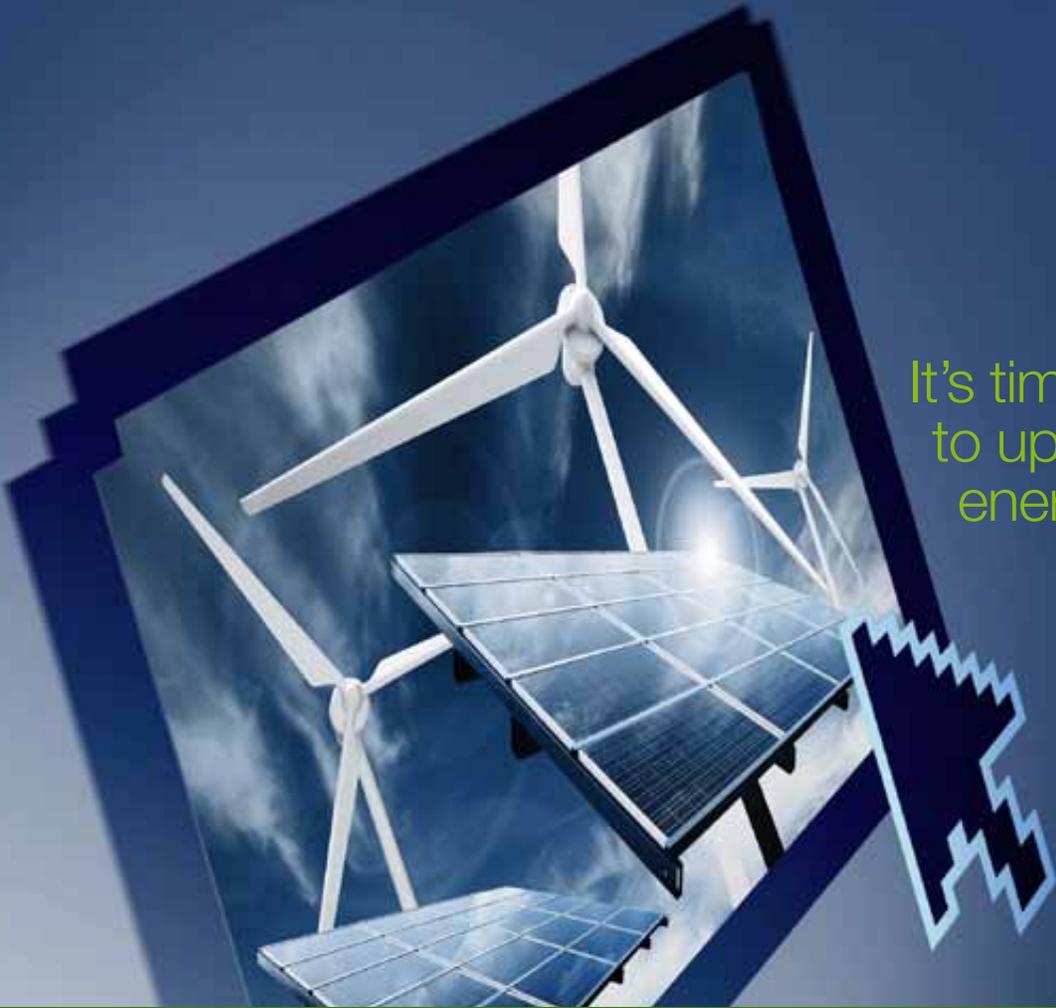


renewable  s doable



It's time for Ontario to upgrade its green energy plans.

Ontario's Green Energy Plan 2.0

Choosing 21st Century Energy Options

Executive Summary

Should the province replace its aging nuclear plants with new nuclear stations or with a portfolio of green energy options?

As Ontario's aging nuclear reactors are retired over the next 15 years, the province must replace its out-dated 20th century electricity system with a new one that will power the province into the 21st century.

Until now, the province has pursued two goals — building new nuclear reactors while expanding its supplies from renewable energy sources. As long as electricity demand was growing, and renewable sources were marginal, both goals seemed compatible. But that's no longer the case.

The situation in Ontario has drastically changed. The province's electricity demand has been falling for the last four years and will likely continue to decline. At the same time, the success of the *Green Energy Act* has led the province to procure more wind, solar and bio-energy than expected over the next 17 years.

With electricity demand falling, coal being phased out, and the natural gas capacity that will be used to balance the system in the medium-term largely already in place, Ontario faces a stark choice: Should the province replace its aging nuclear plants with new nuclear stations or with a portfolio of green energy options?

New nuclear reactors will limit future green energy investments in Ontario by constraining transmission access and overall grid flexibility. By replacing aging nuclear with modern green energy, Ontario would realize the following benefits:

Greater savings: Building a new nuclear plant will cost ratepayers anywhere from 12 to 48 per cent more than delivering that same amount of power using a mix of renewable and more efficient options.



HOME SOLAR PANEL

Long-term green jobs: A green energy portfolio would create an additional 27,000 new jobs over a 10 year period.

Proven: All of the new nuclear reactor designs being considered by the Ontario government are untested prototypes. Green energy technologies have been proven to work in other jurisdictions to replace significant sources of old electricity production, and they are increasingly technologically and cost efficient.

Flexible options: Nuclear power plants are designed to run at full output all the time and are not responsive to changes in demand. Renewable sources, meanwhile, can be incrementally developed faster and in smaller increments, which more appropriately matches gradual changes in supply and demand.

Protection: Ontarians are still paying for the cost overruns for reactors built decades ago. Ontario's progressive *Green Energy Act*, however, protects electricity consumers by requiring green power developers to pay for cost overruns.

This report makes the case for the green portfolio as the more cost-effective option and the one which best prepares this province to prosper in the 21st century. Investing in renewable energy systems is the most effective way to achieve the government's economic and environmental goals while providing a sustainable legacy for future Ontarians.

The New Context: Green Power Exceeding Expectations

Just a few years ago we were told it was impossible for green power to replace aging nuclear stations, such as Pickering. Today, however, it's clear we can.

