Q. Further to PUB-Nalcor-119, please provide any reports, analyses, presentations, and related information Newfoundland Hydro has in its possession concerning possible time-of-use rate alternatives, including any information on possible rate differentials that might be considered

A. Hydro has not conducted any studies on time of use rate alternatives. This response provides studies in Hydro's possession from other utilities:

- PUB-Nalcor-120, Attachment 1 provides a summary report on a residential time of use pilot prepared by BC Hydro;
- PUB-Nalcor-120, Attachment 2 provides the Annual Energy Conservation Progress Report – 2015/2016 for Ontario;
- PUB-Nalcor-120, Attachment 3 provides the Newfoundland Power Time of Day Study summary of results prepared in 2017; and
- PUB-Nalcor-120, Attachment 4 provides a report on dynamic pricing prepared by Hydro Quebec.

# Experimental Evidence: A Residential Time of Use Pilot

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# Experimental Evidence: A Residential Time of Use Pilot

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## ABSTRACT

As a part of BC Hydro's Advanced Metering Initiative (AMI), a time of use rate pilot project involving some 2,000 residential customers was developed for the winter of 2006/07. The time of use rate project provides BC Hydro with opportunities to: (1) gain an understanding of customer needs for information about and acceptance of available and affordable ways to save energy and shift their load to off peak periods; (2) learn about customers' pricing preferences and their responses to pricing signals and (3) assess whether and to what extent pricing can be used as a tool to delay future supply needs and infrastructure investments. For residential customers, the time of use project offers: more rate options; more control over electricity costs; and potential savings on electricity bills.

The purpose of this impact evaluation is to provide decision and policy makers an estimate of the impacts of the residential time of use rate project. Customers participating in the project had an advanced meter installed at their house, and they also received information on how they could save energy during the peak period and shift load from the peak period to the off peak period. The goal of the project is to determine whether customers respond to pricing signals and information on energy use as well as determine the magnitude of the responses.

This study used a variety of methods including random assignment of customers to different time of use rate groups, different communication groups and control groups, interviews with project staff, documents review, focus groups, pre and post customer surveys addressing energy and conservation behaviors, and econometric analysis in order to assess and understand customers' pricing preferences and their responses to pricing signals.

Analysis of customer self-reported behaviours for typical winter seasons before the pilot and for the TOU pilot period and a control group uncovered strong evidence that treatment group households were successful in shifting their evening on-peak use of many electrical end-uses to off-peak times. Customer response to pricing signals in the form of TOU rates was significant with treatment groups exhibiting both a "demand response effect" and "conservation effect". Average treatment group participant's consumption was 29 kWh or 9.6% lower than the control group for the evening peak period, and 112 kWh or 8.6% lower for total consumption.

## Introduction

With many jurisdictions encouraging electricity market deregulation, increasing attention has been paid to the use of time varying retail electricity prices. With these time-of-use (TOU) rates, electricity prices are higher during peak periods, when marginal costs of generation and distribution are higher, and therefore lower during off-peak periods, when the marginal costs of generation and distribution are lower. When presented with TOU rates, customers need to determine whether or not to adjust their consumption of electricity, given the costs and benefits of alternative courses of action. A recent report by the Federal Energy Regulatory Commission (2006) points out that customers' abilities to respond to time-based rates depends on three factors: the time-based rates are appropriately communicated to customers; customers have the

ability to respond to rates through load control systems or self-generation; and customers have time-based metering so that the utility can determine how much energy (and possibly capacity) was used when.

As a part of BC Hydro's Advanced Metering Initiative (AMI), a time of use rate pilot involving 2,000 residential customers was developed for the winter of 2006/07 (November 1, 2006 – February 28, 2007). Customers participating in the pilot had an advanced meter installed at their house, which reported interval data on their demand and consumption on an hourly basis. They also received information on how they could save energy during the peak period and shift load from the peak period to the off peak period.

The goal of the pilot is to determine whether customers respond to pricing signals and information on energy use and to determine the magnitude of the responses. More specifically, the TOU rate pilot provides BC Hydro with the opportunities to: (1) gain an understanding of customer needs for information about and acceptance of available and affordable ways to save energy and shift their load to off peak periods; (2) learn about customers' pricing preferences and their responses to pricing signals; and (3) assess whether and to what extent pricing can be used as a tool to delay future supply needs and infrastructure investments. For residential customers, the residential TOU pilot offers: more rate options; more control over electricity costs; and potential savings on electricity bills.

## Rate Design

The design principles used in developing the TOU pilot rates are as follows: encourage economic efficiency; minimize impacts on other rate payers by using a rate design that is customer revenue neutral and that collects the revenue requirement; use TOU daily peak periods that are short in duration, simple for customers to use, and easy to administer; and, select a rate design that is fair and avoids windfall gains or losses to customers.

The rate attributes and structure are as follows: first, the rate is a **voluntary** rate with customers choosing whether or not to participate in the experiment; and second, the TOU rate has a **two-part rate structure**, which includes a basic charge, energy charges based on TOU prices, a balancing amount and a bill guarantee. In order to test a reasonable range of rate alternatives, there are five experimental rates (T1 – T5) and one control rate (C). The rates vary by number of peaks, by peak rate and by off peak rate as shown in Table 1 below.

**Table 1: BC Hydro Winter Weekday TOU Pilot Rate Design**

| Experimental Group | Morning Peak | Evening Peak | Off Peak Rate (¢ / kWh) | Peak Rate (¢ / kWh) |
|---|---|---|---|---|
| T1 | - | 4-9 pm | 6.33 | 19.0 |
| T2 | - | 4-9 pm | 6.33 | 25.0 |
| T3 | - | 4-9 pm | 4.5 | 28.0 |
| T4 | 7-11am | 4-9 pm | 4.5 | 15.0 |
| T5 | 7-11am | 4-9 pm | 4.5 | 20.0 |
| C | - | - | 6.33 | 6.33 |

Notes, ¢ means Canadian cents.

A number of utilities have undertaken TOU rate pilots for residential, commercial and industrial customers, while some utilities have put in place mandatory TOU rates, particularly for

larger customers. A substantial literature has examined the impacts of these TOU rates, and some of the major studies are listed in the bibliography. Key findings of these studies include the following: (1) customers respond to TOU rates by shifting peak, reducing consumption or some combination of the two; (2) since the peak shifting or consumption change to a price differential is relatively small, relatively large peak to off peak price ratios are required to have significant impacts; (3) permanent TOU rates have larger impacts than experimental (or temporary) rates; (4) demand charges can have effects comparable in size to TOU rates; and (5) enabling strategies such as promotion of load shifting technologies can substantially increase the impact of TOU rates.

We have reviewed a number of other studies focusing on residential TOU rates for utilities with at least one million customers, including a comparison with the BC Hydro TOU rates. This information was used to build a database of some 29 residential customer TOU rates offered by 24 utilities (Tiedemann 2007). Some key observations from this review include the following (all numbers are in U.S. cents). (1) Median peak rate is 16.07 cents per kWh, which is just below BC Hydro's lowest peak rate of 16.15 cents per kWh. (2) Median off peak rate is 3.66 cents per kWh, which again is just below BC Hydro's lowest off peak rate of 3.82 cents per kWh. (3) Median peak to off peak ratio is 3.6, which is between BC Hydro's two lower peak to off peak ratios of 3.0 and 4.0. (4) Median monthly charge is $6.12, compared to BC Hydro which has a monthly charge of $3.14 for all residential rates. This comparison suggests that BC Hydro's set of TOU rates is reflective of standard utility practice in rate design.

## Approach

The study used a variety of methods including random assignment of participating customers to different TOU rate groups, different communication groups and control groups, interviews with project staff, documents review, focus groups (Rink 2006, Rink & Mould, 2007), pre and post customer surveys addressing energy and conservation behaviors (Pedersen 2007), and econometric analyses in order to assess and understand customers' pricing preferences and their responses to pricing signals (Tiedemann 2007).

Participants were randomly assigned to one of the treatment groups or the control group in three different municipalities in three different regions (Lower Mainland, Vancouver Island and the North). This means that there should be no significant market effects, such as free ridership or self selection, affecting the internal validity of the experiment. There are three basic designs, a one peak period design for the Lower Mainland, a two peak period design for Vancouver Island, and a one peak period design for the North. Only the evening peak is addressed in this report. By using treatment and control groups in regions that are reasonably homogenous with respect to heating requirements, as measured by heating degree days, there is no need to weather normalize the data.

Only single family dwellings were considered for participation because of the confounding impact of common walls in multifamily dwellings. All participating customers had an advanced meter installed, whether they were participants or control group members. The operational experience with the AMI meters and advanced technology systems gained through the first year of the pilot was reviewed through interviews with program staff and stakeholders and focus groups with participating customers.

Insight into customer information needs and their awareness and acceptance of the AMI meters, Blue Line Display Monitors (which provide in-home information on energy consumption

and the cost of energy consumed) and the TOU rate was also gained through pre and post participant surveys. The majority of the behavioural questions in the survey are based on four-point scales (always, usually, occasionally, never). For any behaviour, statistical testing focuses on the post pilot survey question top-two box score (proportion always + usually). Random assignment to experimental and control groups with fairly large sample sizes (as a proportion of their populations) supports the assumption that pre-pilot scores for all groups were equal (Cook & Campbell, 1979; Campbell & Stanley, 1963). Thus Z-tests for the difference in the post pilot treatment and control group proportions, based on pooled variance estimates are appropriate.

Metered data were used to calculate average peak period consumption, average off peak consumption, average total consumption and the ratio of consumption during the peak period to consumption during the off peak period. These statistics were calculated separately for each customer in the control group and for each of the treatment groups in each of the three regions, and were used to calculate differences between treatment group and control group consumption. Summary statistics were calculated across regions by weighting regional results by the ratio of the regional sample to the total sample. Although there was no pre-program metering, this is viewed as a strong research design because of random assignment to the control or treatment groups. The post-only design with a control group is largely immune to the internal threats to validity that are typically an issue when a non-equivalent comparison group must be used instead of a true control group (Campbell & Stanley, 1963).

The basic method of the impact analysis is a post-only comparison of peak, off peak and total consumption with a control group and two treatment groups for the North, a control group and two treatment groups for Vancouver Island, and a control group and nine treatment groups for the Lower Mainland, including three rate classes times three communication levels as noted in Table 2. Communication groups included Group A, who received the **standard** communications package (a Welcome Pack and a Kick Off Pack). The **enhanced** communication Group B (who received additional email communications throughout the first year peak pilot period) and Group C (who received the **enhanced** communications package B, **plus** a **Blue Line Display Monitor** which provides in-home information on energy consumption and the cost of energy consumed).

**Table 2: TOU Pilot Populations By Rate Group, Region and Communications Type**

| | | Lower Mainland (N=433,000) | | | | |
|---|---|---|---|---|---|---|
| **Peak to Off Peak Price** | **Total** | **A** | **B** | **C** | **Vancouver Island (N=8,900)** | **North (N=11,900)** |
| T1 (19¢ / 6.33¢) pm | 438 | 134 | 116 | 108 | | 80 |
| T2 (25¢ / 6.33¢) pm | 423 | 118 | 115 | 104 | | 86 |
| T3 (28¢ / 4.5¢) pm | 316 | 105 | 116 | 95 | | |
| T4 (15¢ / 4.5¢) am, pm | 96 | | | | 96 | |
| T5 (20¢ / 4.5¢) am, pm | 98 | | | | 98 | |
| Total Treatment | 1371 | 357 | 347 | 307 | 194 | 166 |
| Total Control | 699 | 530 | | | 97 | 72 |
| Total | 2070 | 1541 | | | 291 | 238 |

Source: Pedersen 2007. A = Standard communications B = Enhanced communications (Treatment group participants in Vancouver Island and the North also received enhanced communications) C = Enhanced communications + Blue Line Monitor

To estimate the average impact of time-varying rates on the share of energy use on peak several simple regression models were estimated using individual customer data. Equation (1) was estimated using ordinary least squares for each of the three regions. Coefficient β provides an estimate of the impact of the peak to off peak price ratio on the ratio of peak and off peak energy use. Equation (2) then uses the estimated parameter values from equation (1) to forecast the potential impact of alternative peak to off peak price ratios on the ratio of peak to off peak consumption, where an asterisk indicates the estimated value of the parameter.

(1) kWh peak/kWh off peak = α + β peak price/off peak price + error

(2) kWh peak/kWh off peak = α* + β* peak price/off peak price

## Results

The meter installation process and related data communication transfer and analysis activities were examined through interviews with program staff and stakeholders and through focus groups with participants. Initially, a number of the TOU meters were not communicating or providing valid data to the vendor's server[1] in November, reducing the precision of the planned analysis.

### Customer Awareness and Acceptance

The objective of the pre and post pilot participant surveys was to gather information regarding participants' conservation attitudes and behaviours, and most importantly, their on-peak use of electricity for various end-uses throughout the four month winter pilot. An additional objective was to solicit feedback on various facets of the pilot for future planning purposes.

