas for base-load electricity supply was based on the cost of a natural gas-fired *combined cycle* power plant despite the fact that natural gas-fired *combined heat and power* plants are a much more efficient option to meet base-load electricity needs. Specifically, natural gas-fired *combined heat and power* plants can achieve energy efficiencies of 80-90% versus the 60% energy efficiency of the best *combined-cycle* power plants. As a result, using combined heat and power plants to meet base-load needs can reduce natural gas consumption and costs by 30% or more relative to the combined-cycle option.[44]

As we have already noted, according to a report prepared for Ontario's Ministry of Energy, Ontario's total combined heat and power potential in 2020 will be 16,514 MW.[45]

Summary

The OPA's analysis shows that the cost of nuclear power is greater than 7.9 cents per kWh even if we optimistically assume that the cost of a new CANDU 6 nuclear reactor is only $2,845 per kW and that the CANDU 6 reactor can operate continuously at an 85% capacity utilization rate for 30 years.[46]

As we have noted above, it is much more likely that the cost of a new CANDU 6 reactor would exceed $2,845/kW and that its average lifetime capacity utilization rate would be less than 85%.

The OPA's analysis also shows that the cost of natural gas-fired electricity is 7.0 cents per kWh assuming that natural gas commodity costs are $8/MMBTU (2005 Cdn $) from 2005 to 2025 and that the electricity is produced at a combined-cycle power plant.

As we have noted above, all credible forecasters are predicting that natural gas prices will average less than $8/MMBTU during this time period. Furthermore, using combined heat and power plants can reduce natural gas consumption and costs by 30% or more relative to the combined-cycle option.

Table 2: CERI Report for OPA: Natural Gas Price Forecasts[1]

		2005	2010	2015	2020	2025
Sproule [1,2]	$US/mmbtu	7.34	6.14	6.62	7.12	7.67
AEO2005 [3]	2003US$/mcf	5.30	3.64	4.16	4.53	4.79
GII	2003US$/mcf			3.84		3.96
EEA	2003US$/mcf			4.69		
EVA	2003US$/mcf			3.71		3.98
PIRA	2003US$/mcf			5.14		
DB	2003US$/mcf			3.66		3.66
SEER	2003US$/mcf			3.9		4.26
Altos	2003US$/mcf			3.92		5.78

[2]Henry Hub

[3]Average lower 48 wellhead price

1 mmbtu = 1 mcf

[1] The Sproule forecast for 2025, $7.67/MMBTU, is in nominal US $ and hence is substantially lower in real terms than the OPA's gas cost assumption of $8/MMBTU (2005 Canadian $). It is also worth noting that according to a recent U.S. Department of Energy forecast, natural gas prices in 2025 will be $5.43/mcf (2004 US$). Canadian Energy Research Institute, *Electricity Generation Technologies: Performance and Cost Characteristics*, pp. 87 & 92; and Energy Information Administration, U.S. Department of Energy, *Annual Energy Outlook 2006*, Overview, p. 11.

Capital Budget Biased Against Energy Efficiency

The OPA is proposing an electricity supply and conservation capital budget of approximately $70 billion to meet Ontario's electricity needs over the next 20 years. According to the OPA, approximately $62 billion of this $70 billion budget should be spent on new supply and only approximately $8 billion on energy efficiency investments.[47] That is, the OPA is recommending that for every $1 that is invested in energy efficiency, $7.75 should be invested in new supply.

What Should Premier McGuinty Do?

At the beginning of the last century, under the leadership of Sir Adam Beck, Ontario Hydro and our municipal electric utilities phased-out coal-fired electricity generation for the first time and created a virtually 100% renewable electricity system that lasted for almost half a century.

The Ontario Clean Air Alliance believes that the guiding vision for Ontario's electricity policy in the 21st century should be to move Ontario once again towards a 100% renewable electricity system. This goal can be achieved by increasing our electricity productivity, investing in new renewable supplies and using high-efficiency natural gas-fired generation as a bridging option as we move away from coal and nuclear power and towards a renewable electricity future.

