ONTARIO'S ELECTRICITY FUTURE

QUESTION 19

What is the value of conservation?

Conservation saves customers money, can help the grid by reducing peak demand, and can make electricity available for heating and transportation.

Over the past decade, conservation has saved money for all electricity customers, and delivered additional benefits to those who participate in programs, including low-income customers and Aboriginal communities.

It has also reduced costs for the electricity system as a whole. Conservation delivers near-term economic and environmental benefits primarily in the hours when it reduces our use of gas-fired generation. However, almost all conservation projects will save electricity for a decade or more, which will also reduce the future need for new generation. Over the past decade, electricity conservation programs have consistently proven to be less expensive, per unit of electricity, than any form of new generation, at an average cost to ratepayers of 2.1 cents/kWh in 2016.[1]

The province remains committed to its long-term conservation target of 30 TWh (through 2032). In a high-electrification future, conservation's role should be larger.

Ontario's current six-year conservation program framework (which goes to the end of 2020 and is undergoing a Mid-Term Review) has been successful to date. It should be refined to update cost-effectiveness testing, target conservation at times of high demand, better integrate conservation of multiple fuels, assess whether current program delivery agents are appropriate and ensure that climate change goals are integrated with energy conservation. Changes to the existing electricity conservation framework taking effect prior to 2020 should be carefully scoped, to avoid disrupting existing programs.

Contents

The details...

"Why do we invest in conservation during an electricity surplus?" is a common question from Ontario's energy stakeholders and critics. As shown in Q5 and Q7, Ontario has surplus electricity only at times of low demand, and most of this surplus is temporary.

During hours of high demand, Ontario runs more expensive and polluting gas-fired generation, which could be avoided through conservation and demand management. As explained in Q5, Ontario can only just meet its peak summer demand with existing resources, and will need new generation in future years because of planned nuclear refurbishments and closures and projected electrification (see Q15).

Electricity conservation programs, which have been reducing overall electricity consumption and consumption during peak demand hours since 2005, will become increasingly valuable as the "surplus" runs out and as the province moves towards electrification to achieve its climate goals. Conservation measures installed today will deliver savings for many years. This section of the ECO's report discusses the current and future value of conservation, and what changes can make conservation more effective.

Ontario has a long-term electricity conservation target that is roughly 20% of current electricity demand.

Current conservation targets and programs

Ontario's Long-Term Energy Plan (LTEP) has a long-term electricity conservation target (30 TWh reduction in electricity use by 2032, roughly 20% of Ontario's current electricity demand). This target is to be achieved through conservation programs, energy codes and standards, pricing policies and other initiatives.

In this chapter, we focus only on utilities' electricity conservation programs that are partially funded through electricity rates and are delivered by local distribution companies (LDCs) and/or the Independent Electricity System Operator (IESO). These programs have been available across the province since 2005. Note: This chapter does not discuss programs such as GreenON, which are funded with cap and trade proceeds to reduce GHG emissions, nor the risk of overlap and confusion between the two types of programs.[2]

The budget to deliver these utility programs comes from all Ontario electricity customers and includes program administration (26% of total cost in 2015) and incentives to customers who participate in conservation projects (74% of total cost in 2015).[3] For most programs, the incentives to participants do not cover the full cost of the conservation project; roughly one-third of the program cost is paid for by participants, as seen in Figure 19.1. The amount spent on conservation is a small fraction of Ontarians' electricity bills. In 2016, electricity customers paid $307 million on LDC/IESO electricity conservation programs, 1.4% of the total cost of electricity service.[4] Conservation spending was lower in 2016 than in 2015.[5]

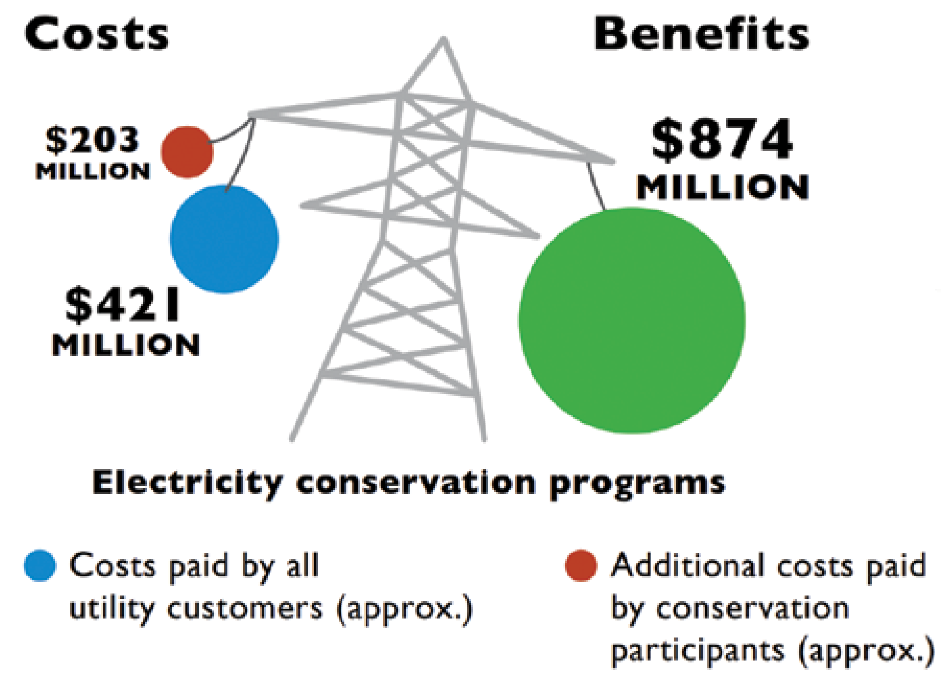

Figure 19.1. The costs and benefits to society of 2014 electricity conservation programs

Note: This figure is based on the actual spending data provided by the IESO for a previous ECO report.