Participants in each of the pilot treatment and control groups were asked to complete a pre-pilot survey in October 2006 and post-pilot survey in March 2007. A self-administered mixed-mode methodology was used, where participants either received surveys via e-mail for Internet completion or in the form of printed, mailed copies. Due to random assignment to the experimental groups, there are no differences in the age, gender or any other demographics of treatment and control participants. Table 2 (above) details the initial population of participants by rate group, region and communications type.

A total of 2,070 pre-pilot surveys were sent to participants and 1,720 pre-pilot surveys were completed for a response rate of 88%, and with the finite correction factor, a maximum margin of error of ± 1.0% at the 95% confidence level. A total of 1,870 post-pilot surveys were sent to participants yielding 1,305 completions for a 70% response rate, and with the finite correction factor, a maximum margin of error of 1.5% at the 95% confidence level. As the returned samples for both the pre and post pilot surveys were representative of the initial pilot population by rate group, region and communications type, it was not necessary to mathematically weight the survey responses.

[1] For the pilot two different vendors provided meters, related software and communication protocols. The communication protocols are complex systems in which signals carrying the metered information are passed along a series of cell-phone like devices to the vendor's server where the metered data is stored and eventually transferred to the utility.

**Comparison of pilot participants and BC Hydro residential customers**. To gain insight as to how the demographic profile of the TOU pilot participants aligns or differs from BC Hydro's greater population of residential customers, TOU pilot participants were compared with similar households living in single detached homes in BC Hydro's service territory (Pedersen 2006). Compared to the overall population of residential customers living in single detached houses, the pilot is somewhat over-represented by women aged 35 to 45 years of age, living in homes with at least two other people. The most striking difference, however, is their level of education as 44% have earned university degrees compared to 25% among the related population. It follows that the total annual household income among pilot participants is much higher than average as 45% reportedly earn $80,000 (CAD) or more compared to 34% among the related customer base.

Given that pilot participants were proactive in voluntary opting-in to the pilot, TOU participants, regardless of whether they were subsequently assigned to the a treatment or control groups, may bring a stronger pro-conservation ethos with them to the pilot as compared to that shared by the majority of BC Hydro's residential customers living in single detached homes. This may have been tempered by the fact that households were 'guarantied' no increase in overall billing as part of the pilot agreement. Pilot participants emerge as being more knowledgeable than many others about how to conserve electricity in their homes, more active in looking for opportunities to save energy in everything they do, more willing to be flexible in their energy habits for a greater good, more likely to make the connection between their own household's energy use and its impact on the environment, and more likely than others to make the connection between their own household's energy use and its impact on the environment.

Like BC Hydro's overall population of customers in single detached houses, nearly all TOU participants own their homes. However, their houses are older than most others and, on average, about 100 square feet larger in floor area. Rolled-up together, households recruited into the TOU pilot are significantly more likely than single detached houses across BC Hydro's entire service territory to have natural gas as their main space heating fuel, 81% versus 64%.

For the 12 months previous to the launch of the pilot, participating households used an average of about 1,700 fewer kWh of electricity than among all other single detached houses across the BC Hydro's service territory. However, their lower consumption can not be attributed to their under-reliance on electricity for space heating as their average annual usage is lower for each of the main fuel types. Instead, it appears as though their strong conservation behaviours overcome the fact that their homes are older, larger in area, and larger in occupancy, which are all drivers of higher consumption.

These differences between pilot participants and the comparable BC Hydro residential customer base limit the external validity of this project, or the ability to forecast the impact of a mandatory residential TOU rate based on the results of this voluntary TOU experiment.

**Participant satisfaction**. Among treatment group participants expressing an opinion, 81% assess their overall experience with the TOU pilot as either "excellent" or "good". Perhaps due in part to a greater ease in shifting their on-peak use of electricity and a greater extent in doing so, at least on a self-reported basis, participants with electric space heating fuel are significantly more likely to rate their overall experience with the pilot favourably than participants with natural gas space heating fuel.

Very closely reflecting their overall experience with the pilot, 83% of treatment group participants indicate that they either "definitely would" or "probably would" continue for a second year of the program next fall if it is offered under the very same set of conditions relating

to the on-peak times, on-peak and off-peak rates, balancing charge, bill guarantee and meter. Although a total of 78% of treatment group participants rate the explanation of the balancing charge favourably, qualitative research during the pilot revealed not only a poor understanding of the amount, but little awareness of it. All evidence points to the belief that participants in this study have a misunderstanding of the balancing charge, despite their claim of having a good one. Participants clearly indicate, however, that the absence of a bill guarantee would have a detrimental impact on their likelihood of signing-on for a second year of the program.

Among Lower Mainland participants with Blue Line Display Monitors, about five in ten of them report having used the monitors at least several times each week in the first month of the pilot. This proportion, however, decreased to about four in ten in the final two months. There is significant division in opinion with respect to the overall performance of the monitor, 43% rate it favourably and 31% rate in unfavourably.

**Self reported changes in behaviours.** Statistical analysis uncovers strong evidence that treatment group households were successful in shifting their evening on-peak use of many electrical end-uses to off-peak times, in turn, revealing favourable "demand response effects". This analysis is based on their self-reported behaviours for typical winter seasons before the pilot and for the TOU pilot period itself, and a control group to help isolate and validate the effects.

For the evening peak, treatment group households showed the most substantial drops in their top-two box usage scores (always + usually) for major household cleaning appliances such as dishwashers (31% ⇨ 11%), clothes washers (25% ⇨ 11%) and clothes dryers (24% ⇨ 9%). They also showed very favourable shifts in their evening on-peak use of hot water for baths and showers (46% ⇨ 35%) and, despite being in the space heating season, electric heaters including portables and baseboards (30% ⇨ 23%).

To a lesser degree, participants on a TOU rate also shifted their on-peak use of stove top elements, ovens, microwave ovens and lighting in various rooms of the home. There does not appear to be a successful demand response effect for end-uses relating to the television and entertainment usage, nor for end-uses relating to computers and home office.

The ease of shifting usage and the extent in doing so is correlated to the same group of drivers – age, space heating fuel, home occupancy size, household composition and consumption. That is, older participants, houses with electrical space heating, households with fewer occupants (especially those without children and/or young adults) and those with relatively lower electricity consumption all emerge as being the most successful, on this self-reported basis, in shifting their on-peak usage.

Just as there has been a "demand response effect" for many end-uses, there has also been a "conservation effect" in that treatment group participants reported having reduced their use of electricity for some behaviours relating to space heating, water use/laundry and lighting.

In terms of the specific treatment group, households on each of the various pricing plans report broad success in shifting their on-peak use of electricity. Having said this, households on the Vancouver Island T5 rate plan (4:1 on-peak to off peak price) can be ranked number one. For select end-uses, especially dishwashers, electric heaters and lighting, the households which received enhanced communications (Group B) throughout the pilot out-performed households which received standard communications (Group A). Homes with Blue Line Display Monitors report less success than all others in the amount of electricity they believe they were able to shift.

## Customer Response to Pricing Signals

Table 3 summarizes the estimated total and peak energy consumption reductions for December 2006 – February 2007 (n=1,950). Data for November are not included due to issues with missing data, calibration of the meter readings or the peak hour setting. Any usable information for November was, however, included in the regression analysis reported below.

The consumption reductions are calculated by first calculating the difference between treatment group consumption and control group consumption by region and then averaging over the treatment groups in a given region. The average results for all three regions are weighted based on each region's share of total participants.

Treatment groups exhibit both a significant "demand response effect" and "conservation effect", particularly early in the pilot period. For all three regions, average treatment group consumption was 29 kWh or 9.6% lower than the control group for peak, and 112 kWh or 8.6% lower for total consumption.

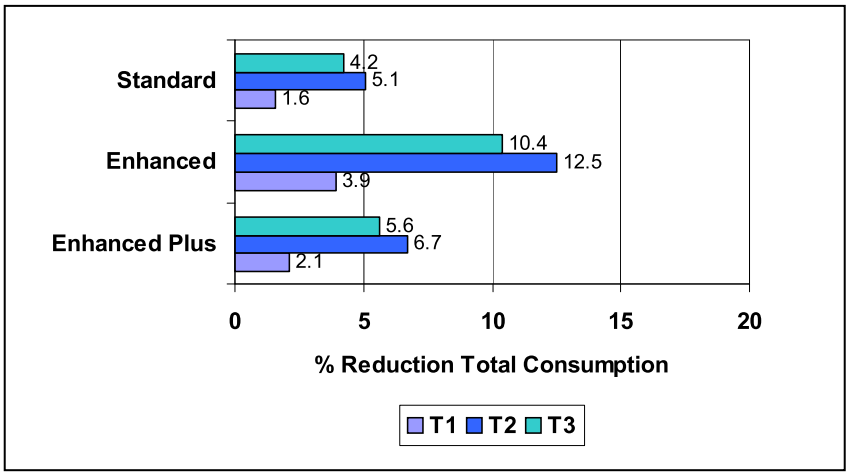
**Table 3: Reductions in Peak and Total Consumption**

| | Peak Consumption | | | Total Consumption | | |
|---|---|---|---|---|---|---|
| Month | Ave Treatment (kWh) | Ave Control (kWh) | % Reduction | Ave Treatment (kWh) | Ave Control (kWh) | % Reduction |
| Dec | 255 | 284 | 10.2 | 1141 | 1321 | 13.6 |
| Jan | 318 | 356 | 10.7 | 1292 | 1401 | 7.8 |
| Feb | 246 | 265 | 7.2 | 1158 | 1205 | 3.9 |
| Average | 273 | 302 | 9.6 | 1197 | 1309 | 8.6 |

## Customer Response to Communications

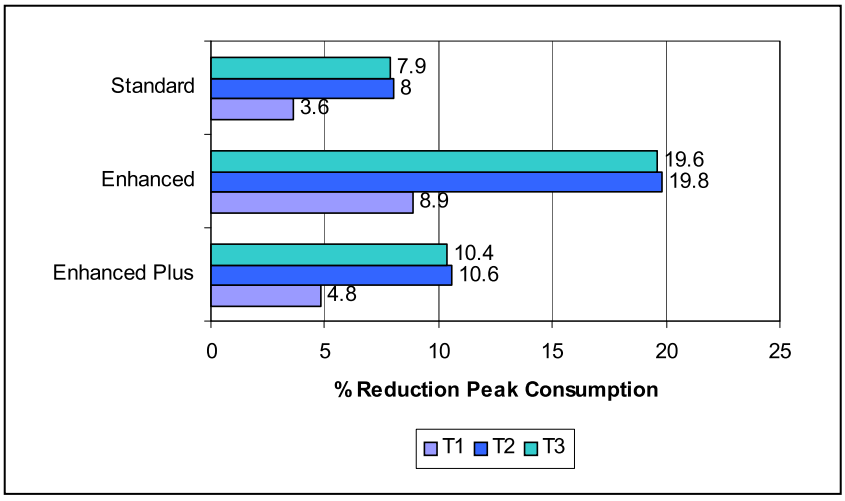
In the Lower Mainland enhanced communications (Group B) had a significant impact on total consumption for some rate options (see Figure 1). The consumption reductions are calculated by first calculating the difference between the communication group consumption and control group consumption. Recall that communication groups included those who received the **standard** communications package (a Welcome Pack and a Kick Off Pack). The **enhanced** communication group who received additional email communications throughout the first year peak pilot period and a third group who received the **enhanced** communications package, **plus** a **Blue Line Display Monitor** (which provides in-home information on energy consumption and the cost of energy consumed).

**Figure 1: Impact of Communication Type on Total Consumption**




In the Lower Mainland enhanced communications (Group B) had a significant impact on peak consumption (see Figure 2).

**Figure 2: Impact of Communication Type on Peak Consumption**




## Impact of Peak to Off Peak Price on Peak to Off Peak Consumption

Table 4 below presents the results of four regression models explaining the impact of peak to off peak price on peak to off peak consumption for two of three regions, for the months of November and December 2007. Results for the North are not provided due to relatively small sample sizes and relatively high levels of missing and problematic data. The coefficients for each model are shown in the relevant column with the t-statistics for the coefficients shown below the coefficients in parentheses. The F-statistic measures the statistical significance of the linear regression with the significance level shown in parentheses.

Model 1 presents the November results for Vancouver Island. This model is statistically significant at the 10% level. The coefficient on the peak to off peak price ratio is negative as expected, and it is statistically significant at the 5% level. Model 2 presents the December results

for Vancouver Island. This model is not statistically significant at conventional significant levels. The coefficient on the peak to off peak price ratio is negative as expected, but it is not statistically significant, although it is larger than its standard error. These results for Vancouver Island show some evidence of peak shifting. A convenient interpretation of this information is as follows: if the peak to off peak ratio is two, then the ratio of peak to off peak energy for Vancouver Island falls by about 1%.

