Making Connections
Straight Talk About Electricity in Ontario

2018 Energy Conservation Progress Report, Volume One

Summary

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Environmental Commissioner of Ontario

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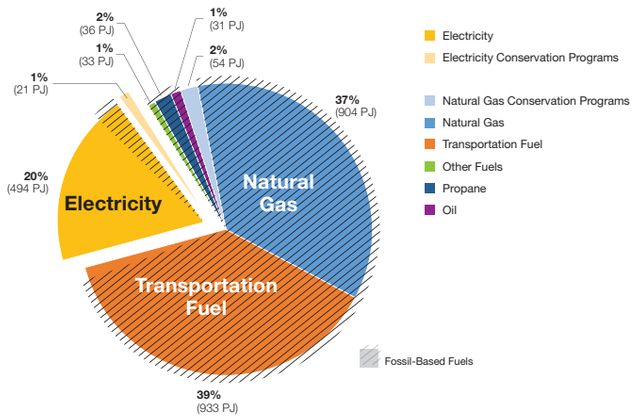
Environmental Commissioner of Ontario

Why is our electricity system so important?

Electricity provided only 20% of Ontario's energy in 2015. But low-carbon electricity is the key to Ontario's energy future.

Electricity is the smallest and greenest of Ontario's energy sources, providing only 20% of Ontario's energy in 2015. Because the other 80% comes almost entirely from fossil fuels (natural gas and petroleum products for heating, transportation and industry), electricity is the key to our energy future.



Ontario's energy use, by fuel type in 2015, including demand reduced by utility-run conservation programs.

Greenhouse gas emissions from burning fossil fuels are the major cause of climate change, the defining challenge of our time. Governments of the world have agreed to dramatically reduce these emissions. Key first steps include increasing conservation, and minimizing fossil fuel use in the electricity system. Second steps are to convert other fossil fuel uses to low-carbon electricity, plus even more conservation.

This report answers 19 questions about electricity in Ontario. Each question and answer is a separate report chapter. The chapters are grouped into five sections:

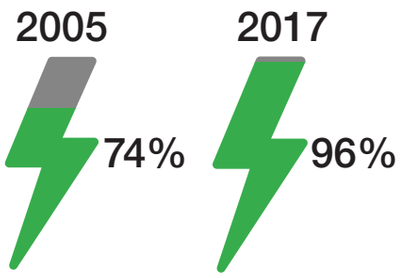
- Ontario's Transition to a Low-Carbon Electricity System
- Impact on the Electricity System
- Impact on Electricity Prices
- Impact on the Environment
- Ontario's Electricity Future

Throughout this report, section icons and question numbers are used to indicate that additional information can be found in other report chapters. For example, **Q10** is a cross-reference to question 10 within the "Impact on the Environment" section.

Ontario is midway through this crucial transformation. In 2005, Ontario had a creaking, highly indebted, high-polluting electricity system that strained to meet demand. Coal-fired electricity looked cheap on the power bill but came at a high cost to the environment, the climate and human health. This could not continue.

Today, Ontario has a more expensive but a more reliable, cleaner electricity system that was 96% carbon-emission free in 2017. This transformation has created dramatic changes and opportunities for those who provide Ontario's electricity, for all of us who depend on that system, for the economy and for our natural environment. And much more change is ahead.

This report, the first volume of the ECO's 2018 Energy Conservation Progress Report, analyzes this transformation. Volume Two (to be released in early summer 2018) will focus on the progress of conservation programs in 2016.



Ontario's electricity system went from 74% low-carbon generation in 2005 to 96% low-carbon generation in 2017

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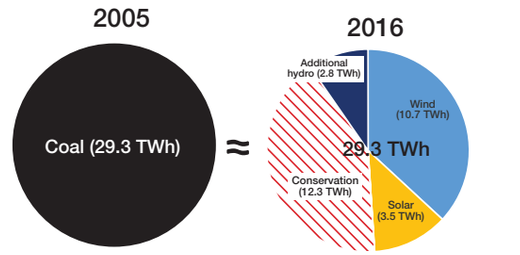
Where does our electricity come from?

Mostly nuclear, plus hydro (water), wind, natural gas and solar. Plus conservation.

