

Charging Forward

The Future of Ontario's Electricity Grid

BACKGROUND
March 2020



environmental
defence

Introduction

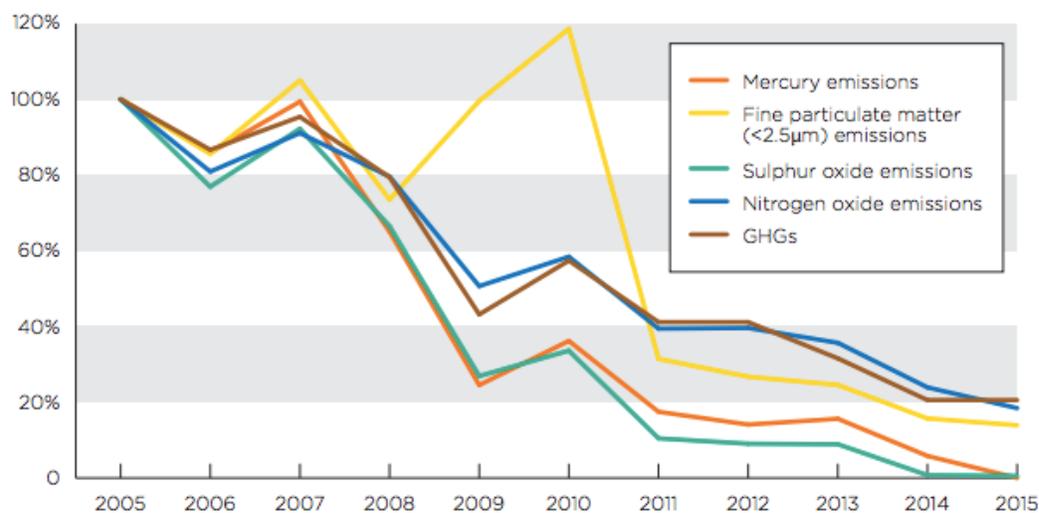
Ontario is facing major choices concerning the future of its electricity system. Our government has promised to cut electricity bills and reduce carbon pollution at the same time. However, the current plan is to increase the use of natural gas to generate electricity, which will almost triple carbon pollution from Ontario's electricity system by 2030. The province's plan also fails to capitalize on what is fast becoming the cheapest form of new energy generation: renewables.

This backgrounder explores why business-as-usual will ramp up carbon pollution, and what we can do to pursue cleaner energy options while cutting costs for Ontarians.

What we've achieved: Ontario's coal phaseout

Ontario's coal phase-out stands as the single largest carbon reduction action in North America. Since the first coal plant closed in 2005, greenhouse gas (GHG) emissions from electricity in this province plummeted from 35 mega tonnes (MTs) in 2005 down to 2.5 MTs in 2017.¹ The federal government is now building on Ontario's success by committing to phase out coal-fired electricity by 2030, and co-founding the Powering Past Coal Alliance to lead international efforts to shift away from coal power.

Figure 1: Emissions in Ontario's Energy Sector (relative to 2005)²



Phasing out coal power in Ontario also had significant health and air quality benefits. Smog days dropped from a peak of 53 in 2005 to zero in 2017³ – a big relief to people with

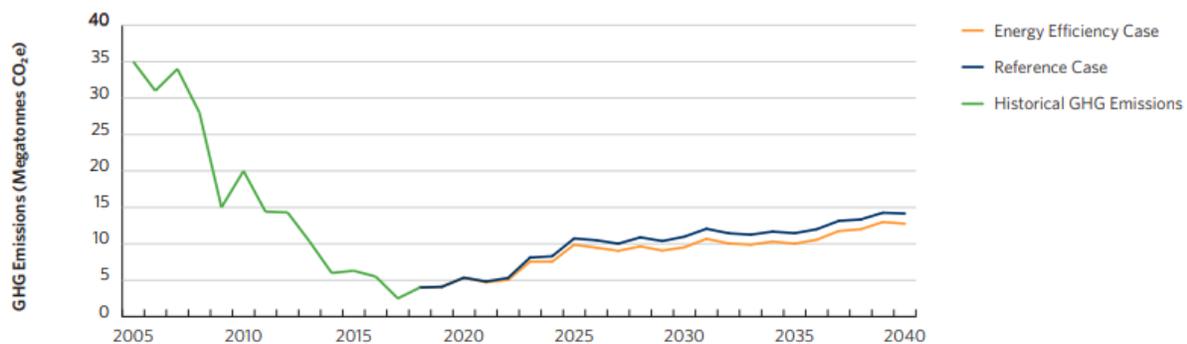
asthma and other health conditions. It's estimated that cleaning up Ontario's grid saved \$4.4 billion per year in health, financial, and environmental costs.⁴