Source: Environmental Commissioner of Ontario, Conservation Let's Get Serious, Annual Energy Conservation Progress Report- 2015/2016 (Toronto: ECO, May 2016) at 126.

Currently, the province is halfway through the 2015-2020 Conservation First Framework (CFF) that targets 7 TWh of incremental electricity savings for distribution-connected customers (a subset of the longer-term 30 TWh target).[6] For more specifics on this conservation framework and the programs offered, see our report Every Joule Counts. In the first two years of the six-year framework (2016 is the latest year for which final verified results are available), electricity conservation programs had saved 2.8 TWh of their 7 TWh target.[7]

Without the ratepayer-funded programs delivered since 2006, Ontario's 2016 electricity use would have been 7 TWh (5% of provincial consumption) higher (there were additional savings from energy codes and standards and other programs (Q3)). Savings from ratepayer-funded utility conservation programs are illustrated in Figure 19.2.

What is the value of conservation? Q19

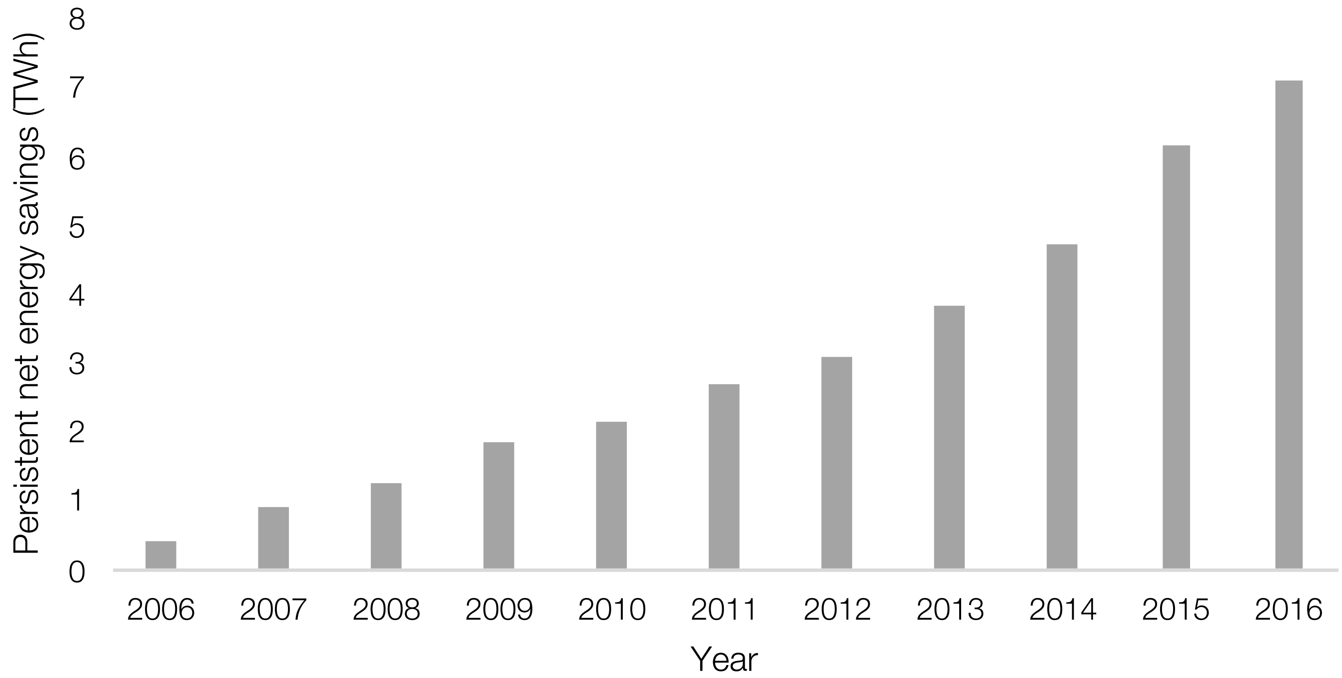

Figure 19.2. Persistent electricity savings from IESO/LDC conservation programs, 2006-2016.

Note: this figure tracks persistent savings from IESO-LDC delivered conservation programs only, and not savings from other policies and initiatives that lead to electricity savings, which we talk about in more detail in Q3 of this report.

Source: Independent Electricity System Operator, information provided in response to ECO inquiry (31 January 2018).

The 2017 LTEP reaffirms the government's commitment to meet the 2032 conservation target. Though the province has not made any specific commitments beyond the 2020 end date of the current conservation framework, the LTEP emphasizes the importance of reducing electricity consumption through conservation programs in the early to mid 2020s. By that time, the province's supply will decrease because of nuclear refurbishments, and demand should increase because of electrification of fossil fuel uses (Q15).[8]

The value of conservation for participating customers

Electricity conservation programs benefit participants. They save money because they become more energy efficient. Current programs offer a mixture of financial incentives and technical assistance, and programs

> Electricity conservation programs benefit participants.

are offered to all sectors. Conservation programs targeting low-income customers and on-reserve First Nations provide proportionally more financial support to participants, while large industrial customers often require higher program budgets to support study and implementation of complex energy efficiency projects that bring about large savings.