Since 2005, Ontario has replaced coal and added capacity with nuclear, solar, wind, hydro (water) and natural gas generation facilities. Conservation has helped reduce demand. In 2016, conservation and new renewable power equalled most of the electricity formerly provided by coal. (Q3, Q4)



Coal provided 29.3 TWh of electricity in Ontario in 2005.

In 2016, conservation, wind, solar and additional hydro provided about the same amount.

Ontario uses different sources of electricity at different times. Demand swings from high to low at different times of day, weekdays versus weekends, and as seasons change. Peak electricity use on the hottest days and coldest evenings can be more than double off-peak electricity use. (Q3) Peak demand has an outsized impact on Ontario electricity costs. (Q9)

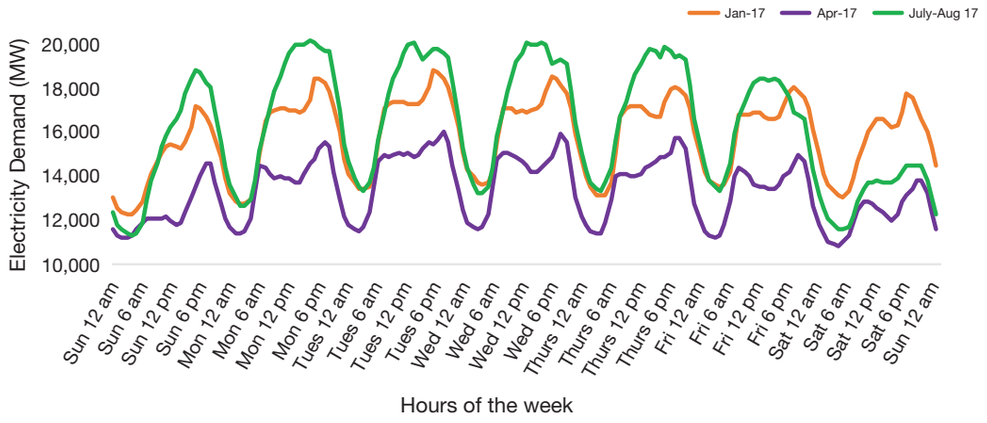
In most hours of the year, Ontario uses little or no gas-fired generation. When demand is low (e.g., nights, weekends, spring and fall), nuclear, water and wind provide the power. Solar helps on sunny days. When demand is high, Ontario uses all its sources of power, including natural gas. (Q3, Q4)

How well does Ontario's electricity system work?

Much better than in 2005.

Ontario's electricity system is in much better shape than it was in 2005. Ontario is self-sufficient, with about the right amount of reliable power available for peak demand, with no brownouts or emergency appeals to reduce electricity use. (Q5)

Hourly electricity demand patterns over a week in January, April and July-August of 2017.



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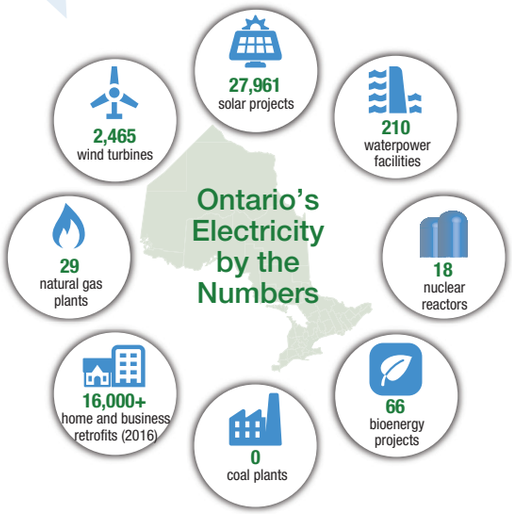
After conservation, which source of power is best?

Every source of electricity has advantages and disadvantages.