A clean grid is a foundational step in cutting carbon pollution from all areas of our lives. Ontario's low carbon electricity can be used to power cars, buses, and trucks in place of gasoline and diesel. Adding more fossil fuels to the grid means that everything powered by electricity pollutes more. This could happen in Ontario unless we change course.

The Base Case: Where we're going

Though we have yet to see a new Long-Term Energy Plan or updated electricity plan from the current provincial government, emissions are expected to rise. Ontario's electricity system operator, the IESO, is now forecasting that electricity sector emissions will nearly triple over the next decade, rising from 4 MTs in 2018 to 11 MTs⁵ in 2030, an increase of 7MTs.

Figure 2: Electricity Sector GHG Emissions (2020)⁶

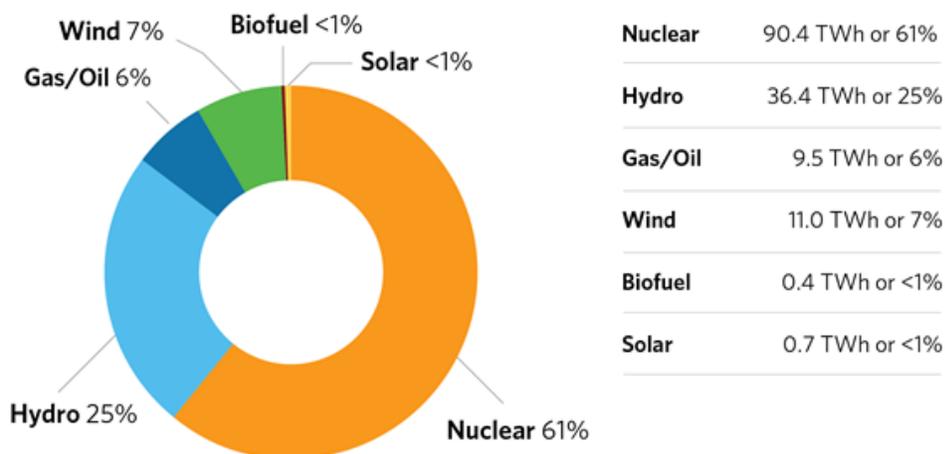


This would undo about a quarter of the greenhouse gas emissions reductions from Ontario's coal phase out. This would also make achieving Ontario's 2030 climate change target nearly impossible. Ontario's Auditor General has identified that the province's plan is between 5 and 12 MTs short of its goal to reduce carbon emissions by 18 MTs by 2030, and this would widen the gap even further (although the Auditor General's report did take into account a smaller increase in electricity emissions).

The projected rise in carbon pollution is the result of increased use of natural gas power plants to meet future electricity demand. Natural gas is responsible for about six percent of electricity generation in Ontario today, and accounts for almost all of the carbon emissions from electricity. The rest of our power comes from a carbon free mix of nuclear, renewables like hydro, wind and solar power, and biofuel.