Conservation programs are offered to low-income customers and First Nations communities at little or no cost to participants, and deliver other benefits. In addition to reducing electricity bills, conservation programs provide other societal benefits such as better bill arrears management, more comfortable living conditions and improved health and safety for residents. Many homes in vulnerable communities are electrically heated. The benefits from improved thermal comfort, and reduction in heat- and cold-related and financial stress can be significant for conservation measures targeting the building envelope or heating or cooling systems.[9]

In August 2017, the Minister of Energy issued a direction to the IESO to redesign, fund and centrally deliver the Home Assistance Program in order to enhance the program and ensure province-wide access.[10] First Nations conservation programs have a similar societal impact on residents. Hydro One, which has the province's largest share of on-reserve First Nations customers, has enrolled close to 3,500 homes in its First Nations Conservation Program. According to the latest LTEP, existing First Nations and Metis conservation programs will be reviewed with the objective of better aligning programs with community needs and interests.

The value of conservation to the electricity system

The electricity system as a whole benefits from conservation much of the year.

First, **conservation reduces the use of existing generation**. This is especially valuable at times of higher demand, when it avoids dispatching higher cost (and frequently GHG emitting) electricity generation, or allows waterpower to be saved for use at peak. This saves the operational and fuel cost and emissions of the electricity that did not get generated because of conservation. The primary benefit occurs from avoiding the need to run a peaking gas generator plant with its considerable fuel costs and emissions.

- Much more gas-fired generation would have been needed in 2016 and 2017 if not for the 7 TWh accomplishments of conservation efforts in previous years.

> The electricity system as a whole benefits from conservation much of the year.

- There were further opportunities for conservation to directly reduce the use of gas-fired generation in approximately 17% of the hours in 2017.[12]
- In another 25% of the hours, conservation could have replaced peaking hydro generation.[13] This also has value, as much of this peaking hydro could otherwise have been stored and used at times of high demand to reduce the use of gas-fired generation.
- Therefore, in 17-42% of the hours in 2017, additional conservation could have directly reduced fuel and operating costs and GHG emissions.

Because conservation measures put in place today will save electricity for many years, they may also **reduce the need for capital investments in new generation, transmission or distribution assets**, especially if the reductions occur at times of higher demand.

- Even though Ontario does not immediately need new electricity generation today, most conservation programs' savings persist for years. Today's programs will therefore help delay or eliminate the need to build new supply in the coming years. Conservation measures with longer lifespans have a higher value since they contribute longer to defer expensive asset upgrades.

Per unit of electricity produced (or saved), conservation is cheaper than any form of new generation, as presented in Figure 19.3.

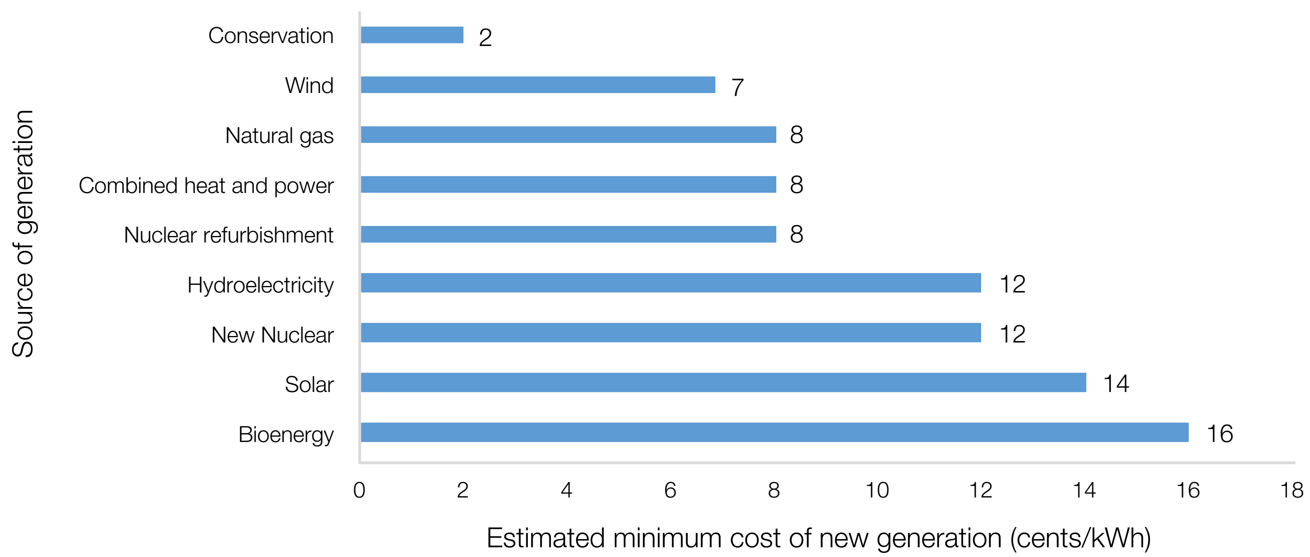

Figure 19.3. Minimum cost estimates of new electricity generation in Ontario, 2016.

Source: Independent Electricity System Operator, information provided in response to ECO inquiry (31 January 2018).

Currently, the value of conservation savings is assessed through two primary cost-effectiveness tests, the Total Resource Cost (TRC) and the Program Administrator Cost (PAC), which compare the costs and benefits of conservation.[14] Most electricity conservation programs have to score greater than 1 in both these tests, to ensure that the programs financially benefit Ontario electricity customers.[15]

Not all conservation is of equal value. Conservation during times of high demand has a much bigger impact. Both operating costs and the ability to defer new generation are maximized when electricity is saved in hours of high demand. Conservation when peaking gas generation is running yields financial, air quality and environmental benefits for the province.[16] There are few, if any, current system benefits from conservation of electricity during off-peak hours, especially when the province is curtailing surplus electricity (Q16).