In 2005, the province's energy planners told the Ontario government that new or re-built nuclear reactors were more cost-effective while green power and conservation were either too expensive or unreliable.

In retrospect, it is clear the government received bad advice. The estimated cost of building new nuclear plants has almost tripled and reactor refurbishment projects have gone substantially over budget and suffered significant delays.

While the province's nuclear energy projects have failed to meet cost targets, the growth of the cleantech sector has exceeded expectations, both internationally and in Ontario.

The thriving green energy industry has confounded its critics and surpassed even the most optimistic projections. In 2008, the United Nations reported that for the first time, more money was invested globally in wind, solar and other forms of renewable electricity generation than into new nuclear, coal and natural gas combined.¹ In spite of the global recession, 2009 was an even better year.² The International Energy Agency recently reported that solar power is likely to be cost competitive with current electricity rates by 2020 if leading governments continue to support that maturation of solar technology in the interim years.³

"We may not need any [new coal or new nuclear], ever... I think baseload capacity is going to become an anachronism."

— Jon Wellinghoff, Chair,
Federal Energy Regulatory Commission, April 21, 2009.³

Ontario's ground breaking *Green Energy Act* has positioned the province as North America's leader in renewable power development. In 2009, Ontario's 1,000 MW of wind power produced 2.3 terawatt hours⁴ of electricity – equivalent to the power used in over 400,000 houses every year, while the output from Ontario's coal plants was down to 8.9 terawatt hours. In the last six months, the province has contracted for an additional 4,800 MW of new renewable energy generation to be built within the next five years under the *Green Energy Act*, which would generate roughly 11.4 terawatt hours annually. At the same time, Ontario Power Generation (OPG) is proceeding with plans to convert some of its coal burning units to produce 2 terawatt hours annually from biomass.

In total, Ontario has already procured more green energy in 2010 than it expected to over the next 17 years. (For a summary of all green energy contracted so far and a comparison with the government's 2007 electricity plan see the Appendix.)

Despite this new landscape, the provincial government has not formally changed its plan to resuscitate the province's aging nuclear supply. Staying the nuclear course will expose Ontarians to increasing costs while delaying and diverting investment in green energy.

But it doesn't have to be that way. The retirement of the antiquated Pickering nuclear station provides an opportunity to upgrade Ontario's green energy supply. Instead of replacing the Pickering station with costly replacement reactors, a green energy portfolio would be a logical step in the evolution of the province's electricity system and economy. By doing so, Ontario would be protecting

the health of its present and future residents. The 20,000 tonnes of highly radioactive waste produced by Pickering are still currently stored at site. While these wastes cannot be eliminated, the province can avoid producing more of it.

The 3,000 MW produced by Pickering reactors represents 15 per cent of Ontario's electricity. A diverse supply of renewable sources, combined with advanced smart grid technology and demand-side management, can replace the traditional model of base and peak load. In Ontario, this can be done at a lower cost than replacing Pickering with more nuclear power.

Leveling the playing field

In 2006, the Ontario government gave the Ontario Power Authority (OPA) *minimum* targets for renewable development over the next 20 years, while giving it a *maximum* for nuclear development.¹³ But in the OPA's 2007 energy plan to the Ontario Energy Board, the minimum renewable targets appeared as maximums, and the development of green power was cut short in order to ensure there was enough room on the electricity grid for nuclear energy.

The reality is that once we have maximized the contribution of conservation and efficiency, nuclear and renewables are direct competitors for 'space' on the grid (See the graph Nuclear Blocks Wind Expansion in the Appendix). The government's policy of replacing aging nuclear reactors with new ones is an expensive barrier to the expansion of Ontario's green energy industry. As aging nuclear stations are retired, cost-effective green energy options should be allowed to replace them.

Room to Breathe: Ontario's Falling Electricity Demand

Thanks in part to the success of the government's conservation programs, electricity demand is now expected to decrease over the next decade. Instead of building additional electricity supply, we can now focus on using modern green energy options to replace retiring nuclear stations.

In 2005, the province's electricity planners warned that Ontarians could face blackouts due to a combination of rapidly increasing electricity demand and the shutdown of the province's aging reactors. These dire projections led Ontario to commit to purchasing new nuclear reactors.

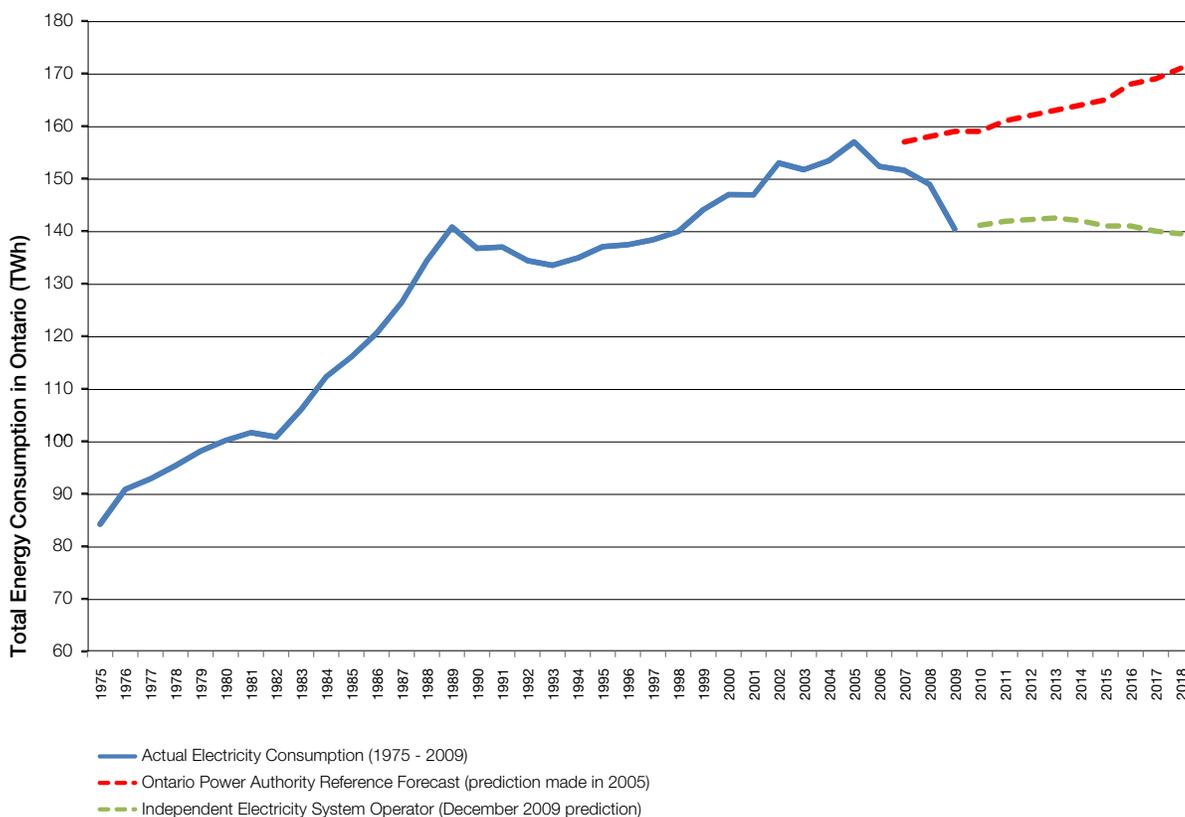
Today, these predictions of imminent blackouts appear to have been unfounded. Instead of increasing, electricity consumption has actually been dropping since 2005, even before the global recession. Demand for electricity in Ontario is projected to continue