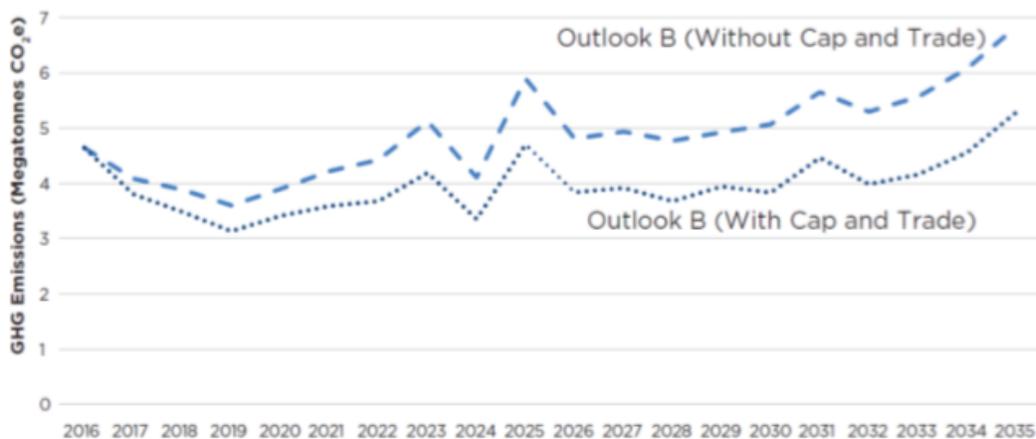
Natural gas use is projected to increase to fill an upcoming reduction in nuclear capacity. The Pickering nuclear plant is scheduled to retire in 2024 (or later, depending on how long past its retirement date Ontario wants to push the aging plant). Other nuclear reactors are scheduled for refurbishment in the 2020s as well, leaving a hole in electricity generation during peak demand times like hot summer days.

Figure 3: Ontario Energy Output by Fuel Type: 2019⁷



System operators have been planning for this drop in nuclear capacity for a long time. But the forecasted rise in emissions was much smaller before the summer of 2018, when Ontario abruptly cancelled its cap-and-trade system, more than 750 renewable energy contracts, and later that year, many electricity conservation and efficiency programs. The graph below covers the same time period as Figure 2 on the previous page. In this forecast, 2030 GHG emissions rise to only 4 MTs instead of 12 MTs with the cap-and-trade program in place. Even without cap and trade, emissions were projected to rise to just 5MTs in previous scenarios.

Figure 4: Electricity Sector GHG Emissions (2015)⁸



A note on nuclear power

Relying heavily on nuclear power is also problematic. While nuclear energy doesn't produce any carbon or air pollution, the massive costs of building, refurbishing, and decommissioning nuclear plants mean that nuclear will be pricier than any other electricity source in Ontario.

Ontario plans to refurbish 10 nuclear reactors at the Darlington and Bruce power plants at estimated costs of \$12.8 billion and \$13 billion respectively.⁹ And there is already evidence of cost overruns. If these refurbishments stay on time and on budget, the price of nuclear power in 2025, after considering these costs, is expected to increase to 16.5 c/kWh.¹⁰ By comparison, Ontario secured an average 20-year price of 8.45 cents per kilowatt hour (kWh) for wind power in a competitive procurement in 2014,¹¹ and wind prices have trended downwards since then.

Nuclear waste poses challenges as well. Nuclear waste created by power plants in Ontario is extremely hazardous, and some of it could remain so for 100,000 years.¹² Currently, low- and intermediate-level wastes are shipped to a storage facility near Kincardine at the Bruce Nuclear site. The plan is to bury the waste deep underground in a “deep geological repository,” but Ontario has yet to find a willing host community. High-level radioactive used fuel – much more toxic – is also accumulating, primarily at the three big Ontario plants. No permanent storage site has yet been found.

Though this backgrounder deals predominantly with the plan to increase the use of natural gas, Ontario should also consider reducing its reliance on nuclear power as part of the electricity planning process.

Ontario’s Opportunity: How to move forward

Nuclear refurbishments and closures have created an opportunity to continue a shift to cleaner electricity. Instead of ramping up natural gas plants, Ontario can shift to a combination of low-cost renewables, energy efficiency, and other clean solutions. In the long-term, these solutions would also reduce reliance on nuclear power.

