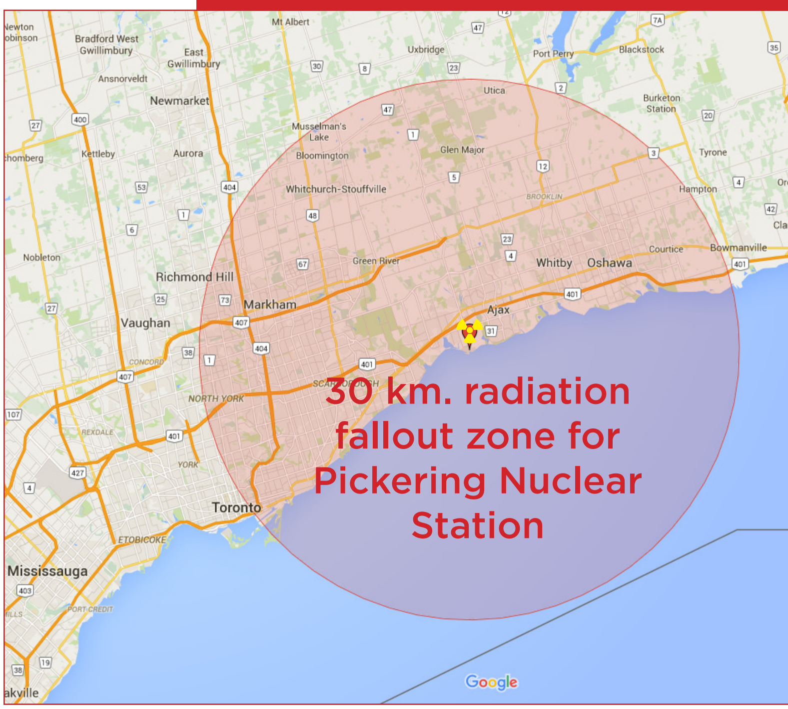
Closing the Pickering Nuclear Station in 2018:



More people live around the Pickering Nuclear Station than around any other nuclear station in North America

A Cost-Benefit Analysis

ONTARIO CLEAN AIR ALLIANCE RESEARCH

Close-Pickering.ca

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Introduction

The Pickering Nuclear Station's operating licence expires on August 31, 2018.

Despite the fact that the Pickering Nuclear Station has exceeded its original design life, Ontario Power Generation (OPG) is planning to seek permission from the Canadian Nuclear Safety Commission to continue to operate it until 2028.[1]

Fortunately, Ontario now has a large electricity surplus and no longer needs the Pickering Nuclear Station to keep our lights on. Moreover, when we do need new electricity resources, our needs can be met at a lower cost by importing power from Quebec and by investing in energy efficiency and cost-effective Made-in-Ontario green energy.

Closing the Pickering Nuclear Station in 2018 can provide the following benefits:

1. Increased public safety for the residents of the Greater Toronto Area;
2. A reduction in our electricity costs of at least $900 million per year; and
3. The creation of 16,000 person-years of employment through immediately decommissioning and dismantling of the Pickering Nuclear Station after closure.

In the wrong place

The Pickering Nuclear Station is surrounded by more people than any other nuclear station in North America. Specifically, 2.2 million people live within 30 kilometres of the Station.[2]

Figure 1 shows the ten North American nuclear stations with the largest surrounding populations.