Model 3 presents the November results for the Lower Mainland. This model is statistically significant at the 1% level. The coefficient on the peak to off peak price ratio is negative as expected, and it is statistically significant at the 1% level. Model 4 presents the December results for the Lower Mainland. This model is also statistically significant at the 1% level. The coefficient on the peak to off peak price ratio is again negative and significant at the 1% level. These result show strong evidence of peak shifting. If the peak to off peak price ratio doubles, then the ratio of peak to off peak energy falls by between 1% and 2%.

**Table 4: Peak to Off Peak Consumption Regression Results**

| | Vancouver Island | | Lower Mainland | |
|---|---|---|---|---|
| | (1) November | (2) December | (3) November | (4) December |
| Constant | 0.439*** (0.01000) | 0.371*** (0.00906) | 0.258*** (0.00300) | 0.216*** (0.00307) |
| Peak to Off Peak Price | -0.00564* (0.00353) | -0.00326 (0.00314) | -0.00456*** (0.00081) | -0.00279 (0.00082) |
| F | 2.55 (0.10) | 1.08 (0.30) | 31.90 (0.00) | 11.47 (0.00) |

Note. One, two or three asterisks mean that coefficient is significant at the 10%, 5% or 1% level respectively. Standard errors for coefficients and probability for F-test are shown in parentheses.

A major advantage of the regression based approach is that impacts of TOU rates can be forecast for rates that were not part of the design. As noted above, the estimate and parameters from equation (1) and various assumed peak to off peak price ratios were substituted into equation (2) to provide estimates of pricing impacts. Table 5 provides these forecasts of peak to off peak consumption for the assumed peak to off peak ratios varying from 1:1 to 1:6, which is approximately the range of estimates covered by the pilot. Two aspects of this analysis are worth noting. First, the estimates for Vancouver Island appear to be reasonable and are fairly consistent across November and December. Second, the estimates for the Lower Mainland are roughly in the same range as those for Vancouver Island and show a material ability for the TOU rate to reduce peak to off peak energy consumption.

**Table 5: Pricing Impacts: Peak to Off Peak Consumption**

| | Vancouver Island | | Lower Mainland | |
|---|---|---|---|---|
| Peak to Off Peak Price | November | December | November | December |
| 1:1 | 0.433 | 0.368 | 0.253 | 0.213 |
| 2:1 | 0.428 | 0.361 | 0.249 | 0.210 |
| 3:1 | 0.422 | 0.358 | 0.244 | 0.208 |
| 4:1 | 0.417 | 0.355 | 0.240 | 0.205 |
| 5:1 | 0.411 | 0.352 | 0.235 | 0.202 |
| 6:1 | 0.425 | 0.348 | 0.231 | 0.199 |

The study has two major limitations. First, a substantial number of the initially installed TOU meters were not communicating or providing valid data to the vendor's server in November and a smaller number were not providing valid information in December. This means that the precision of the statistical analysis is lower than planned. Second, the statistical analysis does not explicitly consider the impacts of the balancing charge or the bill guarantee. Since these are common across all treatment groups, these impacts cannot be determined with the data available. Note, the impact of a mandatory residential TOU rate cannot readily be inferred from this voluntary experiment, since participants in a mandatory rate might respond differently than the voluntary participants in this experiment.

## Conclusions

Analysis of customer self-reported behaviours for typical winter seasons before the pilot and for the TOU pilot period and a control group uncovered strong evidence that treatment group households were successful in shifting their evening on-peak use of many electrical end-uses to off-peak times. For the evening peak, treatment group households showed the most substantial drops in their top-two box usage scores (always + usually) for major household cleaning appliances such as dishwashers (31% ⇨ 11%), clothes washers (25% ⇨ 11%) and clothes dryers (24% ⇨ 9%). They also showed very favourable shifts in their evening on-peak use of hot water for baths and showers (46% ⇨ 35%) and, despite being in the space heating season, electric heaters including portables and baseboards (30% ⇨ 23%). In addition, TOU rate participants reported having reduced their overall use of electricity for some behaviours relating to space heating, water use/laundry and lighting.

Customer response to pricing signals in the form of TOU rates was significant with treatment groups exhibiting both a "demand response effect" and "conservation effect", particularly early in the pilot period. For all three regions, average treatment group participant's consumption was 29 kWh or 9.6% lower than the control group for the evening peak period, and 112 kWh or 8.6% lower for total consumption.

In the Lower Mainland enhanced communications had a significant impact on total consumption for some rate options and a significant impact on peak consumption for all rate options. The Blue Line Display Monitors (Group C, Enhanced Plus) did not appear effective and were not perceived by participants as helpful in shifting or reducing their consumption.

Four regression models help explain the impact of peak to off peak price on peak to off peak consumption for two of three regions, for the months of November and December 2006. If the peak to off peak ratio is two, then the ratio of peak to off peak energy for Vancouver Island falls by about 1%. The results for the Lower Mainland show strong evidence of peak shifting. If the peak to off peak price ratio doubles, then the ratio of peak to off peak energy falls by between 1% and 2%. Using the regression equations to forecast rates that were not part of the pilot design provides peak to off peak ratios varying from 1:1 to 1:6, which is within the range covered by the pilot and shows a material ability for TOU rates to reduce peak to off peak energy consumption.

## Bibliography

Aigner, D. and L. Lillard. 1984. "Measuring Peak Load Pricing Responses from Experimental Data." J. of Business and Economic Statistics, 2.

Architectural Energy Corporation. 2003. Advanced Utility Metering. Report Prepared for the National Renewable Energy Laboratory, U.S. Department of Energy. NREL/SR-710-33539.

Braithwait, S. 2003. "Residential TOU Price Responsiveness in the Presence of Interactive Communication Equipment." In Faruqui and Eakin.

Campbell, Donald and Julian Stanley. 1963. *Experimental and Quasi-Experimental Designs for Research.* Houghton Mifflin: Boston, MA.

Caves, D. W., and E. E. Leamer. 1984. "Estimation of Time-of-Use Pricing Responses in the Absence of Experimental Data." J. of Econometrics, 26.

Caves, D. W., L. Christensen and J. A. Herriges. 1984. "Consistency of Residential Customer Response in Time of Use Experiments." J. of Econometrics, 26.

Charles River Associates. 2005. Impact Evaluation of the California Statewide Pricing Pilot, Final Report. CEC Website, Working Group 3.

Cook, Thomas D. and Donald T. Campbell. *Quasi-Experimentation: Design and Analysis Issues for Field Settings.* Rand McNally: Chicago IL.

Faruqui, A. and K. Eakin, eds. 2000. Pricing in Competitive Electric Markets, Kluwer Academic Publishers: Dordecht, Netherlands.

Faruqui, A. and S. George. 2005. "Using Demand Models to Estimate the Impact of Dynamic Pricing in California." Proceedings of the 2005 International Energy Program Evaluation Conference.

New York. Federal Energy Regulatory Commission (2006). Federal Energy Regulatory Commission, Assessment of Demand Response and Advanced Metering: Staff Report, Docket AD06-2-000, August 2006.

Peak Load Management Alliance (PLMA). 2002. Demand Response: Principles for Regulatory Guidance. March 2002.

Peak Load Management Alliance (PLMA). 2002. Demand Response: Design Principles for Creating Customer and Market Value. November 2002.

Pedersen, M. 2006. *2006 Residential End-Use Study*, Power Smart Evaluation, Power Smart Evaluation, BC Hydro, August.

Pedersen, M. 2007. "Conservation Research Initiative: Quantitative Analysis of Self-Reported On-Peak Behaviours. BC Hydro, Power Smart, July.

Rink, D., 2006, Conservation Research Initiative, Phase One, Synovate, Project Number 06-0769.

Rink, D., and N. Mould, 2007. Conservation Research Initiative, Phase Two, Interim Key Findings, Synovate, Project Number 06-0769.

Tiedemann, K.H. 2007. "Conservation Rate Initiative, Milestone Report. BC Hydro, Power Smart, August.

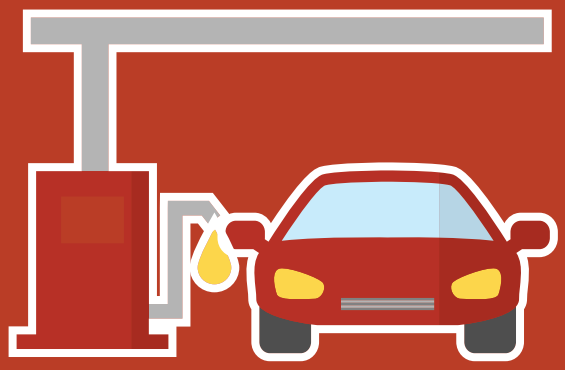
Tiedemann, K. H. 1999. "Using Meta-analysis to Understand the Impact of Time-of-use Rates." Statistics Canada International Symposium Series, 1999.

U.S. Department of Energy. 2004. Approaches for the Application of Advanced Meters and Metering Systems at Federal Facilities through Alternative Financed Contracts.

U.S. Department of Energy. 2006. Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them. A Report to the United States Congress Pursuant to Section 1252 of the Energy Policy Act of 2005. February 2006.

# Conservation: Let´s Get Serious

## Annual Energy Conservation Progress Report – 2015/2016



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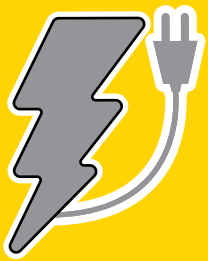

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Environmental Commissioner of Ontario

# List of abbreviations

| | |
|---|---|
| **BPS** | broader public sector |
| **$CO_2$** | carbon dioxide |
| **DOE** | United States Department of Energy |
| **DSM** | demand-side management |
| **DR** | demand response |
| ***EBR*** | *Environmental Bill of Rights, 1993* |
| **ECO** | Environmental Commissioner of Ontario |
| **EMV** | evaluation, measurement and verification |
| **EUI** | energy use intensity |
| **EV** | electric vehicle |
| **GDP** | gross domestic product |
| **GHG** | greenhouse gas |
| **GJ** | gigajoule |
| **GWh** | gigawatt-hour |
| **HDD** | heating degree day |
| **HOT** | high occupancy toll |
| **HOV** | high occupancy vehicle |
| **ICAO** | International Civil Aviation Organization |
| **IESO** | Independent Electricity System Operator |
| **kW** | kilowatt |
| **kWh** | kilowatt-hour |
| **LDC** | local distribution company |
| **LED** | light-emitting diode |
| **LTEP** | Long-Term Energy Plan |
| **M** | million |
| **$m^2$** | square metre |
| **$m^3$** | cubic metre |
| **MEPS** | minimum energy performance standard |
| **MJ** | megajoule |
| **Mt** | megatonne |
| **MOECC** | Ministry of the Environment and Climate Change |
| **MW** | megawatt |
| **MWh** | megawatt-hour |
| **NRCan** | Natural Resources Canada |
| **OEB** | Ontario Energy Board |
| **OECD** | Organisation for Economic Co-operation and Development |
| **OMAFRA** | Ministry of Agriculture, Food and Rural Affairs |
| **OPS** | Ontario Public Service |
| **PJ** | Petajoule |
| **RPP** | Regulated Price Plan |
| **TOU** | time-of-use |
| **TWh** | terawatt-hour |

Environmental Commissioner of Ontario

Commissaire à l'environnement de l'Ontario

Dianne Saxe, J.D., Ph.D in Law
Commissioner

Dianne Saxe, J.D., Ph.D en droit
Commissaire

May 2016

The Honourable Dave Levac
Speaker of the Legislative Assembly of Ontario

Room 180, Legislative Building
Legislative Assembly
Province of Ontario
Queen's Park

Dear Speaker,

It is an honour to deliver to you my first report as the Environmental Commissioner of Ontario. I am pleased to provide the Annual Energy Conservation Progress Report – 2015/2016 for your presentation to the Legislative Assembly of Ontario.

This report fulfils my mandate under section 58.1 of the *Environmental Bill of Rights, 1993* to report annually on the progress of activities in Ontario to reduce or make more efficient use of electricity, natural gas, propane, oil and transportation fuels. Ontario has made a commendable start but much work remains to reduce energy consumption and shift from fossil fuels to less polluting energy sources.

Members of my office received the advice of many Ontarians and international experts in producing this report, and I am grateful for their kind assistance.

Yours truly,

Dianne Saxe

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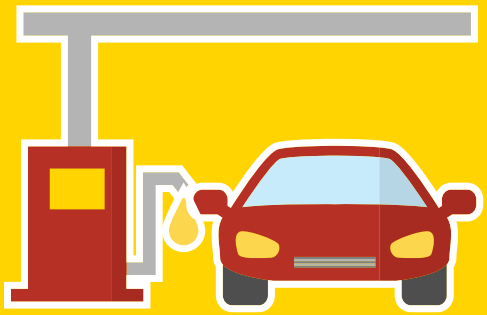

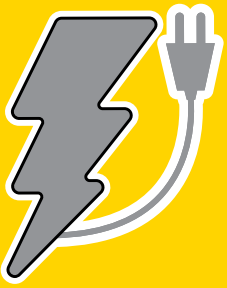

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**Appendices** **Online Only**

**eco.on.ca/reports/2016-lets-get-serious/**

# Executive Summary

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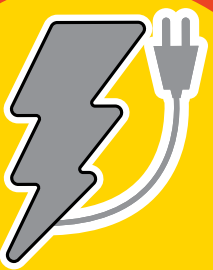

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# What Happened in 2014 - 2015?