In the following sections we will outline pragmatic directives that Premier McGuinty should give to the Ontario Power Authority, the Independent Electricity System Operator, the Ontario Energy Board and Hydro One to keep the lights on between now and 2025 while moving Ontario towards a 100% renewable electricity system.

Demand Response

Paying customers to reduce their demand during periods of peak system demand can provide significant benefits to Ontario, including:

1. Reduced need for high-cost coal-fired electricity imports from the United States. In 2002, on peak days, Ontario paid up to 60 cents per kWh for U.S. coal-fired electricity imports. Instead of sending our money to the U.S. to pay for coal-fired electricity imports, we can keep our money in Ontario by paying industrial, commercial and residential consumers to shift some of their electricity consumption from peak to off-peak periods.

2. Reduced need for new electricity generation and transmission infrastructure.

3. A dramatic reduction in the spot price of electricity. For example, according to National Economic Research Associates, a 2–5% reduction in demand on peak days could reduce spot prices by 50% or more.

4. Reduced risk of blackouts and brownouts.

5. Reduced price volatility as spikes in demand (and therefore price) are moderated by demand response measures. The Independent System Operator New England (ISO New England), the New York Independent System Operator and the Pennsylvania-New Jersey-Maryland Interconnection have all established demand-response programs that pay their customers to reduce demand during periods of system peak demand and/or supply shortages. For example, the ISO New England pays its customers up to $1 per kWh to reduce demand during peak periods.

According to ISO New England:

> "Demand response participants provide an important resource for New England. They help ensure the power grid's reliability, reduce wholesale price volatility that drives up the cost of power for everyone, and reduce air pollution by enabling older, less efficient power plants to run less often."[48]

We are very pleased to note that Ontario's Independent Electricity System Operator (IESO) is in the process of establishing a Reliability Demand Response Program that will commence in the summer of 2006.[49]

The purpose of this program is to reduce the need for voltage reductions or emergency energy purchases from neighbouring jurisdictions during peak demand days. The program will pay large industrial and commercial customers, electric

utilities and market aggregators (e.g., Ozz Corporation) to shift their loads from peak to off-peak periods during days when the reliability of our power system could be in jeopardy.

We recommend that the Government of Ontario should direct the IESO/OPA to add the following objective to the IESO's Demand Response Program: To minimize or completely eliminate the need for coal-fired electricity imports from the U.S.A. on smog alert days.[a]

This would allow the IESO/OPA to pay Ontario consumers to shift their demands from peak to off-peak periods on smog alert days. This, in turn, will keep our electricity consumers' dollars in Ontario, reduce electricity spot prices, reduce electricity bills, reduce air pollution in Ontario from the United States and reduce asthma attacks and other health problems.

Electric Utility Conservation Programs

Pursuant to section 27.1 of the Ontario Energy Board Act, the Government of Ontario should direct the Ontario Energy Board to establish the following conservation and demand management[50] budget targets for Ontario's electric utilities (e.g., Hydro One, Toronto Hydro): 1% of total revenues (distribution revenues plus electricity commodity costs) by 2007; 2% of total revenues by 2008; and 3% of total revenues by 2009.[b]

The total revenues of Ontario's electricity distribution utilities were approximately $10.6 billion in 2004. As a result, adoption of our proposed spending targets would entail electric utility conservation and demand management budgets of approximately $106 million in 2007; $212 million in 2008; and $318 million in 2009. If the electric utilities' conservation programs are as cost-effective as those of Enbridge Gas Distribution, implementation of our spending targets will reduce electricity bills by $7.6 billion.[51]

Fuel Switching

According to a report prepared for the OPA, electric space and water heating is responsible for 33% of Ontario's residential electricity consumption and 10% of Ontario's total electricity consumption.[52] An estimated 650,000 households in Ontario are heated with electric baseboard heaters and over 1.5 million households use electricity for water-heating. [53] As a result there is a significant potential to reduce electricity demand and bills by promoting fuel switching to solar water heaters, geothermal heat pumps and natural gas.