The current cost-effectiveness screening does not adequately recognize this important difference. While it does provide a credit for avoiding new generation from electricity savings at time of system peak, it estimates avoided operational costs from electricity savings in all hours as being of almost identical value.[17] The "avoided cost" assumptions being used by the IESO to calculate the cost effectiveness of the province's suite of conservation programs are outdated, being published in 2014.[18] Given that carbon pricing was not part of the energy system at that time, a 15% adder was included in the cost-effectiveness test to account for benefits such as greenhouse gas reductions.[19]

> Conservation when peaking gas generation is running yields financial, air quality and environmental benefits for the province.

The IESO recently informed the ECO that the existing avoided cost and their assumptions will be updated as part of the IESO's Mid-Term Review process. The IESO is currently working on updating those assumptions as current demand/supply conditions and carbon pricing are not accurately reflected in the avoided cost calculations (see textbox "Incorporating greenhouse gas emission reductions in conservation cost-benefit calculations").[20]

Incorporating greenhouse gas emission reductions in conservation cost-benefit calculations

Under the 2015-2020 Conservation First Framework (CFF), an additional 15% adder is included as part of the societal benefits of conservation in cost-effectiveness testing to account for non-energy benefits such as greenhouse gas (GHG) emission reductions.[21] This is intended as a surrogate for the environmental, economic and social benefits of conservation, but is not very accurate. This adder is currently being reviewed by the IESO as part of the mid-term review process.[22]

A more accurate way of quantifying and valuing GHG emissions reductions from conservation will be needed as the province moves towards major electrification as part of its climate change goals. Two possible tools are presented below. It appears that the IESO will be using a variation of option 1 as it updates its values for the costs and benefits of conservation.

Option 1. Calculating GHG emissions at the margin with a carbon price adder

As explained earlier, conservation programs should focus on reducing consumption during periods of high demand. This is when Ontario turns to gas peaking plants to meet that demand and thereby increases GHG emissions. Cost-effectiveness calculations will more accurately value conservation programs at times of high demand if the cost-effectiveness calculation includes a carbon price adder.[23] The adder would quantify the economic benefit for emissions reductions based on the type of electricity generation at the margin (which would be turned off in the event of conservation).[24] The Atmospheric Fund (TAF) presented this methodology in 2017 to calculate carbon emissions from marginal electricity emissions factors versus the average electricity emissions factors.[25] Using average factors tend to overstate the emissions reductions in hours of low demand and understate those in hours of low demand since savings from all hours are considered the same. According to their analysis, accurately calculating carbon emissions is critical in identifying which conservation programs are more effective in helping the province to meet its climate change goals.

To convert emissions reductions to an economic value, this approach requires an estimate for the cost of carbon (whether based on an estimated market price under cap and trade or a societal cost) that goes out many years into the future, because a conservation measure will deliver savings for many years after implemented.[26]

Option 2. Starting with a "zero emissions energy alternative"

Another way of ensuring that the benefits of GHG emission reductions are accurately valued is to compare the cost of conservation with a "zero emissions energy alternative," to account for the province's climate change goals, which should rule out greater use of gas-fired generation. This path was taken by British Columbia in 2012. Instead of comparing the cost of conservation to the cost of natural gas-fired generation (which was much lower), the province compared conservation to the zero emissions generation source, which was hydroelectric (and much more expensive than gas-fired generation). This change led to a jump in the value of conservation and to more program availability.[27] For Ontario, zero emissions energy alternatives to consider could be the cost of building and operating a new nuclear plant or more wind and solar farms.

Cost-effectiveness testing influences what programs make it to market and are offered to customers. The result is that the current suite of electricity conservation programs fails to focus conservation during hours of high demand, when it is needed the most.

Figure 19.4 presents the proportion of electricity savings that occur from province-wide electricity conservation programs during three distinct summer and winter periods (peak, mid-peak and off-peak) and two shoulder season (spring and fall) periods (mid-peak and off-peak).[28] These peak periods include not just the few hours annually when the system is at overall peak demand, but a larger number of hours when demand is high (e.g. the summer peak period is 1 p.m. to 7 p.m. on weekdays in June, July, and August).

The current suite of electricity conservation programs fails to focus conservation during hours of high demand, when it is needed the most.