Nuclear

Nuclear power provides most of Ontario's electricity, with no air pollution or greenhouse gas emissions and a relatively low cost per kilowatt-hour. To justify refurbishment of the Bruce and Darlington nuclear reactors, Ontario has committed to buy billions of dollars of power from them every year until 2064. (Q14)

Nuclear power has risks that Ontario must balance against Ontario's share of the grave consequences of climate change. Ontario has made a heavy commitment to nuclear while largely abandoning renewables. Nuclear power may not be cheaper than renewables over the long run. (Q14, Q16)

Waterpower (hydro)

Ontario's electricity system was originally built on waterpower, starting with Niagara. Most accessible Ontario waterpower sites were developed long ago, and provide Ontario's cheapest electricity. Some existing sites have added capacity since 2005, and there is underused storage capacity. Ontario has a weak approval process for waterpower with no public hearings, despite the serious ecosystem disruptions that dams often cause. Waterpower's environmental footprint is usually lower if it takes place at sites that have already been altered. (Q4, Q10)

Natural gas

Natural gas-fired electricity can be turned on and off at will, which makes it useful for meeting peak demand and as backup power. Importing the gas drains money out of Ontario. Its price fluctuates on international markets beyond Ontario's control; in 2005, it was much more expensive than it is now. (Q4) Natural gas is a fossil fuel that causes air and greenhouse gas pollution; upstream methane emissions are potent greenhouse gases. (Q11)

Wind and solar

Wind and solar do not cause air pollution or greenhouse gas emissions and are the world's fastest growing sources of electricity. Costs started high, but they are increasingly competitive with fossil fuels and nuclear power. (Q4, Q9)

The Green Energy Act, 2009, fulfilled its key objectives of growing distributed renewable power and a renewable electricity industry, although not as much as planned. Having a Feed-in Tariff was the international best practice, and the rates paid were reduced as costs fell. (Q9)

Wind turbines can have adverse impacts, especially on birds and bats. Appropriate siting helps minimize these impacts. (Q10)

The contributions of solar and wind are systematically underrepresented in some public reports. For example, the 87% of solar power and the 12% of wind power that are embedded (connected to local distribution utilities instead of the bulk grid) are not included in the

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Independent Electricity System Operator's real-time online energy reporting (Power Data). (Q4)

With the end of procurements such as the FIT program, Ontario has largely abandoned its renewable electricity industry, though customers may still generate some of their own power, through net metering. (Q17, Q18)

Aren't solar and wind too variable? Ontario can use them well, as others do.

Ontario's electricity system is successfully integrating wind and solar power. For example, solar power helps meet peak summer demand, the most expensive to serve. (Q6)

As renewable electricity grows, Ontario will need more ways to match supply and demand, including storage and more flexible pricing. Ontario can learn how from other jurisdictions who use much more wind and solar electricity than we do. (Q6, Q16)

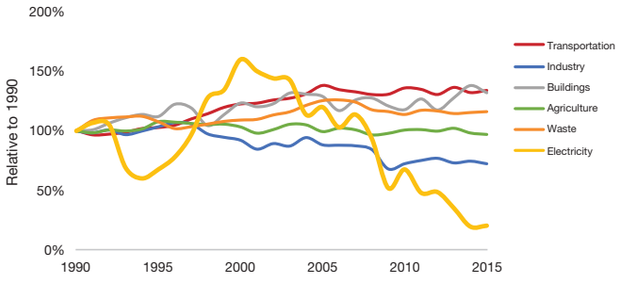
How much good did phasing out coal do?

A lot, actually.

Taking coal out of electricity dramatically reduced Ontario's greenhouse gas emissions, and has improved air quality and public health. (Q11, Q12)

Almost all of Ontario electricity's remaining greenhouse gas emissions and air pollution come from natural gas-fired power plants, which are used mostly to meet peak demand. (Q4, Q11)

Smog over downtown Toronto



Ontario historical GHG emissions by economic sector relative to 1990 levels.

Why does electricity cost what it does?

There are many good reasons. And some bad ones.

There are many good reasons why Ontario electricity prices have gone up and will rise further.

Ontario's cleaner, more reliable electricity system costs about $21 billion each year, up from about $15 billion in 2006. Most of the extra cost is for additional

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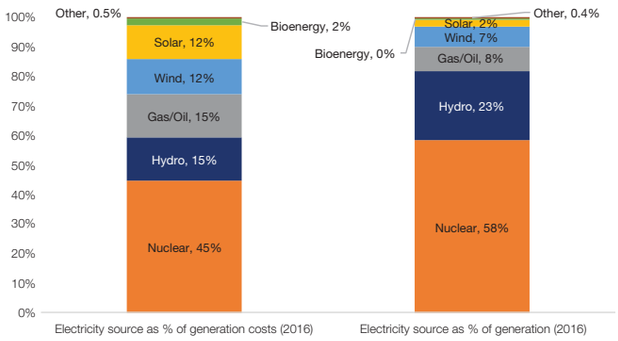
generation capacity. All new sources of power (except conservation) cost more than the old ones, partly because of inflation. Building electricity infrastructure with private capital also costs more than building it with publicly guaranteed debt, as Ontario Hydro used to do. (Q9)

Nuclear, solar and wind power have contributed the most to the rise in rates. Going forward, nuclear costs will rise and solar and wind power costs will fall. (Q9)



Electricity source as a share of generation costs, and share of generation (Ontario, 2016).