to decrease, even as the economy recovers. The North American Electric Reliability Corporation (NERC) predicts electricity demand in Ontario will fall an average 0.7 per cent a year between 2009 and 2018. This 9.5 per cent drop in annual consumption, almost the equivalent to the output of three Pickering reactors, eliminates the predicted need for new reactors.⁶

After decades of energy planners assuming that demand will always rise, they are now recognizing that we can meet our energy needs with less total energy use, while still growing our economy. The demand for electricity is dropping in Ontario as a consequence of changes in the industrial structure, successful conservation programs, and the replacement of old capital with new, more efficient equipment.

The Independent Electricity System Operator (IESO) says this change in its forecast of future demand is due to changes in the economy (both the high Canadian dollar and the recent recession); having conservation programs in place and planned, and increases in embedded generation (on-site power generation like rooftop solar).⁷ In other words, while additional nuclear generation was said to be needed to meet growing demand just a few years ago, electricity consumption can now be expected to modestly decline, eliminating the need for some of the current nuclear supply.

Demand for Electricity in Ontario is Dropping Even as Population and GDP Are Increasing



Nuclear: Over Budget (Again)

The nuclear industry has a history of low-balling its cost estimates. This makes reactor projects appear economical.

The up-front costs of building nuclear plants are high. It is also complicated work that often takes longer than anticipated. Historically, Ontario has had bad luck when constructing nuclear stations. Not a single reactor in Ontario's history has ever been built on time or on budget. Projects to refurbish old reactors have also been late and significantly over budget.

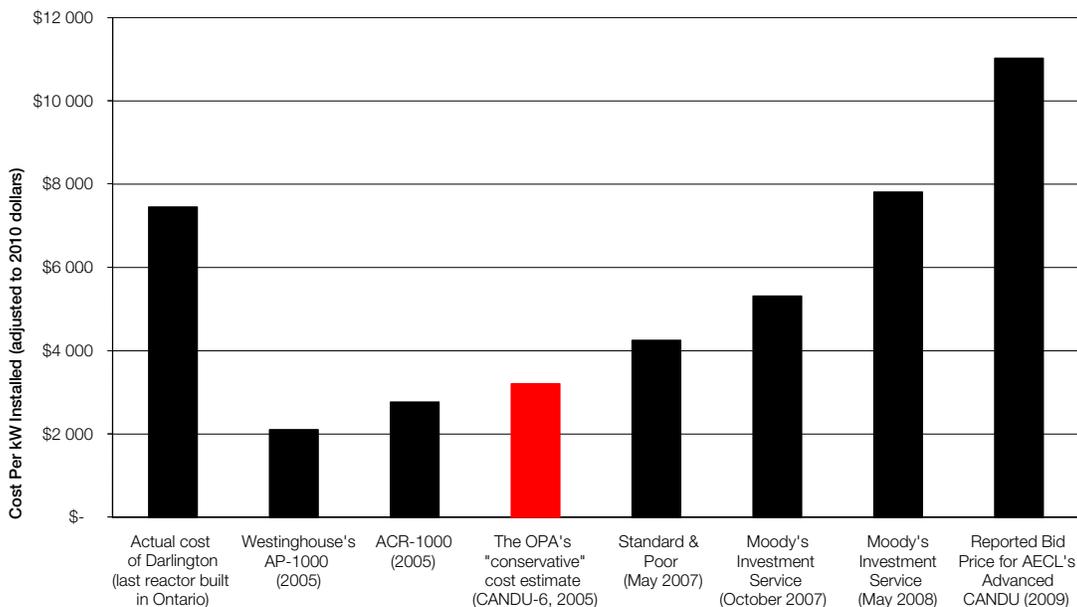
Not long ago, Ontarians were told that nuclear reactors would be inexpensive to construct. In 2005, the Ontario Power Authority (OPA) assumed a new nuclear plant would cost about \$2,900/KWh or about \$6 billion for a 2,000 MW station. After the government suspended its procurement of new reactors in 2009, it was reported that the cost to build AECL's untested Advanced CANDU reactor was over \$10,000/kW or \$26 billion for a 2400 MW station.⁸ At this price, building two new reactors would consume the province's entire 20-year nuclear budget, which included the reconstruction of 12 reactors, in addition to the new ones. The OPA has admitted that building new reactors at these levels would not be cost effective.⁹

Maintaining aging reactors is also expensive. In August 2005, Ontario abandoned restarting two of the Pickering A reactors because of high costs. In response, Bruce Power CEO Duncan Hawthorne said his company's ability to come in on time and on budget refurbishing two of the Bruce A reactors would be a "test case" for future nuclear projects in Ontario, saying "If we can't do this, don't talk nuclear again in this province."¹⁰ Bruce Power failed to deliver. By 2008, the restart was more than a year behind schedule and Ontario ratepayers are on the hook to pay \$237.5 million in cost overruns.¹¹