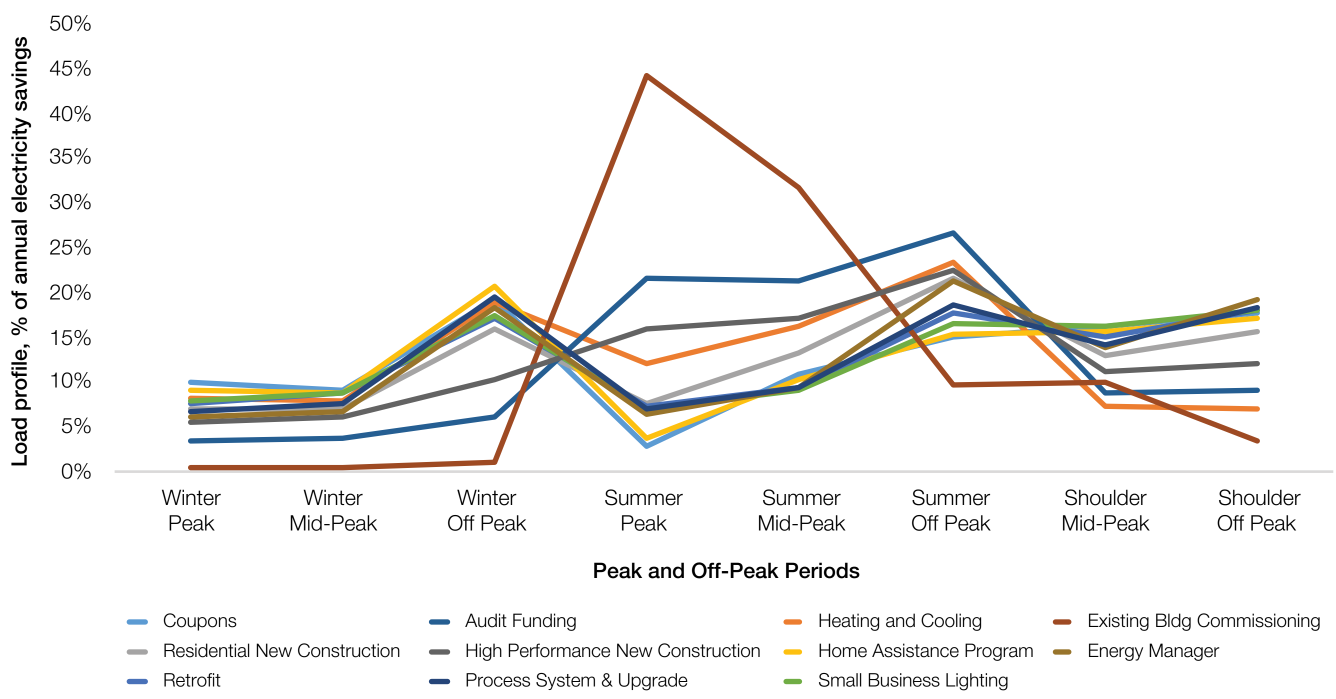

Figure 19.4. 2016 SaveONenergy Programs load profile across peak and off-peak periods.

Source: Independent Electricity System Operator, information provided in response to ECO inquiry (12 January 2018).

Only a few of the current programs, such as the SaveONenergy Existing Building Commissioning Initiative, the Audit Funding Initiative and the High Performance New Construction, have a high proportion of savings during summer peak hours (44, 22 and 16% respectively). Most of the province's programs deliver electricity savings relatively evenly throughout the year. Therefore, conservation programs should be improved to incent electricity savings primarily during hours of high demand.

In the next decade, electricity conservation programs will be essential to temper the increase in demand and to keep costs and emissions low.

Conservation will be more valuable in a high-electrification future

Q15 of this report emphasizes the importance of this province moving towards conservation and electrification of transportation and heating to meet its climate change obligations. In the early 2020s, electrification should increase demand just as the province's surplus generation dwindles because of nuclear refurbishments and shutdowns, and just as natural gas-fired generation grows (**Q17**). In the next decade, electricity conservation programs will be essential to temper the increase in demand and to keep costs and emissions low. Conservation's importance will only grow later in the decade. Most conservation measures installed now will still be saving electricity in 2030, by which time Ontario must have dramatically reduced its reliance on fossil fuels.

The need for a continuous culture of conservation

Another reason for continuing conservation programs now, even though Ontario has surplus electricity in some hours, is that consistency is key to ensure that Ontarians have sufficient conservation when we need it.[29]

The province has made fostering a culture of conservation, for both electricity and gas, a priority. The infrastructure and expertise to deliver conservation has been built up over a decade. Technologies (e.g., software tools to track and report electricity savings) and human resources (conservation staff including specialized roles like energy managers and trained channel partners) take years to build and cannot be easily cancelled or turned on and off without consequence. This also includes customer education to ensure customers are aware of conservation programs.

As a result, electricity conservation results have increased greatly since 2011, as presented in Figure 19.5. Part of this is likely due to program staff improving competence and effectiveness and developing relationships with customers and channel partners over time, with savings coming to fruition in recent years. As a related point, the unit cost of delivering conservation was lower in 2016 than in previous years.

What is the value of conservation? Q19

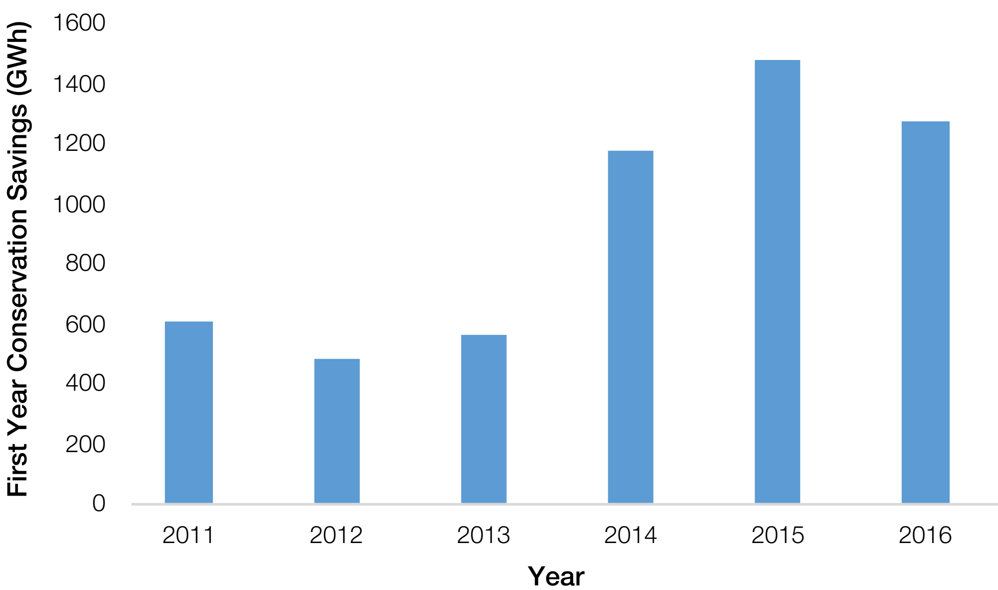

Figure 19.5. First year energy savings from electricity conservation programs 2011-2016.