Note that additional hydro and wind power was available at no extra cost but was not used as supply. See Q7.

In setting the Feed-in Tariff rates for solar and wind electricity, the government balanced multiple public policy goals, including encouraging small-scale and community power, economic development and environmental protection. Ontario's climate makes wind and solar more expensive here than in many other places. The Green Energy Act added costs and delays, including an elaborate process of environmental approvals, a unique third-party right of appeal to the Environmental Review Tribunal and, initially, domestic content requirements. (Q9, Q10)

There are also some bad reasons for today's electricity prices. The Environmental Commissioner of Ontario, the Financial Accountability Officer and the Auditor General of Ontario have all documented mistakes in Ontario's energy policy and implementation, some of which affect rates. For example, the relocation of gas plants from Oakville and Mississauga will cost about $40 million a year for 20 years after 2017, increasing system costs about a fifth of one percent (0.2%). Past nuclear plant cost overruns added about seven-tenths of a cent ($0.007) per kilowatt-hour until March 31, 2018. On the other hand, the sale of Hydro One has not materially affected electricity rates. (Q9)

Today's electricity customers pay only 80% of the cost of the electricity system through their electricity bills. The other 20% has been shifted to taxpayers and to future ratepayers, who will also pay $21 billion in interest on money the province has borrowed under the Fair Hydro Plan. (Q9) Electricity rates will go up again after 2021, when the borrowed money must start to be repaid. (Q13)

Why conserve?

Why bother conserving? To save money, to reduce emissions at peak, and to make electricity available to replace fossil fuels.

The average Ontario household uses 13% less electricity today than it did in 2005. This has helped to buffer the impact of higher electricity rates. (Q8)

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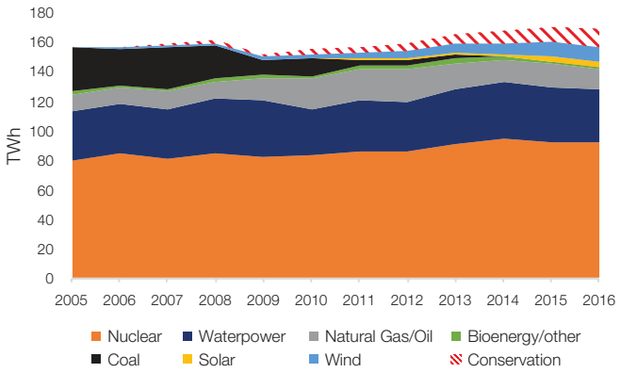
Electricity conservation remains the cheapest way to match supply and demand, but Ontario needs to focus more on conserving electricity when demand is high (e.g., hot summer weekdays and cold winter evenings). (Q19)

Electricity production and conservation by resource, 2005-2016.



Is there a surplus?

Why does Ontario sell cheap power to the U.S.? Because it turns spare capacity into money.

When demand is low, Ontario often has surplus power. This off-peak surplus is a natural consequence of an electricity system based on nuclear and renewables, because supply is not determined by demand. The surplus may largely disappear after 2020. (Q7)

Ontario exports surplus power for more than it costs us to generate that power; Ontario does not lose money by exporting. But there are better options for using this power in Ontario, such as storage, charging electric vehicles and making hydrogen ("power to gas"). Flexible pricing would encourage demand to shift to when there is surplus power. (Q16)

What's ahead?

We need more clean electricity and conservation to replace natural gas, gasoline and diesel. But Ontario is not getting ready.