Solar Water Heating

Hybrid solar/electric water heaters can reduce a homeowner's electric water heating costs by 60% ($180 to $500 per year). However, the biggest barrier to the widespread adoption of solar water heaters is their up-front capital cost (i.e., $2,500 to $3,200).[54] Car dealers would sell few cars if customers were expected to pay the full sticker price in one payment.[55]

The up-front capital cost barrier to solar water heaters could be eliminated if Ontario's electric utilities establish hybrid solar/electric water heater rental programs. The electric utilities would purchase hybrid solar/electric water heaters, install them on their customers' premises and recover all of their costs over 10-20 years via monthly water heater rental charges.

The Government of Ontario should direct Hydro One to launch a pilot project to rent at least 5,000 hybrid solar/electric water heaters to its residential, commercial and institutional customers by December 31, 2007.

[a] This directive can be implemented by the following two modifications to the IESO's Reliability Demand Response Program. First, the program should also be activated on smog alert days. Second, the payment formula for demand reductions should be re-written as follows (the proposed amendments are bolded): "Upon activation and subject to measurement and verification of actual demand reduction, participants receive payments based on the greater of HOEP, **the incremental cost of electricity imports** and $400/MWh for 2 hours of consecutive reduction; $500/MWh for 3 hours of consecutive reduction; or $600/MWh for 4 hours of consecutive reduction."

[b] Subject to the caveat that all conservation and demand management programs must pass the Total Resource Cost Test (i.e., be cost-effective). If an electric utility is unable to develop a portfolio of programs that meet these criteria, the OEB must require it to explain why it could not do so despite its best efforts.

Geothermal Heat Pumps

Geothermal heat pumps can dramatically reduce a home's use of electricity for space-heating, water-heating and cooling. For an average sized home, a geothermal heat pump can reduce its electric water heating costs by 60% ($430 per year) and its electric space heating costs by 65% ($1,320 per year). The main market penetration barriers to geothermal heat pumps are their high up-front capital costs (i.e. $6,300 to $12,500) and lack of public awareness of the their long-term benefits in terms of lower bills.[56]

As a consequence, a utility-sponsored geothermal heat pump rental program could be a pragmatic and cost-effective option to meet the space-heating, water-heating and cooling needs of Ontario consumers where natural gas service is not available.

The Government of Ontario should direct Hydro One to launch a pilot project to rent at least 500 geothermal heat pumps to its residential, commercial and institutional customers by December 31, 2007.

Natural Gas

According to Enbridge Gas Distribution and Union Gas, they can reduce Ontario's electricity demand by 1,500 MW over the next five years by aggressively promoting fuel switching from electricity to natural gas for residential space-heating, water-heating, cooking and cooling.[57]

Promoting end-use fuel-switching from electricity to natural gas is a much more cost-effective option to meet Ontario's energy needs than building new natural gas-fired power plants to replace coal and nuclear power plants.

The Government of Ontario should direct the Ontario Energy Board, pursuant to section 27.1 of the Ontario Energy Board Act, to direct Enbridge Gas Distribution and Union Gas to implement electric-to-gas fuel switching programs (space heating, water heating, cooking and drying) that will reduce Ontario's electrical load by 1,500 MW between 2006 and 2010.

Enbridge Gas Distribution and Union Gas should be encouraged to establish natural gas furnace, boiler and water-heater rental programs to remove the up-front capital cost barrier to high-efficiency natural gas end-use technologies.

Natural Gas Utility Conservation Programs

The energy conservation programs run by Enbridge Gas Distribution and Union Gas are reducing their customers' bills by over $1 billion.[58] However, there is much more that these companies could do to promote the wise and efficient use of natural gas and achieve additional bill reductions for their customers and make Ontario's industries more competitive.

The Government of Ontario, pursuant to section 27.1 of the Ontario Energy Board Act, should direct the Ontario Energy Board to establish the following conservation spending targets for Enbridge Gas Distribution and Union Gas: a) 2% of their total revenues (distribution revenues plus natural gas commodity costs) by 2007; and b) 3% of their total revenues by 2008.