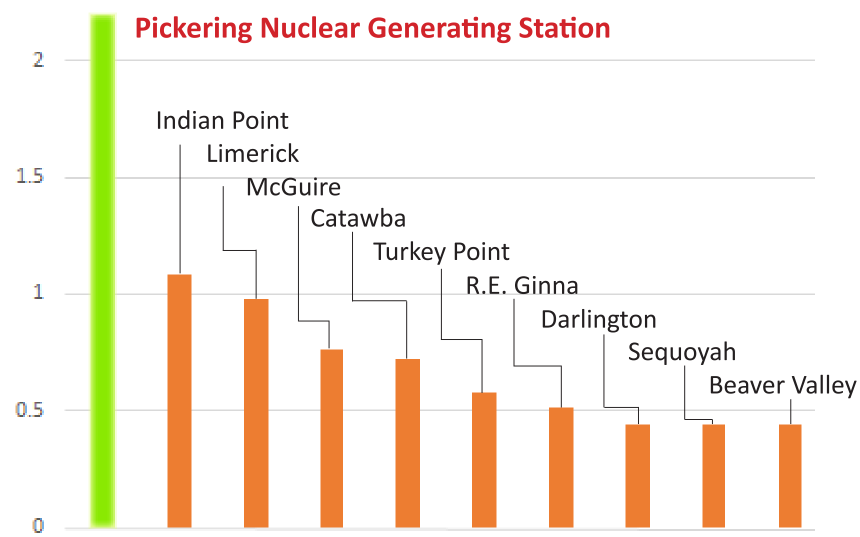
The Indian Point Nuclear Station is #2 with a surrounding population of 1.1 million people. New York Governor Andrew Cuomo is calling for the closure of Indian Point to protect New York City.[3]

Pickering is also the 5th largest nuclear station in North America — larger than Indian Point.

Today we would never build such a large nuclear plant in the middle of such a high concentration of people.

FIGURE 1:

10 North American nuclear plants with the highest surrounding populations
(in millions within 30 km.)



Has exceeded its design life

The Pickering Nuclear Station, which came into service in 1971, was originally designed to operate for 30 years.[4] It is now 45 years old.

Pickering is the 4th oldest nuclear station in North America and the7th oldest nuclear station in the world.

All of the nuclear stations that are older than Pickering are only one to two years older.

Oldest Nuclear Stations in North America

1. Oyster Creek – Ocean County, New Jersey – 1969
2. Ginna – Wayne County, New York – 1970
3. Point Beach – Two Rivers, Wisconsin – 1970
4. **Pickering – Pickering, Ontario – 1971**
5. H.B. Robinson – Hartsville, South Carolina – 1971
6. Palisades – Covert, Michigan – 1971
7. Monticello – Monticello, Minnesota – 1971
8. Pilgrim – Plymouth, Massachusetts – 1972
9. Surry – Surry County, Virginia – 1972
10. Turkey Point – Homestead, Florida – 1972

Oldest Nuclear Stations in the World

1. Benzau, Switzerland – 1969
2. Oyster Creek, U.S. – 1969
3. Tarapur, India – 1969
4. Ginna, U.S. – 1970
5. Point Beach, U.S .– 1970
6. Mihama, Japan – 1970
7. **Pickering, Canada – 1971**
8. Novovoronezh, Russia – 1971
9. Oskarshamn, Sweden – 1971
10. Palisades, U.S. – 1971

Unreliable

According to the World Association of Nuclear Operators (WANO), a key measure of a nuclear station's reliability is its forced loss rate. This is the ratio of its unplanned (forced) energy losses to its planned level of electricity generation.[5]

OPG's *2015 Nuclear Benchmarking Report* compares the reliability of the Pickering Nuclear Station to that of North America's 64 other nuclear power plants.

According to OPG's report, Pickering's forced loss rate is 6.5 times greater than the North American average and 13.3 times greater than the performance of the best quartile nuclear stations. See Table 1.

Moreover, Pickering's forced loss rate is 10.08 times greater than WANO's excellent performance standard, i.e., a maximum nuclear performance index (NPI) of 1.0.[6]

Table 1: Forced Loss Rates of North America's Nuclear Stations in 2014[7]

	NPI Max	Best Quartile	Median	Pickering
Rolling Average Forced Loss Rate (%)	1.0	0.76	1.55	10.08

As a result, Ontario's electricity system planners cannot depend on the Pickering Nuclear Station to help to keep our lights on during high demand periods (e.g., hot summer afternoons when our air-conditioners are running full out).