Now is an optimal time to make this shift. Renewable energy and other clean technologies are at historic low prices, while nuclear costs in Ontario are rising. Some of Ontario’s oldest and most polluting gas plants are about to come off contract. Ontario has a chance to lead a clean energy transition once again.

Here are some of the clean solutions capable of making this shift quickly and affordably.

1. Energy efficiency and conservation

The surest way to cut carbon pollution from electricity is to use less of it. Conservation and efficiency programs help people and businesses do exactly that, often providing loans or incentives to replace older equipment with more efficient versions, upgrade buildings with power-saving lights, or helping consumers shift consumption outside of peak hours. These programs usually meet energy needs with the lowest environmental impact and at very low cost.

Ontario’s investment in conservation and energy efficiency programs helped flatten overall electricity demand between 2007 and 2016, even as population and economic activity (GDP) increased.¹³ The Province has since scaled back these programs¹⁴ despite the fact that they have been instrumental in reducing peak demand, and cost much less than generating and using the same amount of electricity.

A recent study completed for the Ontario Independent Electricity System Operator (IESO) suggested that future electricity demand could be reduced by 25 per cent over the next 20 years through efficiency measures.¹⁵ This would eliminate the need to expand natural gas use for electricity. According to York University Professor Mark Winfield, energy-efficiency improvements could reduce the need to run natural gas-fired generation, and allow for an earlier retirement of the Pickering nuclear plant.¹⁶

Taking a conservation and efficiency route would be cheaper than ramping up natural gas plant activity, as well as being 100% carbon (and all other pollution) free. In 2016, it cost 2.2 cents for Ontario programs to save a kilowatt-hour of electricity. In comparison new natural gas generation costs or nuclear refurbishments range from 8 to 24 cents/kwh.¹⁷

The graph below shows not only the capacity shortfall we’re facing in Ontario, but also the potential impact that simply maintaining Ontario’s current efficiency programs would have in filling the gap. Increasing these programs could have an even greater impact.

Figure 5: Ontario’s Electricity Capacity Shortfall¹⁸



Conservation and efficiency programs also bring more jobs to Ontario than importing more natural gas from out of province. Workers are needed to install energy-efficient lighting, air conditioning, insulation, and other technologies for homes and businesses. A 2018 report from Clean Energy Canada found that implementing extended measures for electricity efficiency would add 200,930 job years in Ontario between 2017 and 2030¹⁹ over the business-as-usual scenario.

2. Renewable energy and storage

Ontario’s electricity planning process should acknowledge the reality of a drastically changed energy economy in which many renewable energy options are cost-competitive or cheaper than fossil fuels. Combining renewable energy sources like wind, solar and hydro power, with storage technologies to use power when it’s most needed, makes them an even more attractive solution.

Renewables like wind and solar power have long been blamed for increases in electricity bills. But in reality, they play a small role. In 2016 wind power made up 6 per cent of the average residential electricity bill, and solar power 5 per cent.

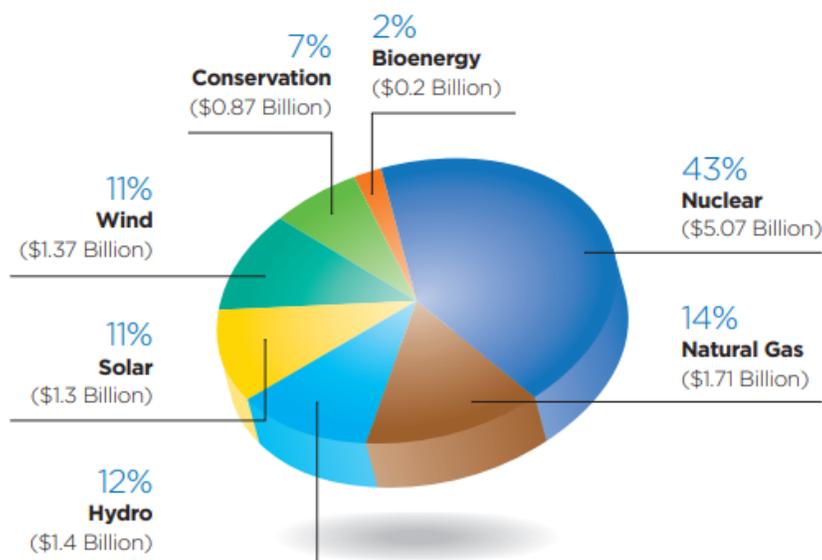
A study commissioned by Environmental Defence in 2016 showed that, when factoring in the impact of natural gas contracts on the Global Adjustment charge, natural gas cost an average 21.50 c/kwh.²⁰ By comparison, renewable wind power was much cheaper, at 12.64 c/kwh.