Made-in-Ontario Renewable Procurement Target

The Government of Ontario should direct the Ontario Power Authority to procure at least 1,200 MW per year of new Made-in-Ontario renewable electricity supply during each of the next five years.

Combined Heat and Power

The Government of Ontario should direct the Ontario Power Authority to procure at least 1,000 MW per year of new combined heat and power electricity generation capacity during each of the next five years.

Currently companies and institutions that meet some or all of their electricity requirements from combined heat and power plants are required to

pay the province 0.7 cents for each kWh that they self generate in order to help pay-off Ontario's $15 billion stranded nuclear debt. This charge is a significant and perverse market barrier to the development of some of our lowest cost new electricity supply sources.

The Government of Ontario should exempt all new combined heat and power projects from the 0.7 cents per kWh nuclear debt retirement charge.

Combined Heat and Power in downtown Toronto

The City of Toronto consumes almost one-fifth of Ontario's electricity supplies. However, only approximately 2% of Toronto's electricity supplies are Made-in-Toronto.[59]

On June 15, 2005, former Energy Minister Dwight Duncan announced that he was directing the Ontario Power Authority to launch a procurement process for 500 MW of new power in downtown Toronto.[60]

The Government of Ontario should direct the Ontario Power Authority to obtain 500 MW of new supply in downtown Toronto from one or more combined heat and power plants. The heat from these combined heat and power plants should be used by the Enwave Energy Corporation's existing district heating system for downtown Toronto and/or by new state-of-the-art district energy (heating and cooling) systems for the new Toronto Waterfront Community, the West Don Lands and/or the Regent Park Redevelopment.[61]

Water Power Imports

The Government of Ontario should direct the Ontario Power Authority to aggressively pursue base-load water power imports from Manitoba, Quebec and Labrador.

Long-Term Planning Directives for the Ontario Power Authority

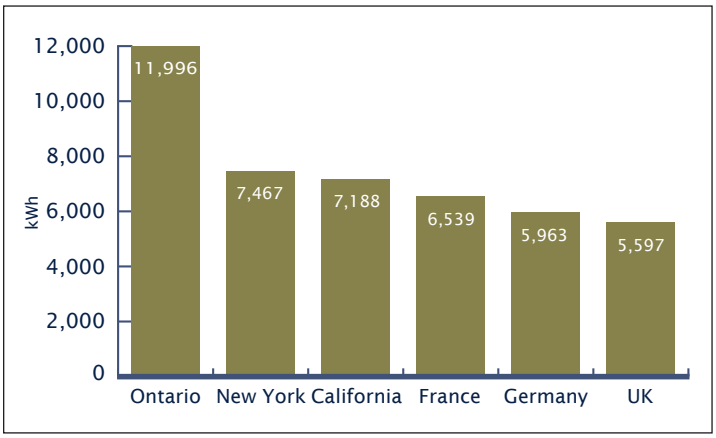
Ontario's Task Force on Competitiveness, Productivity and Economic Progress has identified 14 U.S. states that have a higher standard of living (Gross Domestic Product per capita) than Ontario among the province's 16 member peer group (states and provinces with a population of six million or more – see Figure 6). This prosperity gap is due to our lagging productivity, according to the Task Force.

Ontario and Quebec have the third lowest and the lowest electricity prices respectively amongst the 16 member group. The two provinces also trail the pack in electricity productivity, with Ontario ranking 9th out of 16 and having one of the highest per capita electricity consumption rates in the world (see Figure 5). Figures 7 and 8 show the price of electricity and electricity productivity for Ontario, Quebec and the 14 richest U.S. states and reveal that jurisdictions with higher electricity prices have higher levels of electricity productivity. For example, New York State's price of electricity and its level of electricity productivity are both significantly higher than those of Ontario.