Source: Independent Electricity System Operator, information provided in response to ECO inquiry (12 January 2018); Independent Electricity System Operator, 2015 Conservation Results Report (Toronto: IESO, 2016) at 8; "Annual Conservation Results for 2016", online: Independent Electricity System Operator <www.ieso.ca/power-data/conservation-overview/conservation-reports>. [Accessed 12 March 2018]

Over time, utilities have also grown better at delivering innovative programs. As of early 2017, LDCs had run or were running 12 local/regional conservation programs and close to 20 conservation pilots.[30] The IESO's Conservation Fund has funded over 200 innovative energy projects since 2005, with five projects running in 2015 and another 10 approved in 2016.[31]

Is more electricity conservation possible?

As noted, Ontario already has a target to reduce electricity conservation by 30 TWh by 2032 (20% of Ontario's electricity consumption in 2016). If we want more conservation, can we get it?

Achievable potential studies (APS) are one way to assess how much electricity use conservation programs can reduce. These studies consider elements such as:

- what conservation programs are currently available
- current budget of the framework
- how customers are reacting to these programs (participation rates)
- financial incentives to encourage participation
- determination of energy efficiency measures and associated measure consumption data
- costs and savings for residential, commercial and industrial sectors
- similar activities happening in other jurisdictions.

This produces a range of results of how much or how much more conservation can be achieved.

Unsurprisingly, the "potential" for conservation that these studies predict depend heavily on the constraints applied to them in advance. A study which places a budget limit or requires programs to be "cost-effective" in certain ways will predict a much smaller conservation potential than a study of all conservation programs that are technically feasible.[32]

In 2016, the IESO released two separate studies on the short-term potential (until 2020) and the long-term potential (until 2035) of conservation. The longer-term study found that conservation programs could save from 17 TWh (roughly 12% of 2016 Ontario electricity use) to 79 TWh (55% of 2016 electricity use), depending on the assumptions used.[33] The lowest number assumes the current budget and rates of program participation, the highest estimate represents capturing 100% of the technical potential with no economic constraints. A realistic number is almost certainly somewhere in-between. For example, if 100% of Ontario's customers participated in "cost effective" conservation, the province has the potential to save 45 TWh.[34] While removing constraints increases the estimated amount of electricity that can be reduced in the province using electricity conservation programs, the estimated costs to design and deliver these programs also increase.[35]

In a high-electrification future, the achievable potential for electricity conservation will be higher than it is today. More conservation actions will be cost-effective, and there will also be new opportunities – for example, building conversions from natural gas to electric heating should be accompanied by energy conservation improvements to the building envelope such as insulation, as well as high-efficiency forms of electric heating such as air source or geothermal heat pumps.[36] With low-carbon electrification, electricity conservation will be important to limit new electricity loads, but how much potential there is needs more analysis.[37]

The IESO will now be working with the Ontario Energy Board on the 2019 APS that integrates electricity and natural gas conservation potentials. This APS will identify and quantify (for both fuel sources) energy savings, GHG emission reductions and associated costs for 2019-2038, bringing the potential studies more in line with the province's climate change goals. The study is expected to be completed by June 2019.

What is the value of conservation? Q19

The mid-term review of conservation programs

The IESO is close to completing a Mid-Term Review of the current 2015-2020 conservation framework. It must present the Mid-Term Review by June 1, 2018 to the Minister of Energy with recommendations on improving the rest of the framework and any post-2020 framework.[38]

The review is primarily focused on near-term operational elements of the framework that will apply through 2020.[39] Some of the key discussions and findings during the consultation stage include:[40]

- LDCs as a whole are on track to achieve the 7 TWh target
- This framework has lower costs and greater cost-effectiveness than the previous 2011-2014 framework
- Some LDCs/regions are performing better than others. There is a need to shift allocated targets and budgets to ensure customers continue to have access to all programs across the province
- Barriers to improving the programs and/or the framework include the rigidities around existing LDC/IESO relationship and each party's responsibilities
- Larger customers are looking for greater flexibility in programs to meet their individual requirements, and
- New policies such as the Fair Hydro Plan and the Climate Change Action Plan will have an impact on the conservation framework.[41]

ECO comment

Conservation remains valuable to Ontario electricity customers and will also become more important as Ontario electrifies to meet its climate obligations. However, it is wasteful and inefficient to incent conservation at all hours as if they were of equal value.

RECOMMENDATION: Ontario's utility conservation programs should be focussed on reducing electricity consumption during hours of high demand, when it can directly or indirectly reduce the use of gas-fired generation.

The ECO also puts forward the following parameters to consider as the province and the IESO review the existing framework and begin work on the post-2020 framework:

- The current conservation framework has largely been successful, and the province's LDCs are well positioned to achieve the current conservation target of 7 TWh by the end of 2020.[42] Changes prior to 2020 should be carefully scoped so that they do not overly disrupt the current framework and delivery of existing programs, including conservation projects already in the pipeline.
- Designing a new post-2020 framework should begin now to ensure there is no gap between frameworks, and that conservation programs remain available to customers.
- Cost-effectiveness testing needs to be updated to accurately value greenhouse gas emissions reductions, and to reflect the value of conservation in a future where electricity demand must rise.
- Co-ordination of conservation between gas and electric utilities has always been a challenge, and the launch of the Green Ontario Fund (GreenON) to deliver cap-and-trade funded programs (that must reduce greenhouse gas emissions) brings another actor into the mix. There are risks of duplication of resources, customer confusion, and unclear attribution of results. Ontario should clarify who is the appropriate delivery agent for conservation, ideally with the goal of integrating gas, electricity, and climate into one regulatory framework focussed on improving the customer experience.
- There may also be a role for the private sector to have a larger role in conservation, which could potentially include participation in the Market Renewal Initiative (Q17) and lower the cost of acquiring conservation savings.