Requires natural gas-fired generation for back-up

The Pickering Nuclear Station requires back-up from our greenhouse-gas emitting natural gas-fired power plants when it is out of service for maintenance.

Tabled 2 shows Pickering's actual/forecast annual capacity utilization rate for each year from 2013 to 2021.

Table 2: Pickering Nuclear Station's Actual/Forecast Annual Capacity Utilization Rate[8]

2013	2014	2015	2016	2017	2018	2019	2020	2021
72%	74%	78%	77%	70%	71%	72%	72%	69%

Between 2017 and 2021 OPG is forecasting that Pickering's average annual capacity utilization rate will be 71%; and hence it will require back-up from our gas plants during 3 hours out of every 10.

Not needed

Ontario's peak hour demand for electricity has declined by 17% between 2006 and 2015.[9]

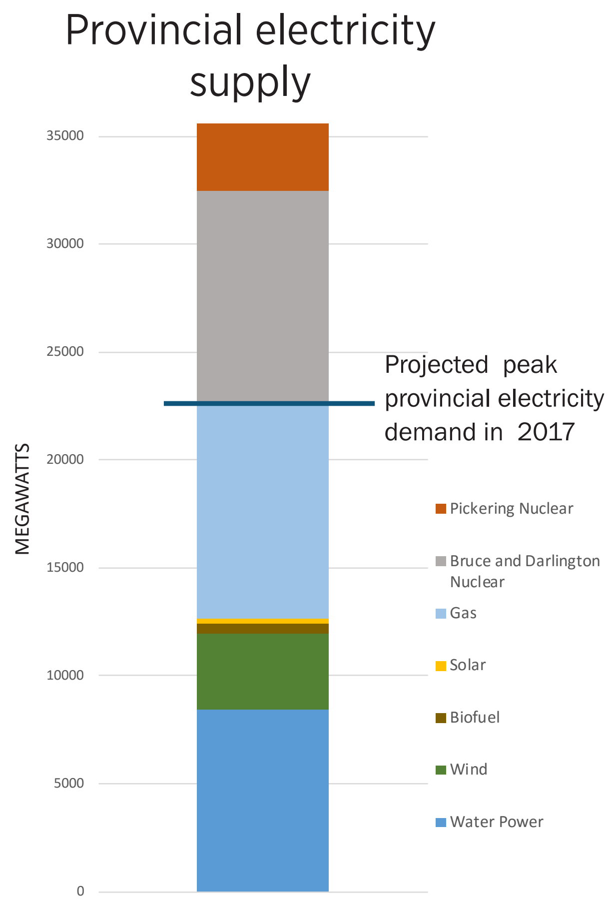
As a result of falling demand and rising electricity supply, Ontario has a large electricity surplus. As Figure 2 shows Ontario's electricity generation capacity exceeds our forecast peak hour demand in 2017 by 57.5%.[10]

The Independent Electricity System Operator (IESO) is forecasting that an additional 1,401 megawatts (MW) of electricity generation capacity will be added to Ontario's electricity grid by the third quarter of 2017.[11] And in 2018, the 900 MW Napanee gas-fired generating station will come into service.[12]

As well, Ontario can import up to 6,513 megawatts (MW) from Manitoba, Minnesota, Michigan, New York and Quebec to meet our electricity needs.[13]

As a result of Ontario's large electricity surplus, in 2015, our total electricity exports (22.6 billion kWh) exceeded the total output of the Pickering Nuclear Station (21.2 billion kWh).[14]

FIGURE 2:



Very high operating costs

According to OPG's benchmarking study, Pickering's operating costs per kWh, exclusive of fuel costs, are higher than those of any other nuclear station in North America.[15]

In 2014 Pickering's fuel and operating costs per kWh (8.16 cents per kWh)[16] were more than double Ontario's average wholesale market price of electricity (3.60 cents per kWh)[17]. As a result, the IESO was required to provide OPG with special payments totalling $917 million to subsidize Pickering's operating deficit.[18]

As a result of rising supply and falling demand, Ontario's average wholesale market price of electricity fell to 2.36 cents per kWh in 2015 and has averaged 1.37 cents per kWh during the first four months of 2016.[19]

According to OPG, between 2017 and 2020, Pickering's fuel and operating cost will range from 8.3 to 9.2 cents per kWh.