Our analysis (outlined in Figures 9 and 10) shows that there is a strong positive correlation between electricity prices, electricity productivity and living standards (GDP per capita). Four of the five richest jurisdictions in the 16 member peer group (Massachusetts, New York, New Jersey and California) have the highest electricity prices and the highest electricity productivity ratios. Similarly three of the four poorest jurisdictions in the peer group (Ontario, Indiana and Quebec) have the lowest electricity prices and low electricity productivity ratios.

In Ontario, we still have an electricity price structure that is distorted by a number of hidden subsidies for nuclear power. We must eliminate these hidden subsidies and move to a real-cost struc-

Fig. 5: Per capita electricity consumption in 2000



ture in electricity pricing for the following three key reasons:

a) To increase our electricity productivity and raise our standard of living;

b) To increase our security of supply; and

c) To ensure inter-generational equity.

The six key actions that must be taken to reduce nuclear subsidies and raise the market price of electricity to its full cost are:

i) requiring Ontario Power Generation (OPG) to earn a competitive rate of return on its capital;

ii) raising OPG's water rental rates to their full market value;

iii) eliminating the Ontario Electricity Financial Corporation's (OEFC's) $20 billion unfunded liability;

iv) eliminating the Government of Ontario's responsibility for nuclear decommissioning with respect to all nuclear reactor restarts, retrofits and new builds;

v) eliminating the Government of Ontario's responsibility for the long-term storage of nuclear wastes with respect to all nuclear reactor restarts, retrofits and new builds; and

vi) eliminating the *Nuclear Liability Act's* $75 million cap on nuclear operators' liabilities in the event of a nuclear accident for all nuclear plant restarts, retrofits and new builds.

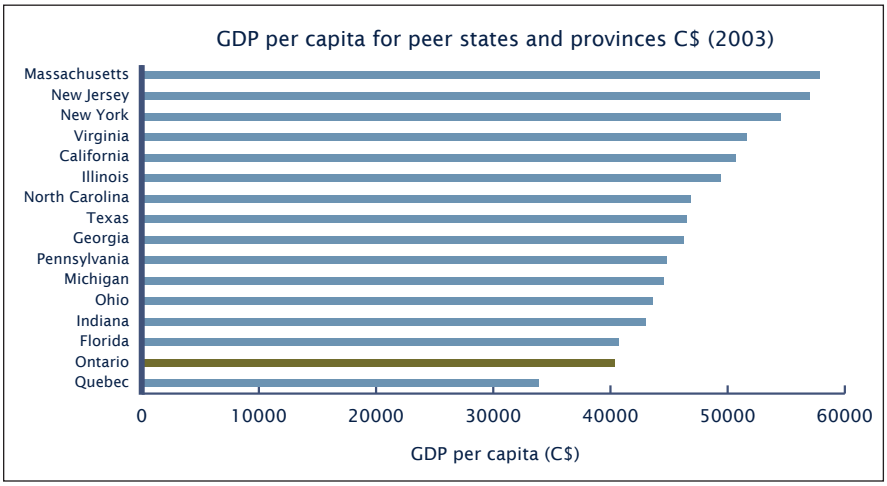
These measures can also be used to provide the Ontario Government with increased revenues that it can use to finance public spending (e.g., schools, universities, health-care), deficit reduction or other public-interest measures.

Eliminating just three of these current subsidies (OPG below-market return on equity, below-market value water power charges, OEFC's unfunded liability) would raise Ontario's electricity rates by approximately 30% from 2003 levels.

Electricity consumers can mitigate the bill impact of a 30% increase in electricity rates by increasing their electricity efficiency and switching to lower cost options for space and water heating (e.g., natural gas, geothermal, solar). For example, if Ontario's electricity consumers could achieve New York State's level of electricity efficiency, our per capita electricity consumption would fall by 38% -- more than offsetting the rate increase, while creating numerous ancillary benefits.