What is the value of conservation? Q19

Endnotes

1. Independent Electricity System Operator, 2016 Conservation Results Report (Toronto: IESO, January 2018) at 11.

2. For more information on the progress of cap and trade programs in Ontario, see: Environmental Commissioner of Ontario, Ontario's Climate Act, From Plan to Progress, Annual Greenhouse Gas Progress Report 2017 (Toronto: ECO, January 2018.

3. For a full breakdown of electricity conservation spending by type in 2015, see: Environmental Commissioner of Ontario, Every Joule Counts, Ontario's Energy Use and Conservation Year in Review, Annual Energy Conservation Progress Report (Toronto: ECO, August 2017) at 96.

4. Independent Electricity System Operator, information provided in response to ECO inquiry (12 January 2018).

5. Environmental Commissioner of Ontario, Every Joule Counts, Ontario's Energy Use and Conservation Year in Review, Annual Energy Conservation Progress Report (Toronto: ECO, August 2017) at 95.

6. There is also a separate target of 1.7 TWh through 2020, and an associated budget, for a conservation program (Industrial Accelerator) delivered by the IESO for larger customers connected to the transmission grid ("Industrial Accelerator Program", online: Independent Electricity System Operator <www.ieso.ca/sector-participants/energy-efficiency-for-large-consumers/industrial-accelerator-program>. [Accessed 12 March 2018]).

7. "Annual Conservation Results for 2016", online: Independent Electricity System Operator <www.ieso.ca/power-data/conservation-overview/conservation-reports>. [Accessed 12 March 2018]. February 2018 SAC meeting: As of January 15, 2018, preliminary results show that the province has achieved 3.85 TWh of its 7 TWh target.

8. Ontario Ministry of Energy, Ontario's Long-Term Energy Plan 2017, Delivering Fairness and Choice (Toronto: Queen's Printer, October 2017) at 37.

9. DNV-GL, "IESO Non-Energy Impacts 2016 Results and Next Steps" (presentation at IESO Mid-Term Review Working Group meeting, October 2017), slide 29 <www.ieso.ca/-/media/files/ieso/document-library/engage/cf/cf-20171019-nei-results.pdf?la=en>. [Accessed 12 March 2018]

10. "Home Assistance Program and Green Ontario Fund Direction from Minister", online: Independent Electricity System Operator <www.ieso.ca/en/sector-participants/conservation-delivery-and-tools/conservation-e-blasts/2017/08/home-assistance-program-and-green-ontario-fund-direction-from-minister>. [Accessed 12 March 2018]

11. "First Nations Conservation Program", online: Hydro One <www.hydroone.com/saving-money-and-energy/residential/first-nations-conservation-program>. [Accessed 12 March 2018]; Hydro One's FCP took over from the OPA's Aboriginal Conservation Program after 2015. 3000 of Hydro One's 3,400 participants were from the previous program (Ministry of Energy, information provided in response to ECO inquiry (13 March 2018)).

12. 2017 data is until November 30 of that year (Independent Electricity System Operator, information provided in response to ECO inquiry (31 January 2018)).

13. Independent Electricity System Operator, information provided in response to ECO inquiry (31 January 2018).

14. The costs of conservation are the administration costs, the cost of customer incentives and/or the incremental cost of more efficient technology, depending on the specific test. The province's provincial, regional and local programs have to pass the Total Resource Cost (TRC) test and the Program Administrator Cost (PAC) test before being delivered (except for programs geared towards low-income customers and First Nations communities). The Total Resource Cost is defined by the IESO as costs incurred to design and deliver programs and customers' costs with the avoided electricity and other supply-side resource costs (generation, transmission, natural gas etc.). The Program Administrator Cost test, on the other hand, compares the costs incurred to design and deliver programs by the program administrator with avoided electricity supply-side resource costs from the perspective of the program administrator (Independent Electricity System Operator, Conservation and Demand Management Energy Efficiency Cost Effectiveness Guide (Toronto: IESO, March 2015) at 10 and 12)).

15. Low Income and Aboriginal conservation programs do not have to be cost-effective. CDM pilots are also not required to be cost-effective.

16. Environmental Commissioner of Ontario, Conservation: Lets Get Serious, Annual Energy Conservation Progress Report 2015/2016 (Toronto: ECO, May 2016) at 116.

17. The IESO's most recent avoided cost values are several years old, and have very similar values of avoided energy costs across the eight time-of-use periods (Independent Electricity System Operator, Evaluation, Measurement and Verification Protocols and Requirements (Toronto: IESO, 2014) at 58). These avoided costs are the output of an IESO planning analysis which compares the hourly costs of a system mix with and without conservation. However, they do not appear to reflect the fact that the marginal cost of electricity in many off-peak hours is currently near zero. One possibility is that the eight chosen time-of-use periods do not align well with the split between hours when gas is on the margin vs baseload resources such as nuclear or renewables.

18. Independent Electricity System Operator, "Ontario Planning Outlook Module 3: Conservation Outlook (presentation, August 2016), slide 16.

19. For more information see: Environmental Commissioner of Ontario, Every Joule Counts, Ontario's Energy Use and Conservation Year in Review, Annual Energy Conservation Progress Report 2016/2017 (Volume Two) (Toronto: ECO, August 2017) at 97.