In addition to the overruns at Bruce A, the refurbishment of the Point Lepreau nuclear station in New Brunswick is significantly delayed and overruns have cost the federal taxpayer hundreds of millions of dollars. Ontario Power Generation's decision not to refurbish the Pickering B reactors is an admission that it is not economical to keep CANDU reactors running. It is currently examining the viability of refurbishing the Darlington nuclear station, but is unsure on how much it will cost. Estimates range between \$6 and \$10 billion.¹²

Given the troubling history of nuclear power in this province, Ontario is fortunate that the *Green Energy Act* provides an excellent foundation for its energy future. However, unless the government changes its policy of replacing nuclear with nuclear, Ontario will have to stop procuring additional green energy under the *Green Energy Act*.

Comparing Nuclear Cost Estimates



The nuclear industry has a history of underestimating the cost of nuclear plants. The bar to the left shows the actual cost for the Darlington nuclear station, the last nuclear station completed in Canada in 1992. The next estimates are early reactor vendor estimates for next generation reactor designs. The red bar in the centre is the "conservative" estimate used by the Ontario Power Authority in 2005 in advising the government to purchase new nuclear plants. The bars to the right show estimates provided by non-industry financial analysts. The bar on the far right is AECL's reported bid for building its Advanced CANDU in Ontario in 2009. All estimates are adjusted to 2010 dollars.

Sources: Darlington construction costs, Ontario Hydro; Ontario Power Authority 2007; Standard & Poor and Moody's Investment Service; the Toronto Star.

Ontario Green Energy 2.0: Proven, Doable and Diverse

It's time for Ontario to upgrade its green energy plans.

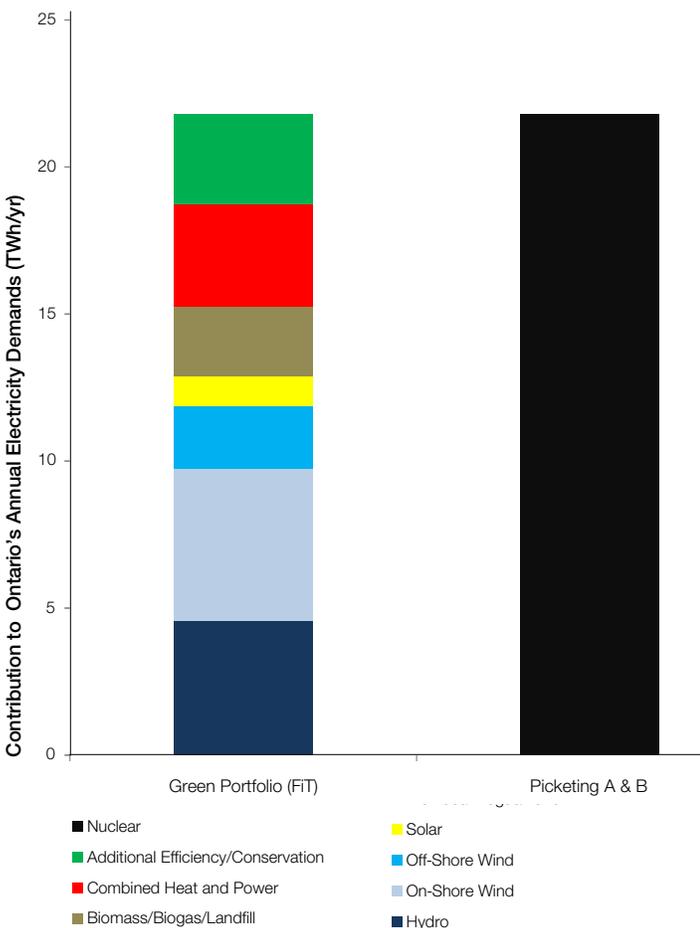
The province has already made commendable progress in building a green economy. Ontario is on track to phase out its coal stations by 2014 and replace them with a mix of conservation, green energy, and cleaner gas generation. Much of this progress, however, will come to a halt if the government stays the nuclear course.

The Green Energy Plan 2.0, outlined below, presents an affordable and forward-thinking option. It is less risky than buying a new nuclear station. The 3,000 MW of capacity in the six reactors at the Pickering plant currently provide about 15 per cent of Ontario's overall electricity when they are operating well. Instead of relying on new untested nuclear plants, Ontario could replace the contribution from these aging reactors to the province's supply with a portfolio of proven hydro, wind, solar, biomass, Combined Heat and Power (CHP), conservation and efficiency options.

Under the current Ontario electricity plan, retiring nuclear stations are to be replaced by new or rebuilt nuclear reactors to continue to provide up to 14,000 MW of supply, while green energy will be capped at about 5,300 MW. However, by increasing targets for renewables, green power could replace nuclear just as it has been allowed to replace coal. This diversity of supply will only benefit the province, which will no longer have to rely on this troubled and costly source.

Industry has already demonstrated its confidence in the economics and potential of green energy in Ontario. A 2009 survey by the OPA found over 15,000 MW of renewable energy projects already in the planning or development stage,¹⁴ more than double what was predicted in its 2007 electricity plan. By the end 2009, the OPA had received applications for 8,000 MW worth of green energy projects.¹⁵ In early 2010, more than 500 new green energy projects had been approved across Ontario. Many of these projects will be built in communities by farmers, municipalities, businesses, and public institutions such as schools and hospitals.

A Green Energy Portfolio Can Replace the Pickering Nuclear Station



This chart illustrates how a portfolio of green energy sources can easily make up for the electricity produced by the deteriorating Pickering B nuclear Station.¹⁶

Ontario can already keep the lights on with less nuclear generation. The province's electricity system is capable of handling large periods of time when many of its nuclear power stations are offline for repairs. Of the 11,300 MW of nuclear supply in Ontario, in 2009 (a relatively reliable year for nuclear power) the average nuclear output was just over 9,400 MW, while the entire system operated for 45 days at a nuclear output lower than 8,300 MW — the equivalent of operating without the entire Pickering station.