Low-income households should be protected from any net bill increase through a combination of energy conservation programs, heating retrofits and a flat-rate on-bill rebate for all Ontarians based

Fig. 6: The prosperity gap: Ontario trails in GDP per capita



*The Task Force on Competitiveness ranked Ontario 13th based on preliminary GDP data. Final year end data actually placed Ontario 15th

Fig. 7 Electricity prices for 2003

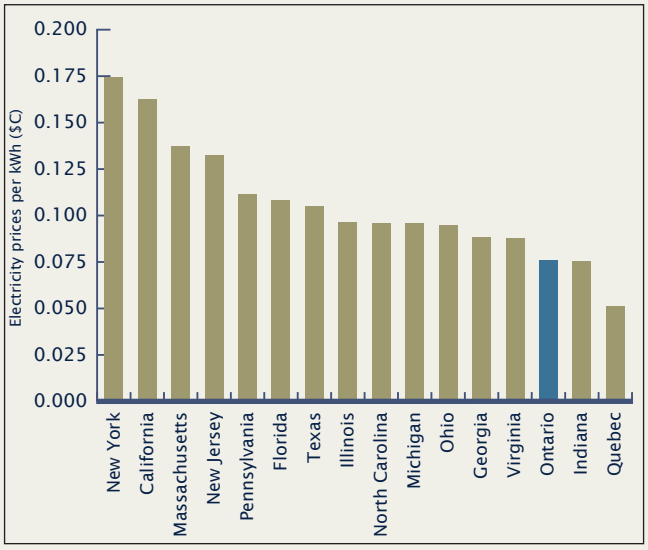


Fig. 8 Electricity productivity for 2003

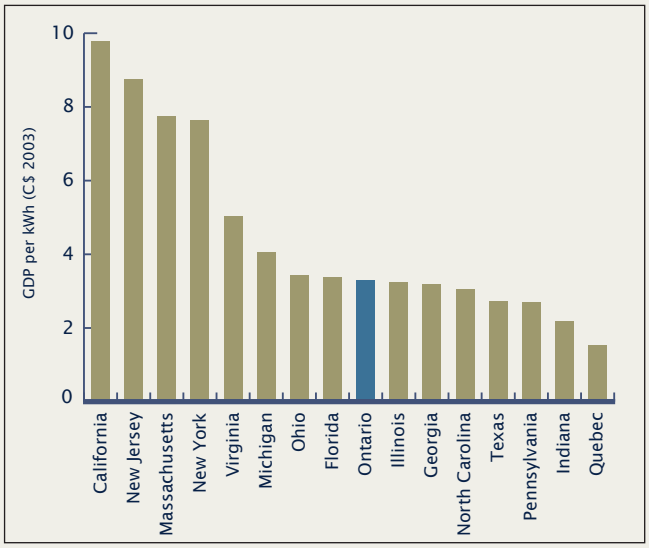
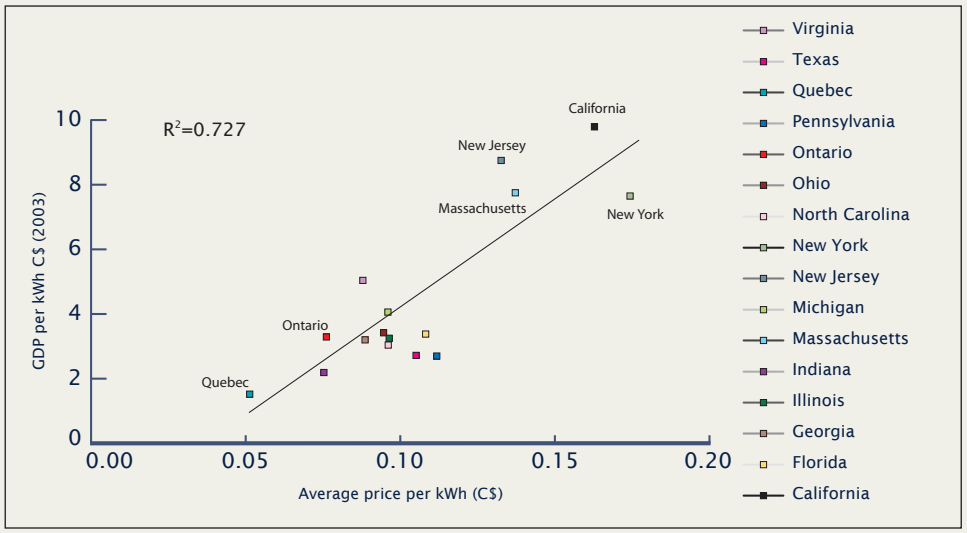
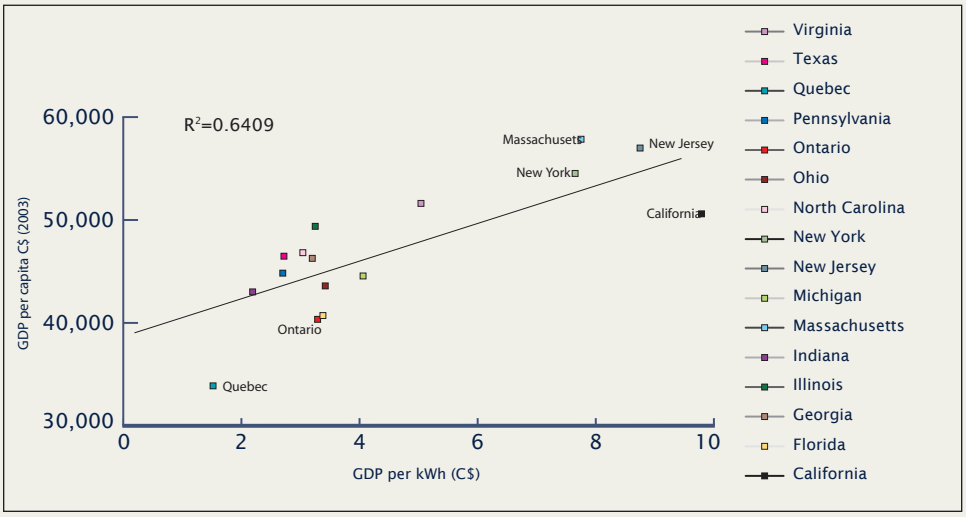