20. Independent Electricity System Operator, information provided in response to ECO inquiry (31 January 2018).

21. Directive from the Ontario Minister of Energy to the Ontario Power Authority, re: Amending March 31, 2014 Direction Regarding 2015-2020 Conservation First Framework (23 October 2014).

22. As part of that review, the IESO retained a consultant who undertook a cross-jurisdictional review of various societal non-energy benefit adders used. The consultant's scan concluded that the 15% adder may be too conservative as the GHG value alone may be around 15%. (DNV-GL, "IESO Non-Energy Impacts 2016 Results and Next Steps" (presentation at IESO Mid-Term Review Working Group meeting, October 2017), slide 18 <www.ieso.ca/-/media/files/ieso/document-library/engage/cf/cf-20171019-nei-results.pdf?la=en> [Accessed 13 March 2018]). The proposed carbon price of $43 is based off of a Ministry of Environment and Climate Change estimate of the social cost of carbon, which the IESO is currently taking into consideration as cost-effectiveness numbers are being reviewed under the mid-term review (Independent Electricity System Operator, information provided in response to ECO inquiry (1 December 2017); Independent Electricity System Operator, information provided in response to ECO inquiry (12 January 2018)).

23. Only natural gas-fired generation and imports have an additional cost of carbon, since the cap and trade regime has been put in place.

24. A methodological challenge is determining what carbon price should be used, given that savings will persist for many years.

25. The Atmospheric Fund, A Clearer View of Ontario's Emissions: Practical Guidelines for Electricity Emissions Factors (Toronto: TAF, July 2017) at 11.

26. For more information on how to calculate the social cost of carbon, see: Environmental Commissioner of Ontario, Ontario's Climate Act, From Plan to Progress, Annual Greenhouse Gas Progress Report 2017 (Toronto: ECO, January 2018) at 228 and 251.

27. Katherine Muncaster et al., Adventures in Tweaking the TRC: Experiences from British Columbia (BC: ACEEE, 2012) at 4-5; BC Ministry of Energy and Mines, Electricity and Alternative Energy Division, Guide to the Demand-side Measures Regulation (BC: Ministry of Energy and Mines, July 2014) at 7.

28. IESO's EM&V Protocols calculate peak hours differently from the OEB's TOU on-peak bucket. The defined summer and winter peak blocks for 2015-2020 are as follows:

	Time	Months
SUMMER (Weekdays)	1pm - 7pm*	June
		July
		August
WINTER (Weekdays)	6pm - 8pm	January
		February
		March

(Independent Electricity System Operator, Evaluation, Measurement and Verification Protocols and Requirements (Toronto: IESO, 2014) at 84).

29. Environmental Commissioner of Ontario, Conservation: Let's Get Serious, Annual Energy Conservation Progress Report- 2015/2016 (Toronto: ECO, May 2016) at 117.

30. For a full list of local/regional programs and pilots, see: Environmental Commissioner of Ontario, Every Joule Counts, Ontario's Energy Use and Conservation Year in Review, Annual Energy Conservation Progress Report 2016/2017 (Volume Two) (Toronto, ECO, August 2017) at 102-103.

31. Ibid at 104-105.

32. To learn more about current cost-effective calculations, see: Ibid at 97.

33. Net Savings and Acquisition Costs of Conservation Potential Scenarios

Conservation Potential Scenarios	2015-2035 Program Net Savings (TWh)	Acquisition Cost ($/MWh)
Achievable Potential- within existing parameters, including constrained budget	17.81	308
Achievable Potential- within existing parameters but no budget constraints	17.91	309
Market Achievable Potential- 100% of incremental program costs are covered	29.05	515
Economic- 100% customer participation for all cost-effective measures	45.57	599
Technical- all technically feasible conservation measures	78.58	18347

The APS does not include potential from behind the meter generation, which was completed in a separate study.

34. Source: Independent Electricity System Operator, Achievable Potential Study: Long Term Analysis by Nexant (Toronto: Nexant, November 2016) at 61 and 81.

35. Ibid.

36. Ibid.

37. Independent Electricity System Operator, "Ontario Planning Outlook Module 3: Conservation Outlook" (presentation, August 2016) slide 21.

38. Ibid slide 22.

39. The ECO participated in the input of this process as an observer in the IESO working group.

40. Some key topics include:
   - the energy savings target as a whole and individually (which includes the results of the 2016 Achievable Potential Study discussed earlier in this chapter). It is important to note that the existing Energy Conservation Agreement (ECA) states that the target cannot be increased from the current target of 7 TWh
   - overall and individual LDC budgets
   - exchange of budgets and targets as needed. The IESO has already been directed to move funding and target from the Industrial Accelerator Program to the LDCs' provincial target
   - individual program performances
   - lessons learnt on cost recovery and performance incentive mechanisms, including the calculation of the mid-term incentives for eligible LDCs, and
   - alignment with the Climate Change Action Plan.

41. Independent Electricity System Operator, "Discussion Draft: Conservation Framework Mid-Term Review" (presentation, 3 January 2018), online: <www.ieso.ca/-/media/files/ieso/document-library/engage/cf/cf-20180109-presentation-revised.pdf?la=en&hash=91295B03E1014981FBB0CB544E0ED2DEB73F9ED3>. [Accessed 14 March 2018]

42. "Ontario's Fair Hydro Plan", online: Government of Ontario <www.ontario.ca/page/ontarios-fair-hydro-plan>. [Accessed 14 March 2018]; "Climate Change Action Plan", online: Government of Ontario <www.ontario.ca/page/climate-change-action-plan>. [Accessed 14 March 2018]

43. Independent Electricity System Operator, 2016 Conservation Results Report (Toronto: IESO, January 2018) at 1.