Ontario's green energy legislation provides many of the right conditions for conservation and renewable energy to thrive. But if green energy is ever to reach its full potential, the government must revise its 2006 commitment to maintaining nuclear at 50 per cent of supply. Otherwise, the government will cause clean energy to remain a marginal source of power in Ontario, despite the innovative *Green Energy Act*.

Green Energy Plan 2.0: The Affordable Choice

No one could blame Ontarians for asking this simple question: Why risk billions of dollars on untested reactors, when proven green energy can keep the lights on at lower risks and lower costs?

The revelation in 2009 that two new reactors would cost \$26 billion — equivalent to the total cost of the government's entire long-term nuclear spending plan — proves that Ontario cannot afford to stay on the nuclear path.

By allowing modern green power to replace the 1960s-era Pickering nuclear station, this green portfolio shows how the *Green Energy Act* could be put to work. Charting such a course is cheaper and will diversify investment in power generation. Better still, it reduces the risks of relying on an expensive form of energy generation to supply our needs.

The graph below shows how building a new nuclear plant will cost rate payers 12 to 48 per cent more than delivering that same amount of power proposed in our Green Energy Plan 2.0.

While more affordable, this plan also provides better protection to Ontario ratepayers. Ontario's progressive Feed-In Tariff ensures that ratepayers only pay for electricity generated, ensuring any cost overruns or unforeseen liability expenses are borne by the developer — not Ontarians. This is not the case for nuclear power. Today, Ontarians continue to pay for cost overruns from reactors built decades ago.

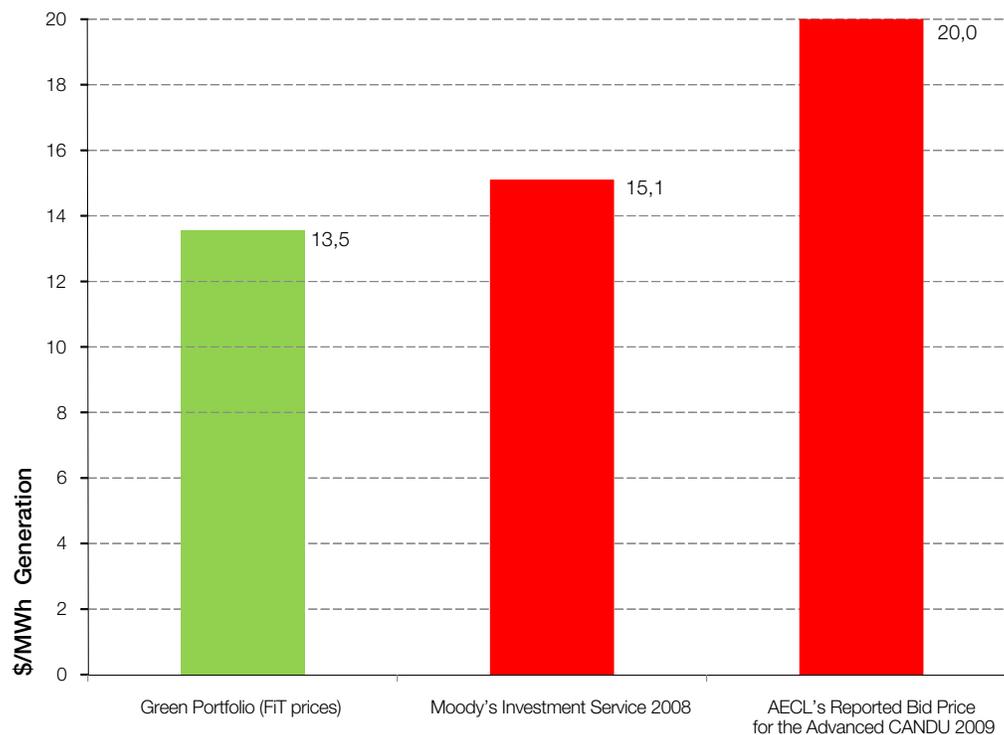
Better still, the plan protects both the provincial ratepayer and the federal taxpayer. In suspending its procurement of new reactors in 2009 because AECL's winning bid was "billions" of dollars too high, the Ontario government asked the federal government to lower the price; that is, it asked the federal taxpayer to subsidize its nuclear plans. Our Green Energy Plan 2.0 shows Ontario can use *Green Energy Act* to meet Ontario's electricity needs without a federal bailout.

"Nuclear generation has a fixed design where construction costs are rising rapidly, while other renewable technologies are still experiencing significant advancements in terms of energy conversion efficiency and cost reductions."

— Moody's Investment Service, 2008.

Green Energy Plan 2.0 is conservative and assumes today's Feed-In Tariff prices. Over time, Feed-In Tariffs are intended to decline while projects that are already approved will remain fixed for 20 years. Either way, our Green Energy Plan 2.0 is already the more affordable choice at today's prices.

A Green Energy Plan Is Cheaper Than New Reactors



"Portfolio Costs" of replacing Pickering

The bar to the left shows how, using current Feed-In Tariff rates, a green energy portfolio made up of renewable energy sources will cost Ontario ratepayers less than generation from a new nuclear power station.¹⁷ The bars to the left provide recently reported cost estimates for new nuclear stations.

Green Jobs Plan 2.0: More Green Jobs

A Green Energy Plan 2.0 would allow Ontario's green workforce to continue growing and diversifying the province's economy.

Aside from saving provincial ratepayers money on electricity bills, the figure below illustrates the sectors in which our suggested upgrade to the province's green energy plans would create an additional 27,000 new jobs over a 10 year period.¹⁸

Ontario is already seeing progress being made on creating a "green collar" workforce. In January 2010, the province signed a \$7 billion deal with the Korea-based Samsung Group. Samsung committed to building four manufacturing plants that will produce renewable technology such as wind turbines and developing 2,500 megawatts of wind and solar farms in Ontario. This investment is expected to generate more than 15,000 jobs.¹⁹ Part of the allure of Ontario for Samsung were the province's regulations and policies such as the *Green Energy Act* that reward investment in renewables.