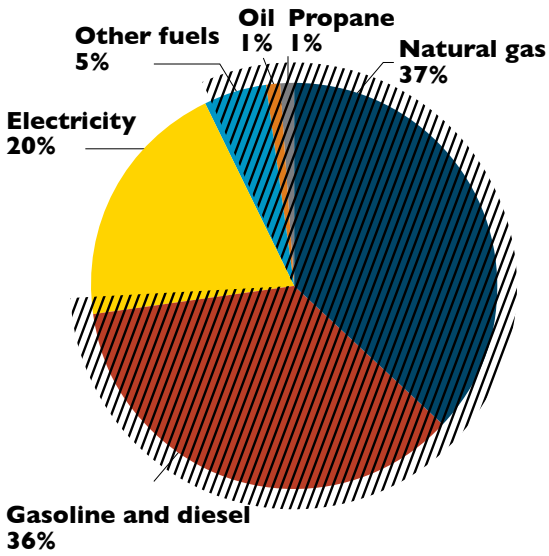
Total energy use in Ontario in 2014 was roughly the same as in 2007, despite a 7 per cent increase in population, a nearly 8 per cent increase in GDP, and the unusually cold winter of 2014. In other words, energy use per capita and per dollar of GDP dropped 7 per cent or more since 2007.

Ontario focuses heavily on conserving electricity, with some effort on natural gas and little on other fuels. Ontario government progress on its energy conservation targets was mixed at best. We give ministries one A, two Bs, one C+, two Ds and one F; no results are available on three targets. Look for our take on how they did in Chapter 2.

**Transportation fuel** use fluctuates but has increased since 2007. In most years, it is Ontario's largest energy use; in 2014, transportation represented 36 per cent of all energy used. For conserving transportation fuels, Ontario has no overall target, no focussed program and no specific budget. However, some recent initiatives may help – see Chapter 3.

**Natural gas** use was 11 per cent higher in 2014 than in 2013, likely due to the cold winter. It supplied 37 per cent of Ontario's energy, primarily to heat buildings, heat water and run factories. In 2014, natural gas ratepayers paid $66 million for gas utility conservation programs that produced predicted lifetime energy savings of 2.6 billion cubic metres of natural gas. The net cost to ratepayers was 2.5 cents per cubic metre of gas saved versus an average residential natural gas price of 18.3 cents per cubic metre. Natural gas use would likely have been 39 per cent of Ontario's consumption in 2014 without past conservation programs.

A new gas conservation framework for 2015 to 2020 has initial targets to increase annual gas savings about 25 per cent. Its budget has doubled




**Ontario's energy use by fuel type in 2014**

to about $116 million per year, and a conservation potential study is underway. Mandatory energy benchmarking and reporting should trigger improved efficiency of natural gas use in public buildings– see chapter 4. Building and product standards also help – see Chapter 5.

**Electricity** provided 20 per cent of Ontario's energy in 2014; 9 per cent of that power came from natural gas-fired generators in 2014 and 2015; the other 91 per cent was supplied by nuclear and renewable sources.

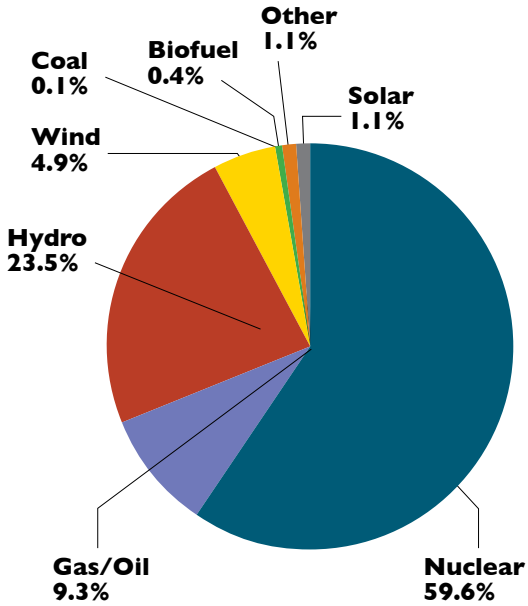
The closure of the last of Ontario Power Generation's coal plants in 2014, and the growth of renewables, means that Ontario now has remarkably low-carbon power, as well as cleaner air (e.g., no smog days in 2015). Although renewable generation is growing quickly, the proportion of natural gas-fired electricity is predicted to grow when nuclear units go offline for refurbishment or shut down.

Ontario ratepayers invest heavily in electricity conservation; that and other factors, including building and product standards, have driven electricity use down. From 2007 to 2014, Ontario's peak demand dropped 4,400 MW (17 per cent)

and total electricity use fell 6 per cent. The Ontario Energy Board now estimates that a typical household uses 750 kWh per month, down from 1000 kWh prior to 2009.

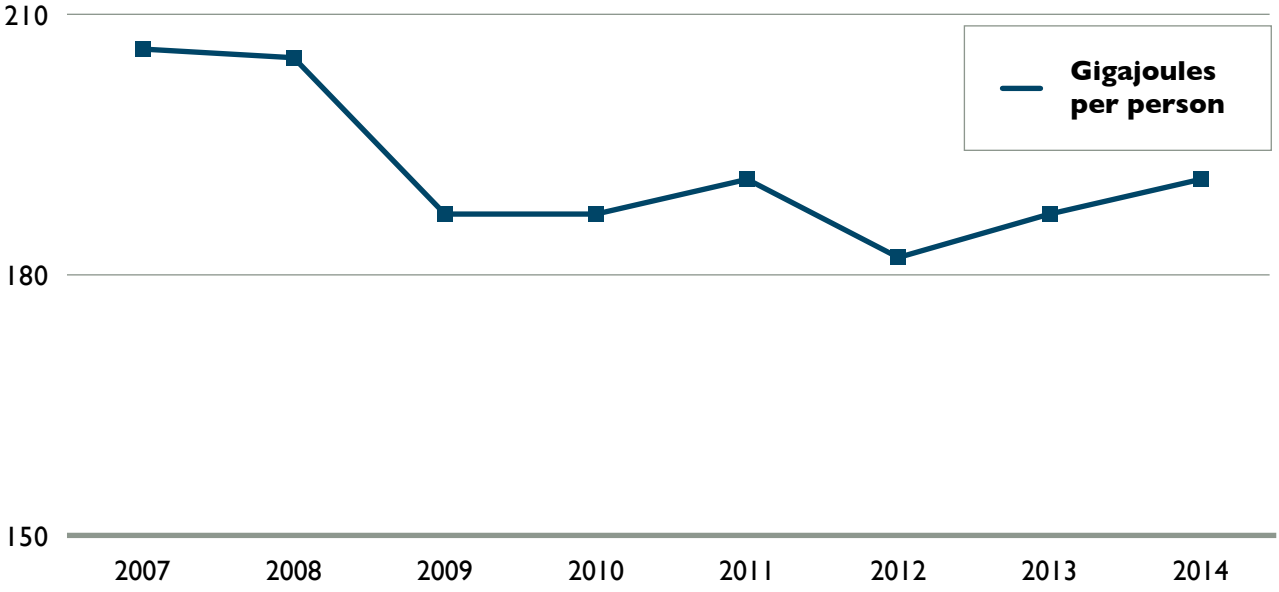
**Conservation** remains the cheapest form of energy. Per unit of energy, Ontario ratepayers pay more for electricity generation or natural gas than for conservation.

In 2014, electricity ratepayers paid $421 million for utility conservation programs that produced predicted lifetime energy savings of 14.6 billion kWh, for a net cost to ratepayers of 2.9 cents per kWh saved. This is cheaper than any form of electricity generation; for example, 6-9 cents per kWh for refurbished nuclear, 8-29 cents for gas-fired turbines and 13 cents for wind power. The electricity conservation budget for 2015 to 2020 is $2.9 billion, roughly $483 million per year, proportionally 8 times per unit of energy provided compared to what we spend on natural gas utility conservation programs. In the short term, electricity conservation produces significant environmental and economic benefits when it displaces natural gas-fired generation. This occurred one-third of the time in 2014.




**Ontario's electricity generation by fuel type (2014)**

From 2011-2014, electricity distributors were required, by their licence conditions, to pursue two conservation targets: a total savings target and a peak demand reduction target. As a group, they exceeded the total savings target but met only 70 per cent of the peak target. A new




**Ontario's energy use (in gigajoules) per person (2007-2014)**

electricity conservation framework has been adopted for 2015 to 2020. Distributors now have only a total savings target, with little incentive to focus on savings during hours that will displace gas-fired generation and provide the greatest environmental and economic benefit.

## Transportation Fuel

**Transportation is Ontario's largest source of greenhouse gas emissions and is usually our largest energy use.** Our transportation fuel use (almost entirely fossil fuels) was higher in 2014 than it was in 2007.

Ontario has made little progress towards its commitment to reduce the carbon intensity of transportation fuels 10 per cent by 2020. **Ontario needs, but lacks, a co-ordinated long-term strategy for all pieces of the transportation puzzle**, including targets, transparency and incentives for land use planning, transit, low-carbon fuels and vehicles, and active transportation.

### What matters most: land use planning

In the Greater Golden Horseshoe where about 63 per cent of Ontario's population lives, urban sprawl is a major issue. Low-density, car-dependent communities have been created that result in high fuel use, harmful emissions and traffic congestion and impacts on human health through air pollution and reduced physical activity. The per capita greenhouse gas emissions from transportation fuels are higher in the outer reaches of the Greater Golden Horseshoe, where urban densities are lower than in the more dense inner areas.

**Building southern Ontario this way was a choice, not a necessity**. It was permitted by public policy, and can be changed by public policy. Will we do better as the population in this region grows by almost 50 per cent over the next 25 years?

The 2015 Crombie Report, *Planning for Health, Prosperity and Growth*, points the way to more compact, complete communities that are less car-dependent. It often takes many years to change land use planning outcomes; Ontario must get started now.

### What we can do now: transit and shared transportation

Ontario has opportunities for **meaningful reductions in transport fuel consumption from transit and shared transportation** in larger urban areas where most people live.

To its credit, Ontario is making substantial new investments in transit. In 2015-16, for the first time, Ontario spent more on transit ($3.6 billion) than on highways ($3.2 billion).

To get the most from these investments, Ontario should:

- Match transit investments to reliable estimates of demand;
- Give transit vehicles priority on busy arterials and highways, to make them faster and more reliable; and
- Consider on-demand shared transportation, especially in areas without enough density to support conventional transit.

### Potential game changer: low carbon vehicles

To meet Ontario's needs for mobility, freight and utility transportation with dramatically lower levels of fossil fuels, Ontario must also shift to low-carbon fuels and vehicles.

Ontario is well placed to electrify transportation because of our widely-available, low-carbon electricity supply that has ample extra capacity (see Chapter 2 and Appendix B), provided that most vehicle charging occurs off-peak. Although sales are increasing, Ontario is likely to miss its target to have five per cent of passenger vehicles electric by 2020. Improved technology and recent provincial initiatives could encourage more rapid growth in electric vehicle sales, if appropriately supported with complementary policies.