Table 3: OPG's Forecast of the Pickering Nuclear Station's Fuel & Operating Costs[20]

2017	2018	2019	2020
8.309 cents per kWh	8.753 cents per kWh	9.184 cents per kWh	9.226 cents per kWh

Clearly, it does not make economic sense to continue to operate the Pickering Nuclear Station given that its fuel and operating costs per kWh are at least 2.3 to 6 times greater than the market price of electricity and we don't require its power.

By closing the Pickering Nuclear Station on August 31, 2018, when its licence expires, we can reduce our annual electricity costs by more than $900 million per year.

Nevertheless, OPG claims that Pickering should remain in service until at least December 31, 2024 since its "availability reduces the need to construct and operate more expensive gas-fired capacity."[21]

OPG's assertion is without merit for the following reasons.

1. Given Ontario's large and growing electricity surplus and our access to up to 6,513 MW of supply from neighbouring jurisdictions, there is no evidence that Ontario needs new generation capacity between now and 2024 to keep our lights on.
2. If Ontario needs new capacity to meet our peak hour demands, extending the life of the *unreliable* Pickering Nuclear Station would not be a smart response. As noted above, Pickering's forced loss rate exceeds the World Association of Nuclear Operator's excellent nuclear performance index (NPI) loss rate by a factor of 10.
3. If Ontario does need more electricity, it can be obtained at a lower cost by importing water and/or wind power from Quebec and by investing in energy efficiency and increasingly cost-effective Made-in-Ontario green energy.

Lower-cost options available

Quebec Water Power

Quebec is the fourth largest producer of water power in the world and has a large and growing supply of power available for export.

According to the Quebec Energy Commission, Hydro Quebec can only obtain high prices for its exports during the 300 peak demand hours of each year. And as a result of transmission constraints, Quebec can only export 10 billion kWh per year during the high price periods. As a consequence, approximately two-thirds of Hydro Quebec's electricity exports are sold at an average price of 3 cents per kWh. According to the Quebec Energy Commission, Hydro Quebec's low-price electricity exports will grow by 50% between 2014 and 2022 from 20.1 billion kWh to 31.1 kWh per year.[22]

In addition, Quebec has the opportunity to export even more low-cost water power by investing in energy efficiency and reducing its domestic customers' electricity bills, which would free up even more of its heritage water power capacity for export. According to Professor Pierre-Olivier Pineau of the University of Montreal, cost-effective energy efficiency investments could increase Quebec's water power export potential by approximately an additional 30 billion kWh per year.[23]

Quebec Wind Power

Quebec can also increase its electricity exports by contracting for more wind energy. In 2014, Quebec contracted for 446.4 MW of wind power at an average price of 6.3 cents per kWh.[24] By combining wind power with its massive hydro-electric reservoirs, Hydro Quebec can convert intermittent wind power into a firm 24/7 electricity supply for Ontario.