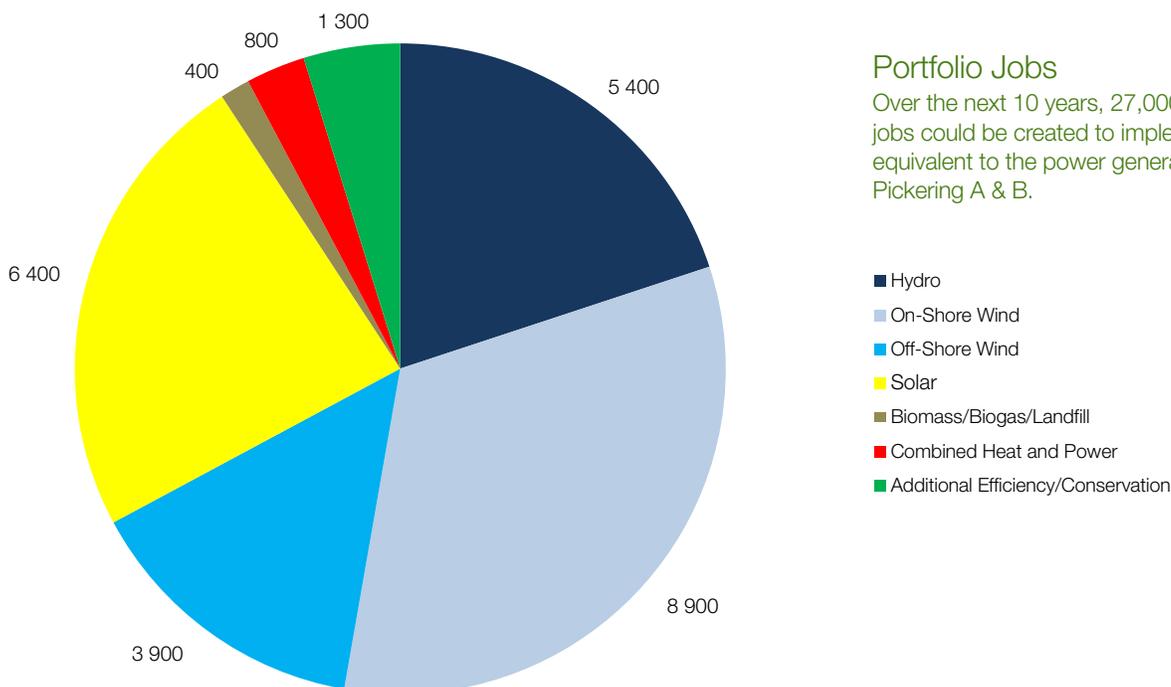
The province's domestic content requirements, for example, require at least 25 per cent of wind project costs and 50 per cent of large solar project costs to come from Ontario goods and labour. Along with guarantees in prices for energy generated from renewable sources, companies will have the confidence to invest in Ontario, hire workers, and produce and sell green energy.

The growth in the green jobs sector can and should continue. A recent study by Blue Green Alliance, a coalition of environmental and labour groups, estimated that 90,000 jobs could be created with green energy over the next decade²⁰ by replacing aging nuclear stations with green energy as they retire.

One of the major benefits of the *Green Energy Act* is that it allows renewable energy producers across the province to connect to the grid — not just those working in a nuclear facility. Aboriginal communities, homeowners, farmers, schools, factories, co-ops, as well as large-scale commercial generators will be able to boost local economies and create jobs by selling green energy to the province's electricity grid. In the green energy future, everybody wins.

Unlike jobs in the nuclear industry, an upgraded green energy plan will bring more diverse jobs to all corners of Ontario. The province can expect to see jobs in wide-ranging sectors such as manufacturing, industrial efficiency, clean generation, home retrofitting, and offshore developments.

Distribution of Jobs Created by Replacing Nuclear Power with a Green Portfolio



The Green Future Starts Now

Following the coal phase-out, the Ontario government must revise its policy on replacing aging nuclear facilities with new ones to continue developing a modern green energy economy.

Building a 21st century energy system means that Ontario must learn from its 20th century mistakes with nuclear power. Clean energy sources must be given room to grow in order to realize their potential. The Ontario government's role is to provide direction and guidance to encourage the province's transition to a green energy future.

In 2008, then-Minister of Energy and Infrastructure George Smitherman stopped the Ontario Energy Board's review of the Ontario Power Authority's 2007 long-term electricity plan and instructed it to review and "enhance" its long-term targets for renewables, conservation, and decentralized energy within six months.²¹ At the time, the minister insisted nuclear would still remain at 50 per cent of supply, inadvertently limiting significant enhancements to green targets.²²

Since that time, it has become clear that green energy can play a more significant role in Ontario's energy plan. Nuclear costs are increasing at a time when demand forecasts are decreasing, making it an unsuitable fit for Ontario's needs. The *Green Energy Act* could — if permitted — encourage renewable power to thrive by stimulating more investment in clean technology.

Despite this, the current Energy and Infrastructure Minister Brad Duguid has stated that green energy development will be limited to targets set several years ago (about 10 per cent of supply)²³ — targets that were set when nuclear costs were believed to be significantly lower.

The government needs to provide clear direction to our electricity planning agency to avoid investing in risky nuclear energy again. A 21st century energy system cannot depend on 20th century thinking.

The growth of green energy in Ontario has been driven by the government's commendable and successful coal phase-out. It is replacing dirty coal power with green energy, conservation, and cleaner gas generation. There is no reason this momentum cannot continue, allowing green energy to take the next step in Ontario.

Right now, Ontario has a once-in-a-lifetime opportunity to replace the six aging reactors at the Pickering nuclear station with safer and more sustainable options. By making wise decisions today, Ontario will usher in a new era of prosperity for tomorrow.