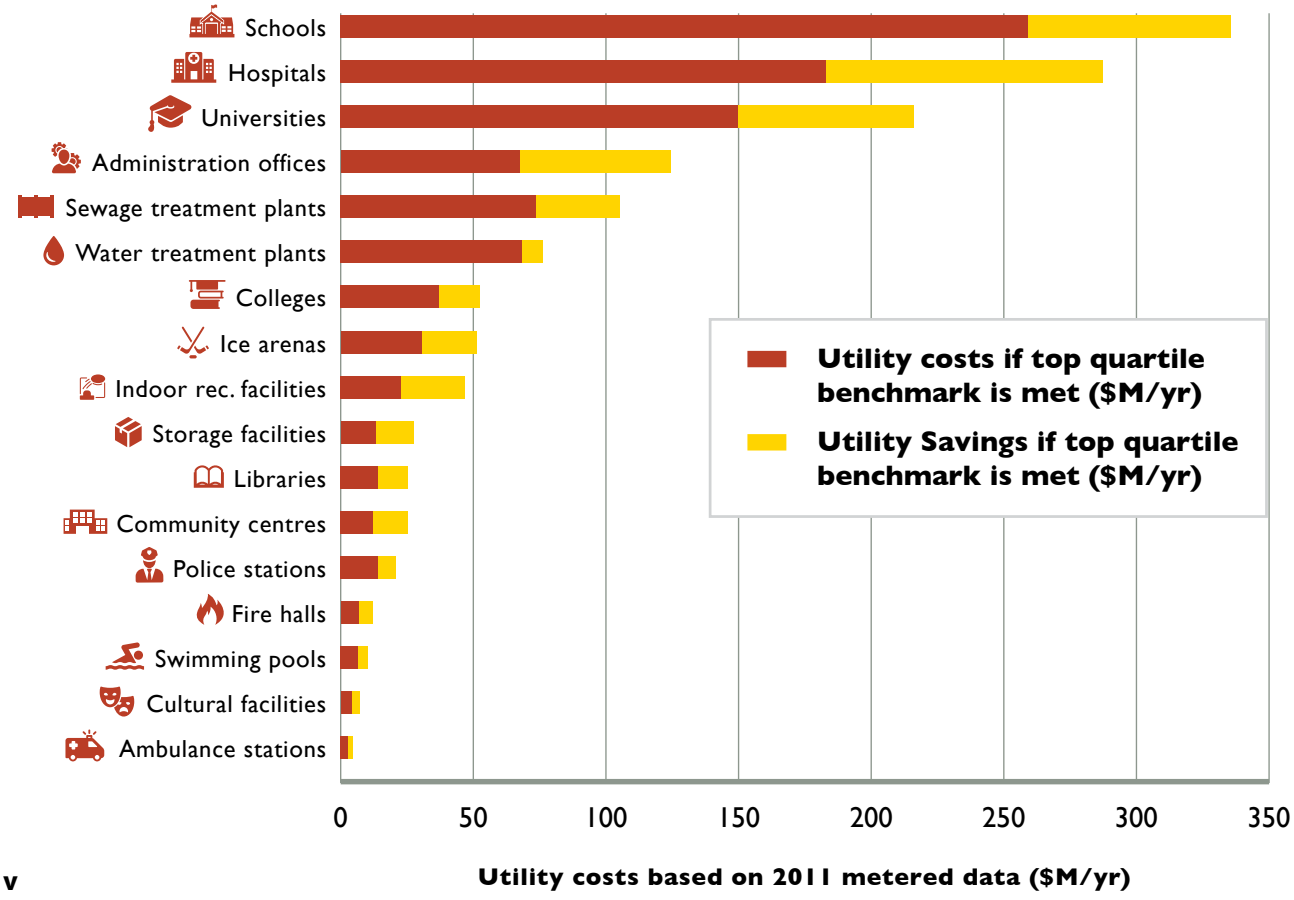
## Public Buildings

Buildings, from single-family homes to office towers, used about 37 per cent of Ontario's energy in 2014, mostly natural gas for comfort and water heating.

About 8 per cent of this (3 per cent of Ontario's total energy demand) was consumed in public buildings. Most of these are broader public sector facilities (BPS), i.e. municipalities, hospitals, universities, colleges and schools, which had to start reporting their energy use in 2012.

What did we learn from the first three years of mandatory energy reports from each BPS building in Ontario?

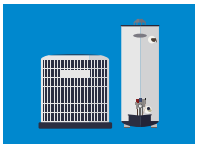
1. Public buildings vary hugely in their energy use. **If all BPS buildings performed as efficiently as the top quarter of their building type, taxpayers could save $450 million and 1 megatonne of GHG emissions every year** (based on 2011 data).
2. Mandatory energy reporting in the broader public sector is already producing valuable environmental and financial benefits.



Ontario could unlock large energy and financial savings in the most inefficient public buildings. Ontario should provide public bodies with information and incentives. Using the *Green Energy Act, 2009* Ontario should set targets, insist on transparency, and require public sector organizations receiving funding to consider conservation in every capital project. Ontario should also remove barriers that prevent public bodies from borrowing to upgrade their buildings, and from using the resulting energy savings to pay back the loans.

You can see the energy used by each broader public sector building in your community on our website, at **eco.on.ca/reports/2016-lets-get-serious/**

Using energy more efficiently in public buildings will save taxpayers' money, improve air quality and reduce climate damage. But **for real progress, Ontario must get serious about energy efficiency in private buildings**, including offices, industries and housing.



## Codes and Standards

Energy performance codes and standards are powerful tools for energy conservation. They can be either voluntary or mandatory, and can apply to buildings, vehicles, equipment, etc.

This year, we focus on energy efficiency standards for appliances (e.g., stoves), equipment (e.g., motors, furnaces) and other products (e.g., lights) which are regulated under the *Green Energy Act.* Together, efficiency standards regulate products that consume roughly 90 per cent of home energy use, 60 per cent of commercial building use, and 30 per cent of industrial energy use.

Canada sets standards for products that cross provincial and international borders; Ontario sets standards for products sold in the province. Ontario used to adopt Canadian federal standards, which often follow U.S. standards. Since 2010, Canadian standards fell behind as the U.S. moved higher. Commendably, Ontario began to directly adopt U.S. standards. Some Ontario standards will now automatically update when U.S. standards do.

However, U.S. standards are not always the answer. Ontario's climate, industrial mix and electrical supply are different from the U.S. average. The Ministry of Energy proposed eight Ontario-specific standards with higher efficiency. Most were later watered down or abandoned, but Ontario has become a continental leader in standards for commercial boilers, and in phasing out inefficient incandescent light bulbs.

Ontario should:

- Restore its authority to inspect and enforce energy efficiency standards;
- Increase efficiency standards as technology permits;
- Establish efficiency standards for water fixtures that waste both water and the energy used to pump, treat and perhaps heat that water; and
- Consider the impact of durability on the total energy footprint of products.

## Measuring the Value of Conservation

Energy conservation is good public policy. Conservation is the cleanest and least costly way to supply energy, and it also has substantial environmental and climate benefits.

Ontario has focused on conserving electricity and natural gas, via conservation programs delivered by electric and natural gas utilities and funded by their customers. Both gas and electricity conservation programs have consistently proven to be cost-effective. On the whole,

Ontario's investments in electric and natural gas conservation have made sense, and have been somewhat successful in reducing electricity and natural gas use. Ontario has not taken effective steps to conserve other fuels.

Ontario should focus more on conserving fossil fuels, not just on electricity. In the short term, lowering total electricity consumption only has significant financial, air quality and climate benefits when that conservation displaces gas-fired generation. Gas supplied 9 per cent of Ontario's electricity in 2014, but operated at the margin (and could be displaced by conservation) roughly one-third of the time. The percentage of gas-fired generation is expected to increase in coming years, when nuclear plants are being refurbished or have been closed.

In the longer term, conservation minimizes capital costs and the other impacts of building new infrastructure, and makes space on the grid for population growth and new uses of electricity such as transportation. A culture of conservation, and the necessary technology and expertise, must be built over time and cannot be easily turned on or off. To have enough conservation when we need it, a consistent pro-conservation policy is appropriate.

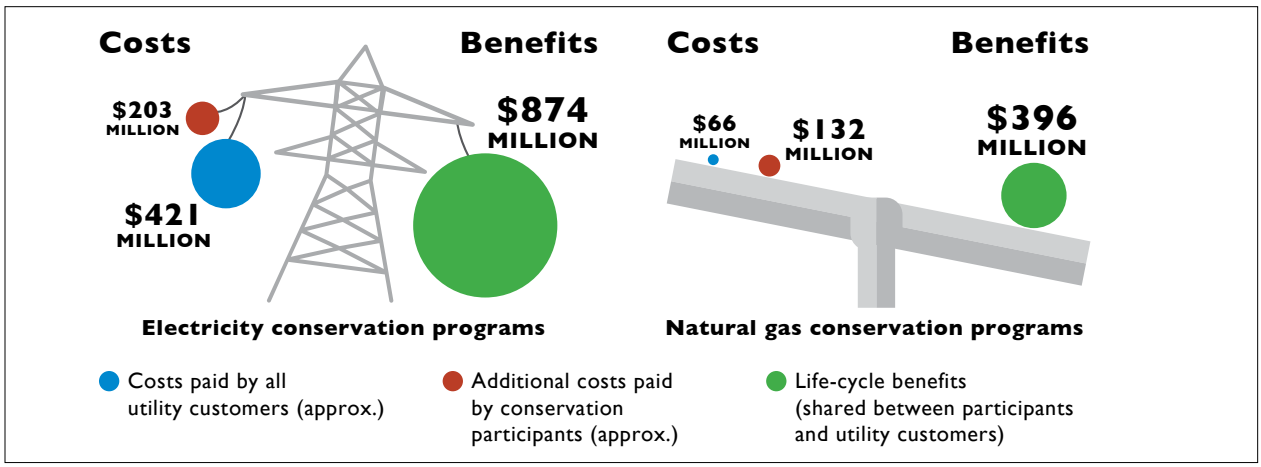
## Fossil Fuel Subsidies

Although Ontario has ambitious energy conservation and climate targets, other Ontario policies conflict with these objectives. One notable example is fossil fuel subsidies.

Ontario plans to put a price on carbon (greenhouse gas emissions) in 2017, in order to reduce the consumption of fossil fuels. But **the province also provides more than half a billion dollars in fossil fuel tax breaks every year.** By international definitions, these tax breaks are fossil fuel subsidies.

Fossil fuel subsidies discourage energy conservation and worsen climate change, air pollution, and damage to human health and ecosystems. Other governments have begun to reduce or eliminate them. Canada has made two international commitments to phase-out and rationalize fossil fuel subsidies while providing targeted support for those who need it most. Ontario committed in its 2016 Climate Change Strategy to "look at removing existing initiatives that support fossil fuel use".

Ontario's current fossil fuel tax breaks were adopted before science revealed the harm caused by burning fossil fuels. Now we know better. **Ontario could do less harm, and more public good, by updating our tax system.**



# Key Recommendations From This Year's Report

1. All public bodies in Ontario should get serious about a "cleaner, leaner, greener" approach to energy, especially reducing the use of fossil fuels.
2. Ontario should adopt formal targets for reducing fossil fuel consumption.
3. Public bodies should be accountable to the public for the energy they use.

## Chapter 3: Transportation Fuel

4. The Minister of Transportation and municipal councils should reduce transportation fuel consumption by:
    a. Accommodating population growth within complete communities served by good transit and active transportation infrastructure;
    b. Making transit faster and more reliable through cost-effective transit investments and by granting transit vehicles priority on key arterials and highways; and
    c. Supporting the rapid growth of low carbon transportation vehicles and fuels, including electrification.
5. Public bodies should report the energy use of their fleets.
6. The next Ontario Building Code should require conduits in new buildings so that electric vehicle charging infrastructure can be conveniently and cost effectively added by occupants.
7. The Ontario Energy Board and utilities should encourage electric vehicle charging during off-peak hours, through enhanced time of use rates and load control technology.

## Chapter 4: Public Buildings

8. The Minister of Energy should:
    a. disclose the energy used in Ontario government buildings in a user-friendly format;
    b. set energy use intensity targets for all public buildings;
    c. implement *Green Energy Act, 2009* provisions that protect consumers by mandating home energy use disclosure prior to sale; and
    d. require large private sector buildings to disclose their energy intensity.
9. The Minister of Finance should remove barriers that prevent public bodies from borrowing to upgrade the energy efficiency of their buildings, and from using the resulting energy bill savings to repay the loan.

## Chapter 5: Codes and Standards

10. The Minister of Environment and Climate Change and the Minister of Energy should establish product standards for the efficient use of water in fixtures.
11. The Ministry of the Environment and Climate Change should obtain authority to inspect and enforce compliance with product efficiency standards.

## Chapter 6: Measuring the Value of Conservation

12. Ontario should focus electricity conservation on times of higher demand, when conservation displaces natural gas-fired generation.
13. The Independent Electricity System Operator should improve public participation in conservation planning by providing greater transparency about marginal hourly generation and how it is implementing recommendations for conservation program improvements.

## Chapter 7: Fossil Fuel Subsidies

14. The Minister of Finance should redirect tax breaks from supporting fossil fuel consumption to activities that contribute to the public good.

# 1 Introduction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# 1.0 Introduction

Since 2009, the *Environmental Bill of Rights, 1993 (EBR)* has required the Environmental Commissioner of Ontario (ECO) to report annually to the Speaker of the Legislative Assembly on Ontario's progress in making better use of electricity, natural gas, oil, propane and transportation fuels. This report provides Ontario's only comprehensive public summary of energy conservation and efficiency. We assess the quantitative savings achieved by conservation programs;[1] evaluate progress against government targets, and identify barriers to better results.[2] We also review major energy conservation policies announced or implemented in 2015.

**Ontario's only comprehensive public summary of energy conservation and efficiency.**

For excellent social, economic and environmental reasons, Ontario is committed to dramatically reducing our greenhouse gas (GHG) emissions and to investing in conservation and energy efficiency. These two objectives are inherently intertwined. Most of our GHG emissions are from burning fossil fuels for energy. To significantly reduce our GHG emissions while improving our quality of life, we must be more efficient in how we use all forms of energy, and must shift away from fossil fuels.

## 1.1 The Changing Context

Energy conservation decisions occur in a constantly fluctuating context. World energy prices soar and drop; industries grow and decline; economic growth and recessions come and go. The policy landscape has also undergone almost constant change, including changes in laws and regulations, directives issued by the Minister of Energy, and decisions of the Ontario Energy Board. The pace of change is illustrated by the long list of 2015 initiatives in Chapter 2 and the Appendices of this report.