Fig. 9: Relationship between electricity prices and electricity productivity



State/Province	GDP per kWh
California	$9.79
New Jersey	$8.75
Massachusetts	$7.75
New York	$7.65
Virginia	$5.04
Michigan	$4.06
Ohio	$3.42
Florida	$3.38
Ontario	$3.29
Illinois	$3.25
Georgia	$3.20
North Carolina	$3.04
Texas	$2.72
Pennsylvania	$2.70
Indiana	$2.19
Quebec	$1.52

Fig. 10: Relationship between electricity productivity and GDP per capita



on the bill impact of higher rates on the lowest income consumers. Such a rebate would encourage continued conservation while helping to eliminate the bill impact of higher rates on low income households.[62]

The Government of Ontario should direct the Ontario Power Authority to develop a long-term strategy to achieve the following objectives, to the fullest extent practical:

- ***Raise the price of electricity up to its full cost without raising the electricity bills of low income consumers or impairing the competitiveness of Ontario's industries; and***
- ***Raise Ontario's electricity productivity (GDP per kWh) up to New York State's level.***

Endnotes

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8. According to the OPA, Ontario's required resources (peak day demand plus required reserve) in 2006 are 28,174 MW and Ontario's existing and already planned resources that will be in service in 2025 equals 22,028 MW. Therefore if our required resources in 2025 equal our 2006 level, the gap will be 6,146 MW (28,174 – 22,028 MW). Emails from Andrew Pietrewicz, Power System Planning, Ontario Power Authority to Jack Gibbons, January 11, 2006.
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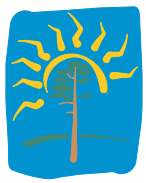
OCAA Members

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



Ontario Clean Air Alliance
625 Church Street, Suite 402
Toronto M4Y 2G1
Tel: (416) 926-1907 ext. 245
Fax: (416) 926-1601
E-mail: contact@cleanairalliance.org
Web Site: www.cleanairalliance.org