Recommendations

1. Direct the Ontario Power Authority to replace the Pickering reactors by increasing its mid-term baseline targets (between the years 2015 and 2020) for renewables, conservation, and Combined Heat and Power.
2. Forgo or delay²⁴ buying new reactors.
3. Follow through on commitments to establish a Feed-In Tariff for Combined Heat and Power generation in order to enable the development of diversified baseload generation.
4. Instruct the Ontario Power Authority that aging nuclear facilities can be replaced by cost effective green energy options.

Highlights of Ontario's Green Energy Plan 2.0

Adopting a portfolio of renewable energy sources has numerous benefits:

Doable — All the energy options in the portfolio are proven to work and can easily meet and surpass the green targets established in 2006.

Diverse — Instead of risking billions of dollars on an untested reactor, this green portfolio would provide power diversity from proven sources: onshore and offshore wind; local, residential, and industrial power stations; and efficiency programs.

Disperse — Combined Heat and Power (CHP) stations could provide efficient baseload power to hospitals, schools, and industrial facilities across Ontario instead of being centralized in a distant location.

Conservative — The OPA already intends to surpass its original targets for wind power for 2014. The additional wind capacity proposed here is less the OPA's own deployment estimates for 2014.²⁵

Cost effective — Feed-In Tariff rates are scheduled to be reviewed and likely decline over time for new projects, while projects that are already approved will remain fixed for 20 years. Meanwhile, nuclear power costs have continued to escalate.

Endnotes

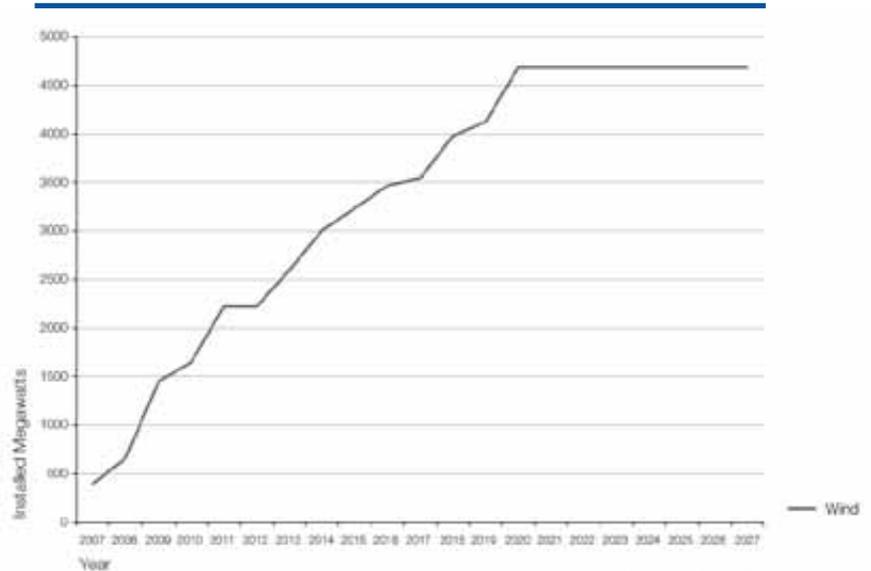
- 1 Macalister, Terry, (2009). "Renewables took bulk of global energy investment in 2008, says UN." *The Guardian*, accessed online: <www.guardian.co.uk/environment/2009/jun/03/renewables-energy-spending>, April 20, 2010.
- 2 Roney, J. Matthew, (2010). "Wind Power Soared Past 150,000 Megawatts in 2009." *Earth Policy Institute*, accessed online at: <www.earthpolicy.org/index.php?indicators/C49/wind_power_2010>, March 30, 2010.
- 3 International Energy Agency. "IEA sees great potential for solar, providing up to a quarter of world electricity by 2050". Media Release, accessed online at: <http://iea.org/press/pressdetail.asp?PRESS_REL_ID=301>, May 11, 2010.
- 4 Independent Electricity System Operator. "Wind Power in Ontario Generates a New Record in 2009", Media Release, accessed online at: <http://www.ieso.ca/imoweb/media/md_newsitem.asp?newsID=5019>, January 8, 2010.
- 5 "Energy Regulatory Chief Says New Coal, Nuclear Plants May Be Unnecessary". *New York Times*, accessed online at: <<http://www.nytimes.com/gwire/2009/04/22/22greenwire-no-need-to-build-new-us-coal-or-nuclear-plants-10630.html>>, April 22, 2009.
- 6 Hamilton, Tyler. "Hydro use decreasing," *Toronto Star*, October 30, 2009.
- 7 Personal communication from Alexandra Campbell of the IESO with Keith Stewart of WWF-Canada, January 13, 2010.
- 8 Hamilton, Tyler. "\$26B cost killed nuclear bid," *Toronto Star*, July 14, 2009.
- 9 In response to questioning at the Ontario Energy Board, the Ontario Power Authority admitted that at an overnight capital cost of \$3,600 with an additional 2 cents in operating and maintenance costs and an 8 per cent discount rate, nuclear stations would be uneconomical. See: Ontario Power Authority, EB-2007-0707, Exhibit, Tab 43, Schedule 3.
- 10 Erwin, Steve. "Ontario's Nuclear Future at Risk If New Project Goes Over Budget: Bruce CEO," *The Canadian Press*, October 20, 2005.
- 11 Leslie, Keith & Romina Maurino. "Ont. Electricity consumers on hook for Bruce Power cost overruns: critics say," *The Canadian Press*. April 17, 2008.
- 12 Minutes, "2011/2012 Regulated Facilities Payment Amounts Stakeholder Information Session 2." Ontario Power Generation, April 1, 2010.
- 13 Ontario Energy Board. *Report of the Board on the Review of, and Filing Guidelines Applicable to, the Ontario Power Authority's Integrated System Plan and Processes*, pp. 5–6, accessed online at: <http://www.oeb.gov.on.ca/documents/cases/EB-2006-0207/IPSP_report_final_20061227.pdf>, May 14, 2010.
- 14 Survey results available online at: <<http://www.powerauthority.on.ca/fit/Page.asp?PageID=924&ContentID=10106>>.
- 15 "Ontario's Feed-In Tariff Program Background." Ontario Power Authority, accessed online at: <<http://www.powerauthority.on.ca/Page.asp?PageID=122&ContentID=7136>>, May 14, 2010.
- 16 Generation data were developed based on what would supply the equivalent of 3,000 MW of nuclear power generation (85% capacity factor assumed), while continuing to meet peak supply and reliability demands. Land-based and offshore wind power, often considered one of the more challenging power sources to integrate large quantities of, would account for 6,400 MW of supply (including what is already built and contracted). This is significantly less than the 10,000 MW scenario that was modeled in the Ontario Wind Integration Study performed by General Electric for the Ontario Power Authority, the Independent Electricity System Operator and Canadian Wind Energy Association in 2006. This scenario suggested that 10,000 MW of wind power could be integrated into the Ontario system by 2020 by adding less load following capacity than is already built in the province.
- 17 Renewable power generation costs based on 2010 Feed-In Tariff rates, additional conservation costs are estimated by the Ontario Power Authority to be 2.7 c/kWh, Combined Heat and Power system costs estimated to be 8.5 c/kWh. Nuclear plants have relatively low operating costs and the bulk of the cost of delivered power is related to their capital costs. The 20 cent/kWh figure for new nuclear reactors that have a capital cost of \$10,800/kWh is based on an extrapolation of the Ontario Power Authority's cost estimate (\$2,900/kW capital costs = 8.6 cents/kWh, of which only 0.3 cents is Operating and Maintenance costs) and Moody's cost estimate (\$7,500/kW capital costs = 15.1 cents/kWh, of which only 1.5 cents/kWh is variable costs). These costs would be higher if the reactors don't achieve the high capacity factors (~90 per cent) that are predicted for them, as the fixed capital costs must be spread over fewer delivered kWh.
- 18 Job creation figures were developed based on the model results of the analysis in the 2009 study by Robert Polin and Heidi Garrett-Peltier of the Political Economy Research Institute (PERI) at the University of Massachusetts-Amherst *Building the Green Economy* available online at <www.bluegreencanada.ca>. The jobs figures include both direct and indirect employment recognizing the level of investment required to meet the green energy portfolio, the labour intensity of this spending and the level of local content of the spending.
- 19 Denette, Nathan. "Hamilton: Samsung deal keeps jobs from going south," *The Canadian Press*, accessed online at: <<http://www.greenergyact.ca/Page.asp?PageID=924&ContentID=1398>>, May 14, 2010.
- 20 Pollin, Dr. Robert . *Building the Green Economy*. Commissioned by WWF-Canada, Blue Green Alliance and the *Green Energy Act* Alliance, May 2009.
- 21 Smitherman, George (Ontario Minister of Energy and Infrastructure). "Amendment to the Supply Mix Directive", Issued September 17, 2008. Available online at: <http://www.powerauthority.on.ca/Storage/83/7831_Ministry_Directive_PSP_Sept_18_08.pdf>.
- 22 Maurino, Romina. "Ontario eyes bigger focus on renewable energy to meet power needs," *Canadian Press*, September, 18 2008.
- 23 Spears, John. "184 power producers are given green light," *Toronto Star*, April 9, 2010.
- 24 According to the *Ontario Electricity Act*, the Ontario Power Authority is tasked with revising the Integrated Power System Plan (IPSP) every three years. A decision on whether new nuclear stations are economical and/or needed could be delayed until completion of the next iteration of the IPSP in three years. Such a decision could still allow the various environmental and regulatory approval processes to continue, keeping the nuclear option open for a future government.
- 25 The OPA's 2007 IPSP application estimated that there would only be 3005 MW of wind generation in 2014 with wind development stopping completely in 2019 (Source: OPA, EB-2007, Exhibit D, Tab 9, schedule 1, p. 8). The OPA now estimates that installed wind capacity will reach 5,300 MW in 2014. (http://www.powerauthority.on.ca/Storage/111/15898_Integrating_Renewable_Energy_Supply_Resulting_from_Uptake_of_the_FIT_and_microFIT_Programs.pdf) This portfolio proposes just under 2000 MW of wind generation in 2014.