A decade ago, Ontario began to invest in conservation again and the Legislature subsequently turned to the ECO in 2009 to monitor energy conservation. At that time, the issue of greatest concern was adequacy of electricity supply and affordability of oil and gas. The electrical system was in crisis; we were facing the risk of rotating brownouts; fossil fuel prices were rising steadily and so was our energy demand.

Today, the short-term picture is quite different. With reduced industrial load, due to the closure of many industrial facilities, and with all nuclear plants aging but operating,[3] we are in a temporary period of ample electricity supply. The recent crash in the price of oil, natural gas and coal has changed the energy market in Ontario, across the country and indeed the world. At the same time, climate change has finally been generally accepted as the pressing existential threat that it is, raising the urgency for Ontario to meet its ambitious targets for reducing its greenhouse gas emissions.

## 1.2 Ontario's Energy Conservation and Climate Commitments

The ECO monitors, evaluates and reports on Ontario's progress towards its energy and climate commitments. These are set out in several key documents. Ontario's official energy conservation commitments are:

- The Conservation First white paper, released in July 2013, states that Ontario will choose conservation as the initial resource before adding new supply to meet the province's energy needs. By the government's own account,[4] conservation is the cleanest and least costly energy supply alternative, and it also has substantial environmental and climate benefits.
- Ontario's 2013 Long-Term Energy Plan set a long-term electricity conservation target of 30 terawatt-hours (TWh) in 2032. This represents a 16 per cent reduction in its forecasted demand for electricity. It also aims to use Demand Response (DR — programs that temporarily reduce electricity use during periods of peak demand) to meet 10 per cent of peak demand by 2025, equivalent to approximately 2,400 megawatts (MW).
- Ontario has not set an overall target for natural gas conservation, and is promoting policies to extend natural gas use to new areas of the province. However, the Ontario Energy Board has approved individual targets for natural gas conservation by the gas distribution utilities that it regulates. The decision relevant to this report is the Ontario Energy Board's approval of the 2015-2020 Demand Side Management Plans of Union Gas and Enbridge Gas Distribution. The current targets are approximately 1.1 billion cubic metres of lifetime natural gas savings from Enbridge's 2016 conservation programs, and 1.3 billion cubic metres from Union's 2016 programs (excluding Union's large-volume customers, which will contribute a large amount of additional savings), with slightly more challenging targets for subsequent years.[5]
- Ontario has set no target for conservation of other forms of energy, including transportation fuels, oil or propane.

There is now a world-wide consensus that, if we increase the average world temperature by more than 2 degrees Celsius (°C), severe, pervasive and irreversible impacts will be likely.[6] To mitigate these risks, Ontario has made the following climate commitments:

- The "Under 2 MOU", signed by Ontario in May 2015, is a Memorandum of Understanding between sub-national jurisdictions to commit to the objective of limiting warming to below 2°C. It has now been signed by 128 jurisdictions.
- In Paris, France, at the 2015 United Nations Climate Change Conference (COP 21), Canada (with Ontario's support) and the other countries of the world committed to hold the increase in the global average temperature even lower, to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.
- To implement Ontario's share of this commitment, Ontario's 2015 Climate Change Strategy set targets of reducing Ontario's GHG emissions 15 per cent by the end of 2020, 37 per cent by the end of 2030, and 80 per cent below 1990 levels by 2050. The same minimum targets are set out in section 6 of the *Climate Change Mitigation and Low-carbon Economy Act, 2016*.

Ontario's climate targets will require major changes in Ontario's energy system, including significant increases in energy efficiency.

**Ontario's climate targets will require major changes in Ontario's energy system, including significant increases in energy efficiency.**

## 1.3 What is Energy Conservation?

By energy conservation and energy efficiency, we refer to several closely related concepts, all with the common benefit of reducing energy consumption. For example, the energy required to heat an existing home can be reduced many different ways (see Figure 1.1), including by:

- reducing the target temperature and putting on a sweater;
- using a programmable thermostat, so that the house is not heated as much when it is empty or at night when everyone is in bed;

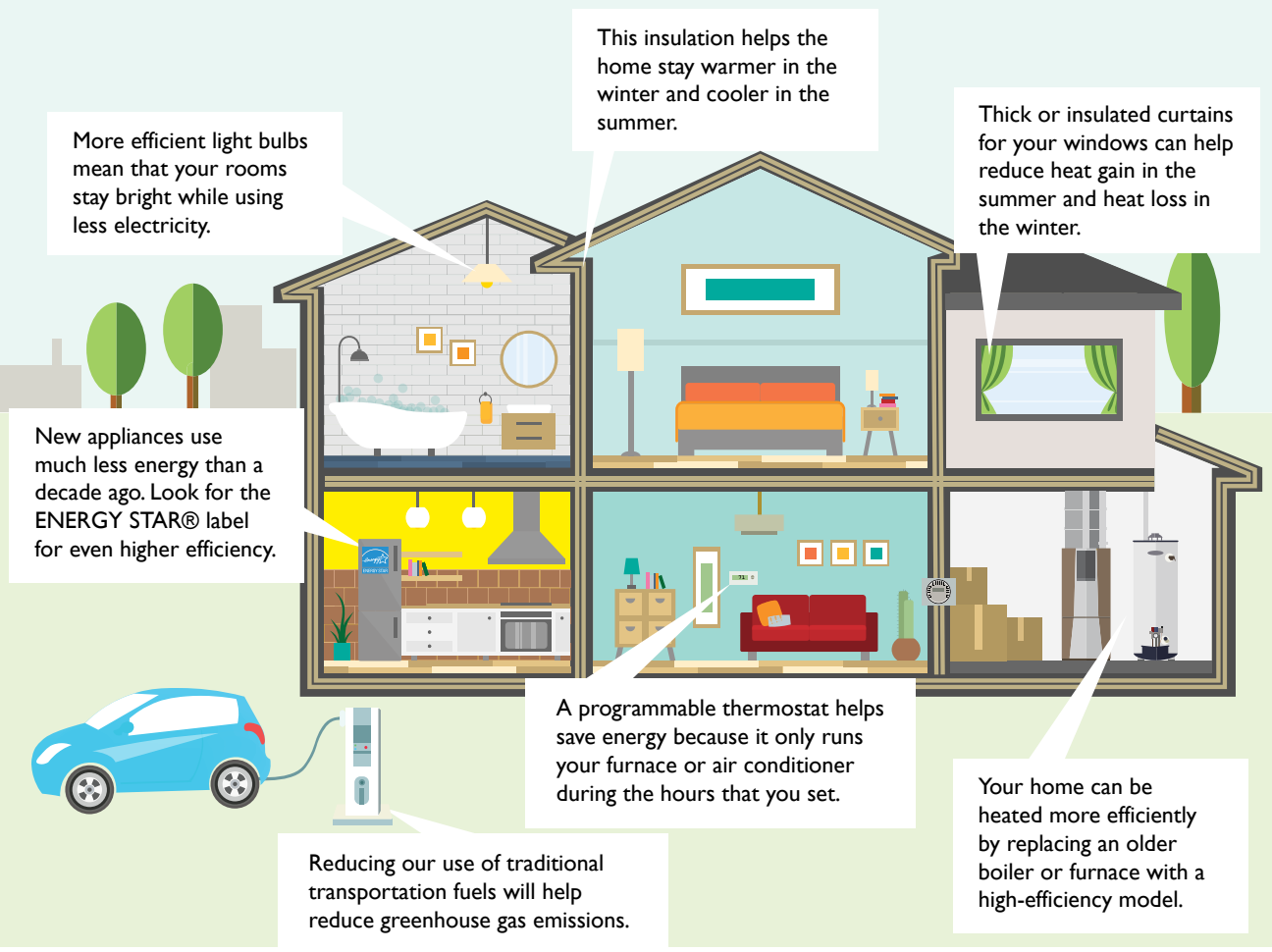


**Figure 1.1: Save energy and reduce GHG emissions in the home**

- insulation, weatherization and otherwise improving the building envelope, so that the building doesn't leak as much heat;
- insulated floor coverings (including carpet) that are warmer underfoot;
- improving maintenance of heating equipment, such as changing filters and cleaning ductwork;
- recovering and reusing heat from waste water or exhausted air;
- using more efficient heating equipment, by converting electric baseboard heating to an air source heat pump,[7] or replacing an older boiler or furnace to one that is high-efficiency; and
- supplementing the main (central) heat supply with point of use heating or renewable sources such as wood in clean-burning wood stoves.[8]

Energy demand for cooling can be reduced in many of the same ways, although to meet the opposite need, by:

- reducing heat gain (e.g., through awnings, curtains or planting trees for shade);
- minimizing heat creation in the building, such as by changing incandescent and halogen lighting[9] to more efficient and cooler fluorescent or LED bulbs;
- dressing in loose, lighter clothing to stay cooler;
- reducing humidity and increasing air flow (e.g., fans) so that the home feels comfortable at a higher temperature; and
- venting internal heat sources such as cooking and clothes dryers to the outdoors, etc.

Critical peak electrical demand can be reduced by smart devices that can turn off heavy loads for short periods at times of peak demand and by home and grid energy storage.

Because of the urgency of reducing Ontario's dependence on fossil fuels, we also review opportunities to substitute low-carbon energy sources for fossil fuels.

## 1.4 How Much Can Energy Conservation Help?

According to the International Energy Agency, better energy efficiency can provide about 40 per cent of the global GHG reductions needed to avoid global warming above 2°C.[10] Around the world, many countries are seeing economic growth despite lower energy consumption, due in part to better energy efficiency.[11] 2015 was the second year in a row that global energy-related carbon dioxide emissions ($CO_2$) – the largest source of man-made greenhouse gas emissions – stayed flat despite economic growth.[12]

Can Ontario do it too? The Ontario economy is already growing faster than energy consumption (see Figure 1.2). From 2007 to 2014, the energy used per dollar of GDP has decreased by almost 8 per cent.

**Better energy efficiency can provide about 40 per cent of the global GHG reductions needed to avoid global warming above 2°C.**

However, there is much more to be done if Ontario is serious about its energy and GHG reduction targets. Energy conservation remains the cheapest source of new energy. Reducing

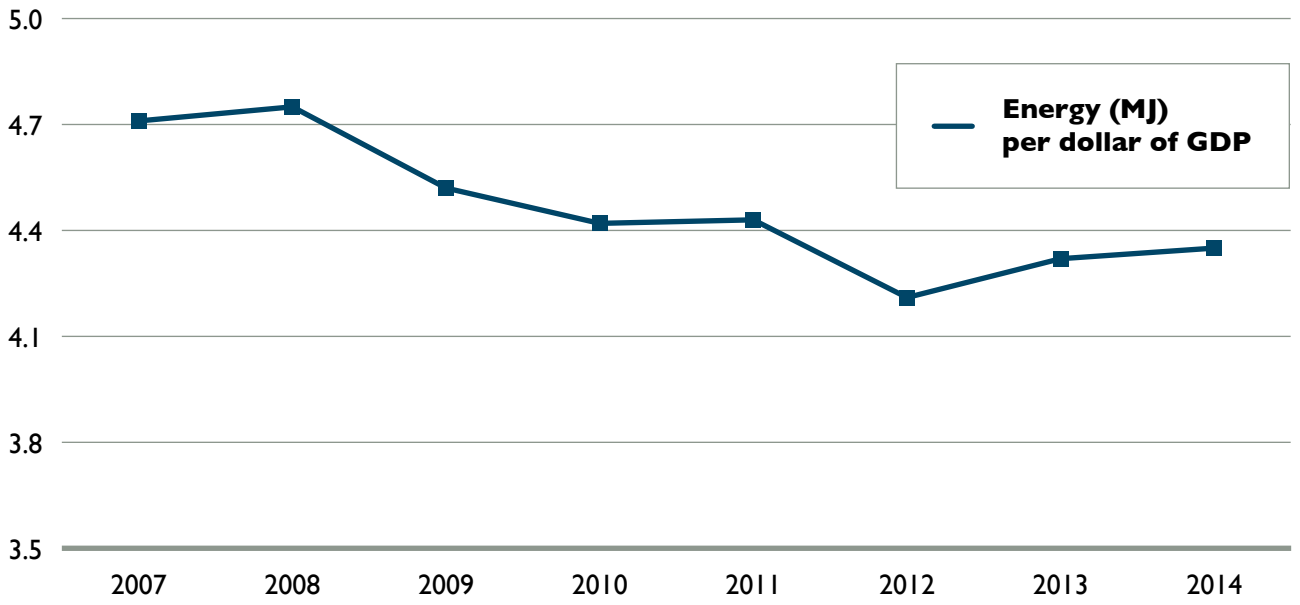


**Figure 1.2: Energy use (in megajoules) per dollar of gross domestic product (GDP) in Ontario, 2007-2014 (in 2007 dollars)**

Source: Energy use data from Statistics Canada – Catalogue no. 57-003-X and IESO. GDP data from Statistics Canada with additional calculations from Ontario Ministry of Agriculture, Food and Rural Affairs.



energy demand diminishes negative environmental impacts on the built and natural environments, limits harmful emissions from fossil fuel combustion and reduces the need for disruptive new energy infrastructure to be built in local communities.