Figure 6: Cost of Wind Power vs Gas Power, 2016²¹

Power Source	(TWh)	averaged cents/kwh
Wind	11.9	\$12.64
Gas	9.6	\$21.50

Renewables are also often mistakenly blamed for higher Global Adjustment costs (the difference between fixed, contracted prices Ontario pays to electricity producers and the market price). But nuclear power makes up by far the largest component of the Global Adjustment at 43 per cent, and natural gas was the second highest at 14 per cent.²²

Figure 7. Breakdown of Global Adjustment, 2016²³



In addition, renewable energy costs have plummeted since the first green energy contracts were negotiated. For example, the cost of electricity produced by the Nation Rise Wind Farm, which was cancelled by Environment Minister Jeff Yurek in 2019, was only 7 cents/kwh.²⁴ Between 2018 and 2019, Alberta bought solar and wind power for 3.9 and 4.8 cents per kwh respectively.²⁵ Wind power costs are projected to decline further everywhere as the technology continues to improve.²⁶

The cost of energy storage technologies, which store energy from sources like wind, solar, and hydro when they're not needed on the grid, is also coming down fast.²⁷ This opens up opportunities to install renewables together with storage technologies like batteries, ensuring power is available at peak demand times. A 2019 study calculated that as the costs of batteries decline, the cost of supplying electricity with renewables and battery storage would be cheaper than nuclear power in Ontario.²⁸

3. **Importing clean hydro power from Quebec**

A third opportunity for Ontario is to import more hydroelectricity from Quebec. Quebec boasts the world's fourth-largest hydropower system, and is looking to increase electricity exports to bring in revenue. Quebec also has extra capacity in summer when Ontario needs it most.²⁹

Ontario has existing exchange agreements with Quebec, and likely could buy more. In 2017 Quebec offered 8 billion kWh per year for 20 years at 5c/kwh,³⁰ which is cheaper than gas, nuclear, wind, or solar – Ontario rejected the offer.³¹ Hydro One is investing \$24.4 million to increase its ability to import power from Quebec by 1,650 megawatts (MW) during Ontario's annual peak demand. This upgrade will be completed by December 2022, when the first two Pickering nuclear reactors (1,030 MW) are scheduled to shut down.³²

To import larger amounts of electricity from Quebec, Ontario would need to further enhance tie-ins and interconnections with Quebec, which would take longer than boosting efficiency programs and/or increasing renewable energy with storage. The IESO has outlined a few options for timelines, estimating the cost of these options to be "as high as \$1.4 billion, including the cost of the new timeline, as well as required upgrades to the eastern Ontario transmission system."³³ This highest cost estimate would still be much cheaper than the current plan to refurbish 10 nuclear reactors at the Darlington and Bruce power plants, estimated at \$12.8 billion and \$13 billion respectively, as cited earlier.

Conclusion

Ontario has many options available to keep its grid low carbon and keep costs down.

The decision on which electricity pathway to take could mean the difference between Ontario meeting its climate change targets or blowing through them. It could also mean Ontarians getting locked into decades of increasingly expensive high-carbon energy while the rest of the world transitions to cleaner sources.

Planning needs to start soon, and the public needs to know what options are available to us. The choices made in the coming years about electricity generation will have huge impacts for years to come.

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