Appendix: Green Energy Exceeding Expectations

The long-term electricity plan the OPA submitted to the Ontario Energy Board in 2007 capped the long term development of renewable energy in Ontario at 5,312 MW of wind solar and biomass.

According to the plan, wind, solar and biomass development would stop in 2020 just after additional reactors came online. Wind development would be capped at 4685 MW, solar at 88 MW and biomass at 539 MW. The graph to the right shows how wind was planned to flatline after new reactors went online in 2018 and 2019.

Nuclear Blocks Wind Expansion



Source: OPA 2007

The table to the right shows how Ontario has already procured more renewable energy electricity than was anticipated in the OPA's 2007 electricity plan. By 2010, Ontario had already procured 1255 MW of solar power compared to the long-term target of 88 MW planned in 2007.

Energy source	New renewables in IPSP (2007)	Announced new renewables March 2010
Solar	88 MW	1255
Wind	4685 MW	4692
Biomass	539 MW	1178
Total Annual Production (Solar, Wind and Biomass)	12.4 TWh	14.7 TWh

The table below provides a breakdown of green energy sources that have been procured by the government.

Ontario's Growing Renewable Energy Supply		Capacity (MW)	Output (MWh)
Existing wind power (IESO 2009 output data)		1,162	2,300,000
Renewables from March 10, 2010 announcement	Biogas / Biomass	6.5	29,609
	Wind (onshore)	1	2,453
	Water	0.9	4,652
	Solar	103	108,274
Renewables from April 8, 2010 announcement	Biogas	31	141,211
	Biomass	19	86,549
	Solar	652	685,382
	Water	192	992,333
	Wind (onshore)	1,229	3,014,491
	Wind (offshore)	300	919,800
Samsung Targets	Wind (onshore)	2000	4,905,600
	Solar	500	525,600
OPG Biomass (based on proposal to convert Atikokan and 2 units at Nanticoke)		1121	2,000,000
Total New Renewable Generation by 2015			15,715,953

A 21st century energy system cannot depend on 20th century thinking. Following the coal phase-out, the Ontario government must revise its policy on replacing aging nuclear facilities with new ones to continue developing a modern green energy economy.



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