**Energy conservation remains the cheapest source of new energy.**

## 1.5 This Year's Report

This year, our report assesses Ontario's recent and proposed initiatives to conserve energy, with a particular focus on fossil fuels. The conclusions of each major chapter are highlighted in the Executive Summary. The printed version of the report is intended for a general public audience; the more detailed Appendices for a technical audience are available on our website at **eco.on.ca/reports/2016-lets-get-serious/**

**Chapter 2** is an overview of conservation results from 2014[13] and government policy initiatives from 2015. Further details are provided in Appendices A, B and C (online only).

**Chapter 3** examines three groups of recent initiatives with potential to make a meaningful impact on our largest energy and fossil fuel use sector: transportation. These initiatives include:

- Land-use planning;
- Shared transportation investment, priority and innovation; and
- Low carbon vehicles and fuels, especially electrification.

**Chapter 4** looks at the opportunity for energy efficiency improvements in Ontario's existing public buildings. Mandatory energy use reporting in the broader public sector has now produced enough high-quality data to identify buildings that should be investigated first for energy efficiency opportunities. We have created a user-friendly on-line tool that enables taxpayers and ratepayers to identify the poorly performing buildings in their community or sector.

**Ontario already knows how and why to conserve more energy. Let's get serious and do it.**

**Chapter 5** examines what Ontario is doing, and could do, to keep its energy efficiency product standards up to date.

**Chapter 6** looks at the economic and environmental value of conservation.

**Chapter 7** looks at the barrier to energy conservation created by subsidizing fossil fuel consumption.

**Chapter 8** is a consolidated list of recommendations, both from this year's report, and key outstanding recommendations from past reports.

Ontario already knows how and why to conserve more energy. Let's get serious and do it.

1

## Endnotes

**1.** Data presented for electricity and natural gas program results in 2014 are the most recent verified results available; final results typically lag by one year because the utilities must compile the data and have it approved by the Independent Electricity System Operator or Ontario Energy Board.

**2.** Environmental Commissioner of Ontario, report, *Annual Energy Conservation Progress Report – 2009 (Volume One)*, p.6, May 2010 — contains a full description of the reporting mandate and approach.

**3.** Pending the closure of Pickering and the refurbishment of units at Darlington and Bruce.

**4.** Ministry of Energy, policy paper, *Conservation First*, pp.0-2, 2013.

**5.** In response to the government's March 26, 2014 directive to the Ontario Energy Board instructing it to achieve all cost effective conservation, the Board established the new Demand Side Management Framework (2015-2020) for natural gas. This new Framework set targets for Enbridge Gas Distribution and Union Gas, and approximately doubled program budgets from the previous Framework. According to the Ministry of Energy, this directive brought spending in line with other leading jurisdictions.

**6.** World Resources Institute, website, *Understanding the IPCC report*, accessed April 2016; Intergovernmental Panel on Climate Change, report, *Climate Change 2014 Synthesis Report*, pp.72-73 & pp.81-82.

**7.** Electric baseboard heating, for example, is approximately 50 per cent less efficient than air source heat pumps. Heat pumps can help to reduce the huge toll that high electric heating costs have on many low income families. A typical electricity bill can represent 10 per cent or more of the income for such families (as per Ministry of Energy, news release, *Ontario to Remove Debt Retirement Charge and Launch Low-Income Electricity Support Program*, March 26, 2015).

**8.** Open fireplaces do not provide a climate benefit even if they displace fossil fuels. Black carbon, though a short-lived GHG, is an important contributor to global warming both in terms of trapping outgoing solar radiation and diminishing albedo on snow and ice, darkening them and thus causing faster melting.

**9.** This type of lighting can put out substantial amounts of heat.

**10.** According to the International Energy Agency, energy efficiency represents 49 per cent of the 3.1 Gt of savings that its 4 proposed policies could achieve (which represent 80 per cent of emissions reduction needed to keep under 2°C). See: International Energy Agency, report, *World Energy Outlook Special Report: Redrawing the Energy-Climate Map*, p.9-10 & p.54, June 10, 2013.

**11.** International Energy Agency, report, *Efficiency Market Report 2015: Market Trends and Medium-Term Prospects*, p.16, 2015.

**12.** International Energy Agency, news release, *Decoupling of global emissions and economic growth confirmed*, March 16, 2016.

**13.** This Section discusses the most recent verified data.

# 2

# What Happened in 2014 - 2015?

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# 2.0 What Happened in 2014 - 2015?

## 2.1 How Much Energy did We Use?

Total energy use in Ontario in 2014 was roughly the same as in 2007, despite a 7 per cent increase in population, an 8 per cent increase in GDP, and the unusually cold winter in 2014. In other words, energy use per capita and per dollar of GDP has dropped 7 and 8 per cent, respectively, since 2007, furthering the trend of decoupling energy use from economic growth (see Figures 1.2 and 2.1). This decoupling is likely due to:

- structural changes in the economy, e.g., shift away from manufacturing to services; and
- improved energy efficiency as a result of conservation programs, codes and standards, and energy prices.

**Energy use per capita and per dollar of GDP has dropped 7 and 8 per cent, respectively, since 2007.**



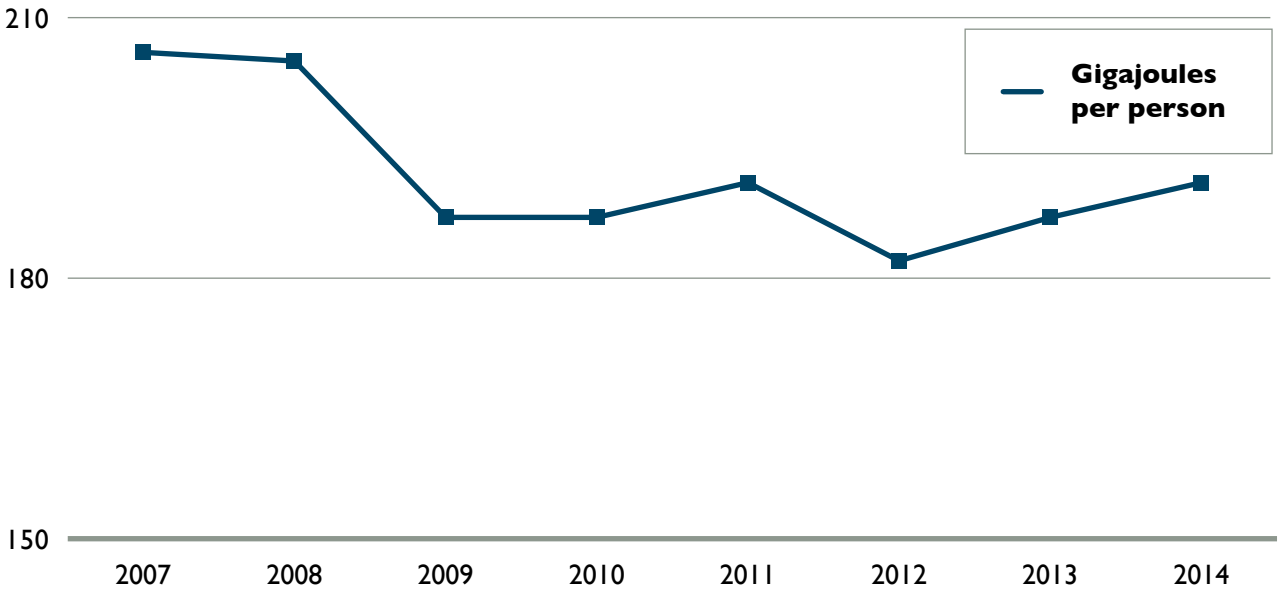


**Figure 2.1: Ontario's energy use (in gigajoules) per person (2007-2014)**

Source: Energy use data from Statistics Canada – Catalogue no.57-003-X and IESO. Population data from Statistics Canada.

## 2.2 What Kinds of Energy did We Use?

In 2014, as shown in Figure 2.2, over 80 per cent of Ontario's energy came from fossil fuels: mainly natural gas and petroleum-based transportation fuels (mostly gasoline and diesel). Except for coal,[1] Ontario used more fossil fuels in 2014 than in 2007.

**Over 80 per cent of Ontario's energy came from fossil fuels.**

**Except for coal, Ontario used more fossil fuels in 2014 than in 2007.**

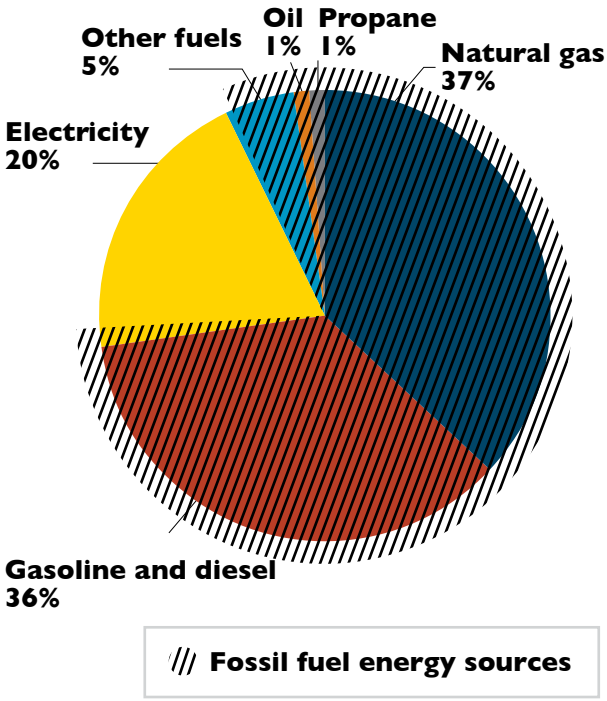


**Figure 2.2: Ontario's energy use by fuel type in 2014**

Note: 2014 values are preliminary data. Other Fuels refers to coke oven gas, petroleum coke, steam etc. (These fuels do not form part of ECO's reporting mandate under the *Environmental Bill of Rights, 1993*.) Other Fuels also captures any statistical difference between the total energy use data reported by Statistics Canada and the individual fuel use it reports. This figure does not fully capture the use of biomass for energy.

Source: Statistics Canada – Catalogue no.57-003-X and IESO.

Here is how Ontario's energy use has changed, by fuel, since 2007:

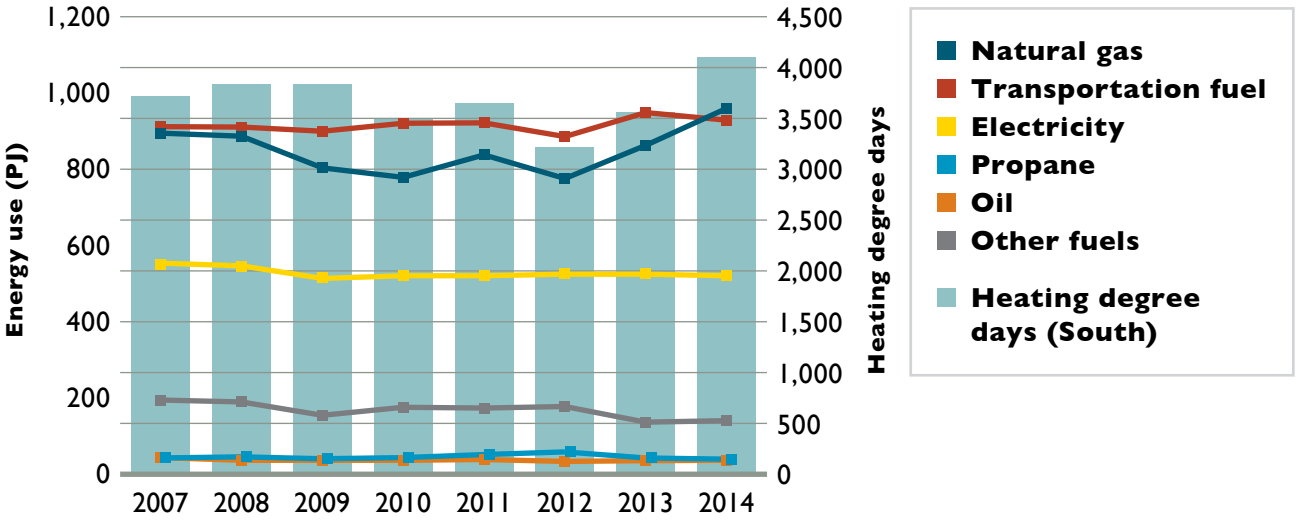


**Figure 2.3: Ontario's energy use (in PJ) by fuel type as well as southern Ontario heating degree days, 2007-2014[2]**

Note: 2014 values are preliminary data.