The limits on greenhouse gas pollution in Ontario's Climate Change Mitigation and Low-carbon Economy Act mean that more than 40% of the fossil fuels now used for heating and transportation must be replaced by conservation, active transportation, biofuels, direct renewable energy and low-carbon electricity over the next 13 years, within the lifetime of today's vehicles and furnaces. This means that low-carbon electricity supply must increase much more than the government plans. (Q15)

The Ontario government is not prepared for this transformation. The 2017 Long-Term Energy Plan mostly ignores the urgency of climate change and the 80% of Ontario's energy that comes from fossil fuels. (Q13)

Ontario's current plans for obtaining future electricity supplies (other than nuclear) may save money in the short run if electricity demand remains flat. But they will discourage the growth of renewable electricity, may not save money if demand grows, and may not produce the low-pollution, low-carbon electricity supply that Ontario will need. (Q15, Q17, Q18)

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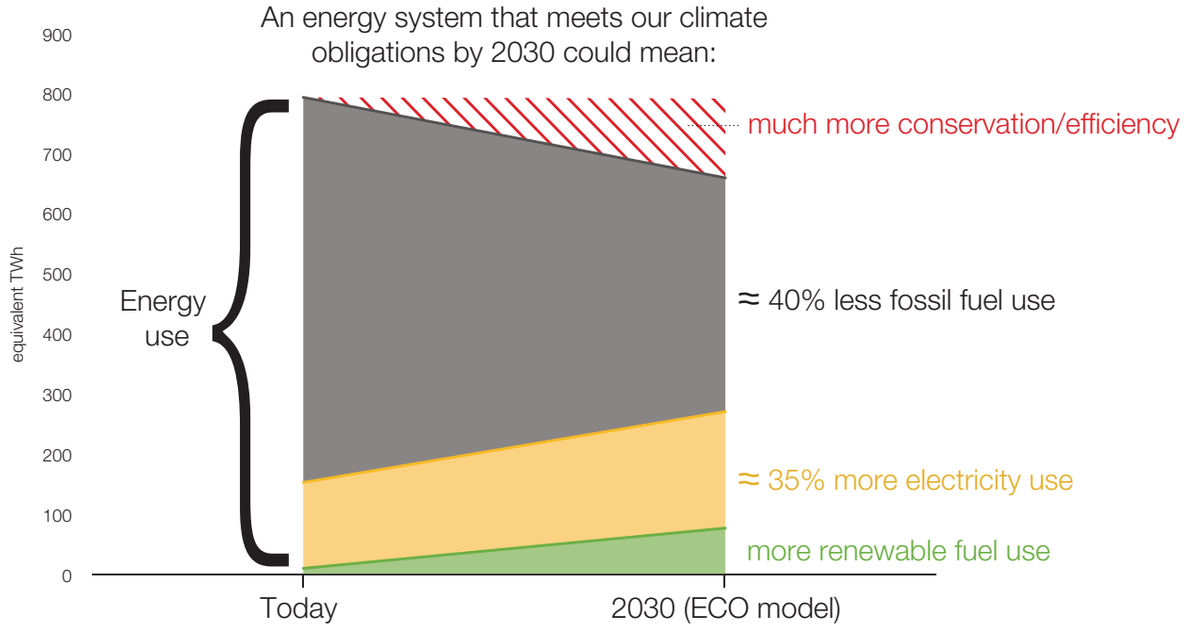

Summary of ECO recommendations

The ECO recommends that:

1. Ontario's Long-Term Energy Plan should be required by law to be consistent with the Climate Change Mitigation and Low-carbon Economy Act. It should plan Ontario's energy system, not just electricity, and should prepare for significant electrification of transportation and heating.

2. Conservation should play a larger role than it does now and should be focussed on times of high demand. It will have more value as demand grows.

3. Ontario should do more to minimize adverse impacts of electricity generation, such as bird and bat kills by wind turbines.

4. To help people who are unduly affected by electricity rates, low-income and Aboriginal financial support programs should be supplemented with enhanced conservation programs to make electrically heated homes more efficient.

5. Ontario should learn from jurisdictions who already use much more renewable electricity, and update electricity infrastructure and energy system regulations to encourage the low-carbon transformation. For example:

   a. Ontario should get better at using flexibility tools, such as storage, demand response, interties and prices, to match supply and demand, instead of turning off (curtailing) low-carbon off-peak electricity and running gas-fired generation at peak.

   b. Net metering and Market Renewal should provide sufficient incentives to grow renewable electricity as needed to keep Ontario's electricity supply low-carbon.

   c. Local distribution utilities should facilitate a growing level of renewable generation and storage.

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