Expanding the Quebec-Ontario Electricity Transfer Capacity

Currently, the electricity intertie capacity between Ontario and Quebec is 2,788 MW.[25] However, as a result of transmission constraints on the Hydro One system, Ontario is unable to import 2,788 MW during *every* hour of the year. Specifically, Ontario's maximum potential electricity imports are capped at between 16.5 to 18.5 billion kWh per year.[26] This is equivalent to 12%-13.5% of our annual electricity consumption.[27]

According to the IESO, the total cost of eliminating these constraints is $825 million. However, $325 million of these upgrades need to be made in any case to improve local reliability in Ottawa. Therefore the incremental cost of removing these import constraints is $500 million.[28] If these upgrades are made, we will be able to import 24.4 billion kWh per year from Quebec,[29] which is equivalent to 18% of our annual electricity consumption.[30]

In addition, Ontario's ability to import power from Quebec could be increased by an additional 50% by building a new 1,500 MW intertie with Quebec near Cornwall at a cost of $1.4 billion.[31] This would allow us to import enough power to meet 27% of Ontario's electricity needs.[32]

Quebec's new provincial energy policy calls for an expansion of its electricity intertie capacity with other Canadian provinces.[33]

Clearly, there is a large potential for increased mutually beneficial electricity trade between Ontario and Quebec at a price that will raise Hydro Quebec's export revenues and lower Ontario's electricity costs.

Energy Efficiency

According to the IESO, its large industrial energy efficiency programs save electricity at an average cost of 1.5 cents per kWh; and its residential, commercial and small industrial energy efficiency programs save electricity at an average cost of 3.5 cents per kWh.[34]

Made-in-Ontario Green Energy

In 2016 the IESO used a competitive procurement process to contract for 300 MW of wind energy at an average price of 8.59 cents per kWh.[35]

That is the *total cost* of Made-in-Ontario wind power is now lower cost than Pickering's forecast *fuel and operating costs* alone in 2018.

Decommissioning would create 16,000 jobs

If we close the Pickering Nuclear Station in 2018, we can create 16,000 person-years of employment by 2030 by immediately decommissioning and dismantling the aging plant.[36]

According to the International Atomic Energy Agency, the "preferred decommissioning strategy shall be immediate dismantling."[37]

In contrast, OPG's planned approach is called "deferred decommissioning" – the reactors are put in a state of "safe shutdown" after defueling and dewatering and then left idle for 30 years or more before final dismantlement and disposal. Under this approach most of the costs (and job creation) are postponed for more than 30 years.[38]

That is, under OPG's proposal, if Pickering's licence is extended to 2028, the plant will remain dormant from 2028 to 2058 and will be fully decommissioned and dismantled by 2070 at the earliest.

Conclusion

No one would build one of the world's largest nuclear plants in the middle of the country's largest urban area today. Keeping the Pickering Nuclear Plant operating for another decade or more represents a completely unnecessary risk for the millions of residents of the GTA. We have many safer and more reliable ways to meet our electricity needs than continuing to operate a 45-year-old nuclear plant that uses technology developed in the 1950s and that was constructed in the 1960s.

Endnotes

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16 Ontario Energy Board Docket No. EB-2013-0321, Exhibit JT1.14 (Refiled: 2014-06-03).

17 www.ieso.ca/Pages/Power-Data/price.aspx.

18 In 2014 Pickering produced 20.1 billion kWh. 20.1 billion kWh x (8.16 – 3.60 cents per kWh) = $917 million. Ontario Energy Board Docket No. EB-2016-0152, Exhibit E2, Tab 1, Schedule 1, Table 1.

19 www.ieso.ca/Pages/Power-Data/price.aspx.

20 Ontario Energy Board Docket No. EB-2016-0152, Exhibit E2, Tab 1, Schedule 1, Table 1; Exhibit F2, Tab 2, Schedule 1, Table 1; Exhibit F2, Tab 2, Schedule 3, Page 6; Exhibit F2, Tab 3, Schedule 1, Table 1; Exhibit F2, Tab 4, Schedule 1, Table 1; Exhibit F2, Tab 5, Schedule 1, Table 1; Exhibit F3, Tab 1, Schedule 1, Table 3; Exhibit F3, Tab 2, Schedule 1, Table 2; Exhibit F4, Tab 1, Schedule 1, Table 2; Exhibit F4, Tab 2, Schedule 1, Table 2; Exhibit F4, Tab 4, Schedule 1, Table 3.

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