'Other Fuels' refers to coke oven gas, petroleum coke, steam, etc. (These fuels do not form part of ECO's reporting mandate under the *Environmental Bill of Rights, 1993*.) 'Other Fuels' also captures any statistical difference between the total energy use data reported by Statistics Canada and the individual fuel use it reports. For 2013 and 2014, the ECO adopted a methodological change for how we calculate the 'Other Fuels' category to improve its accuracy.

Heating degree days are the number of degrees that a day's average temperature is below 65°Fahrenheit (18° Celsius), the temperature below which buildings need to be heated, so it is a major determinant of energy use.

Source: Energy use data from Statistics Canada – Catalogue no.57-003-X and IESO. Heating Degree Days data from Environment Canada.



## 2.3 What Sectors Use the Most Energy?

The transportation and building sectors together accounted for 73 per cent of Ontario's total energy demand in 2014.

## 2.4 How Much Energy did Ontario Conserve?

Conservation remains the cheapest form of energy. Ontario focuses heavily on conserving electricity, less on natural gas and a little on conserving other fossil fuels. There was no action or progress on conserving other fuels.

### 2.4.1 Transportation Fuels: Very Limited Progress

**Transportation** fuel use fluctuates, but has increased about 2 per cent since 2007. It was Ontario's largest use of energy every year except 2014, and is supplied by fossil fuels almost exclusively. In 2014, transportation fuels (gasoline and diesel) were 36 per cent of total energy consumed (Figures 2.2 and 2.4).

As in previous years, efforts to improve the efficient use of transportation fuel and to reduce energy use in this sector were modest. The ECO cannot attribute any transportation fuel conservation results to Ontario government programs in 2014. Ontario has no overall target for conserving transportation fuel, and no focused program or budget for reducing the use of transportation fuel.

**The ECO cannot attribute any transportation fuel conservation results to Ontario government programs in 2014.**

In terms of substituting cleaner fuels, the ECO expects Ontario to miss its 2020 targets for low carbon fuels and vehicles (5 per cent electric vehicles and a 10 per cent reduction in the carbon intensity of all transportation fuels).

Nevertheless, per capita transportation fuel use was down slightly in 2014, perhaps because of recent transit investments and high gasoline and diesel prices until the last quarter of 2014. Some opportunities to reduce transportation fuel use are discussed in Chapter 3.

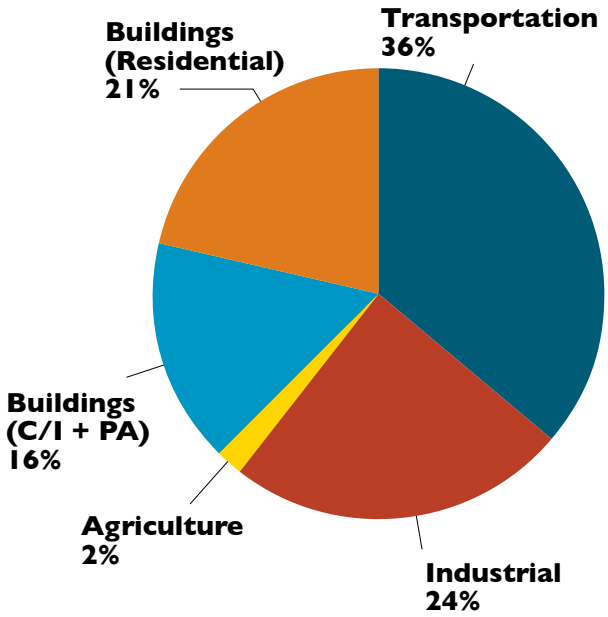


**Figure 2.4: Ontario's energy use by sector in 2014**

Note: 'C/I' stands for commercial and institutional; 'PA' stands for public administration.

Source: Statistics Canada – Catalogue no.57-003-X.

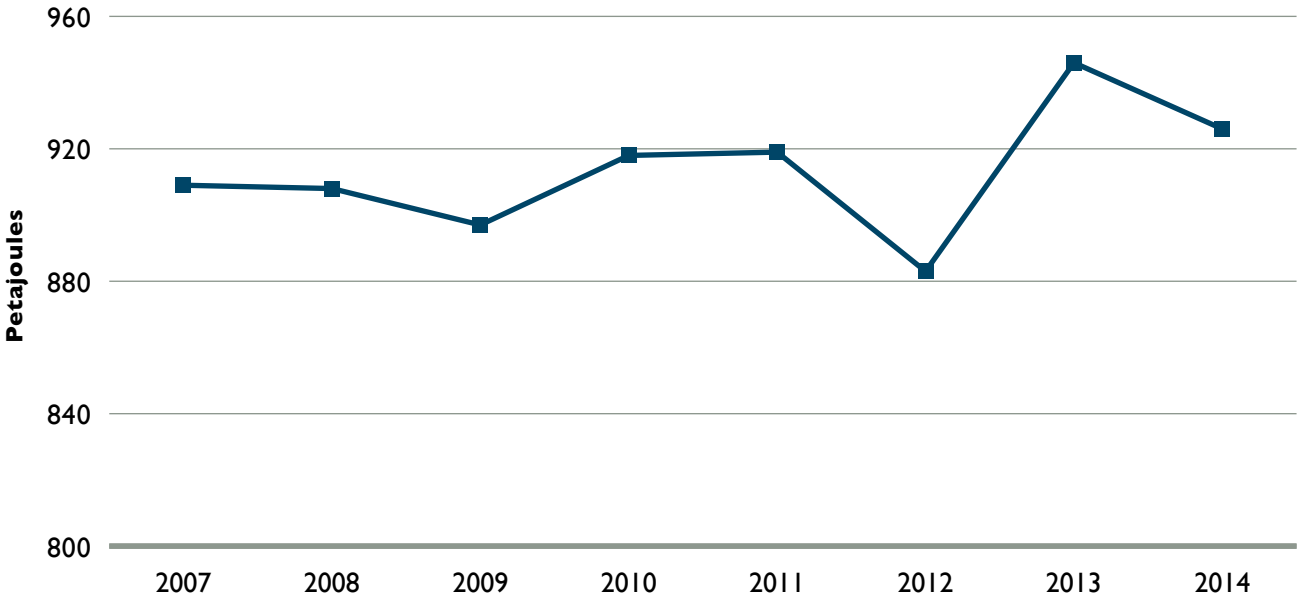


**Figure 2.5: Ontario's transportation fuel use from 2007-2014**

Source: Statistics Canada – Catalogue no.57-003-X.

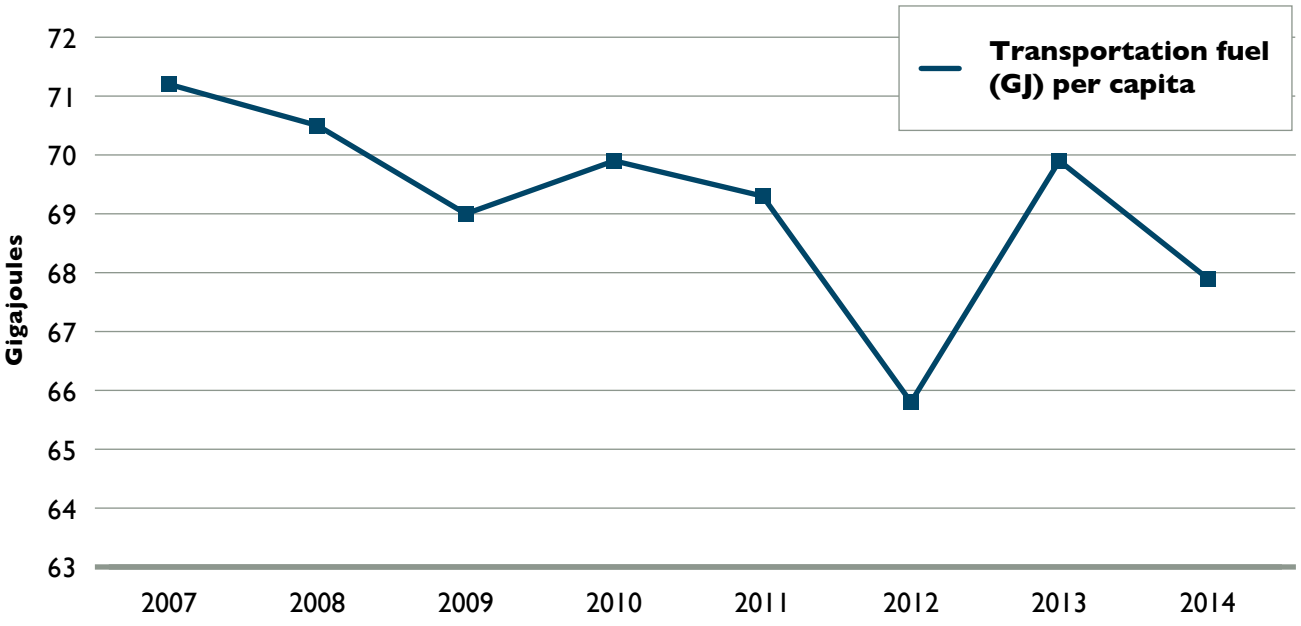


**Figure 2.6: Ontario's per capita transportation energy use, from 2007-2014 (in gigajoules)**

Source: Statistics Canada – Catalogue no.57-003-X.

Other relevant initiatives in 2015 included:

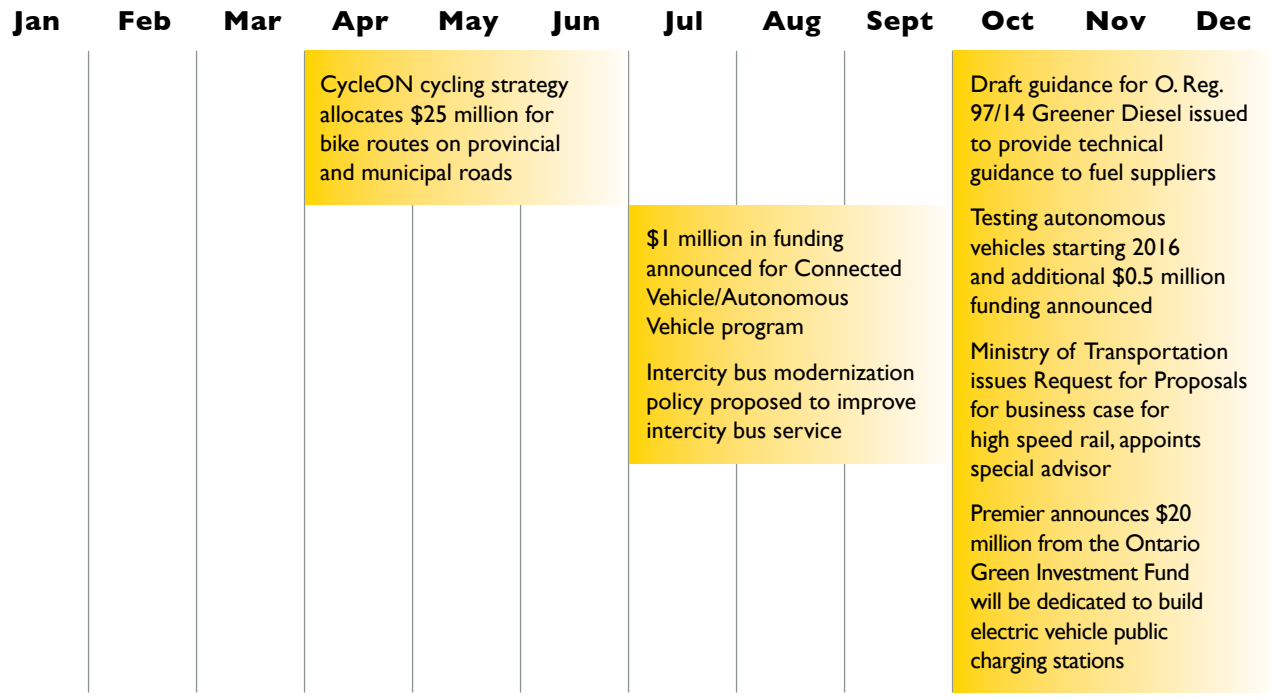


**Figure 2.7: Key transportation energy initiatives in Ontario (2015)**

2

### 2.4.2 Natural Gas: Some Conservation, but Swamped by Cold Winter Weather

**Natural gas** distributed in Ontario is a fossil fuel with the exception of small amounts of biogas (renewable natural gas). The Ontario Energy Board does not presently allow natural gas distributors to include any additional cost for renewable natural gas in their ratebase. Evidence in a 2012 Board hearing suggested that 2 per cent renewable natural gas could be added to Ontario's natural gas supply for about $18 per residential customer per year.[3]

Natural gas use fluctuates but has increased since 2007. Gas use was 11 per cent higher in 2014 than in 2013, likely due to the cold winter (see Figure 2.3). Natural gas is used primarily for space and water heating, for industry, and to generate electricity. In 2014, it supplied 37 per cent of Ontario's energy.

**Gas use was 11 per cent higher in 2014 than in 2013.**

## How Clean is Natural Gas?

Natural gas is usually considered the cleanest of the fossil fuels. However, the greenhouse gas benefits of natural gas are very sensitive to the leak rate of unburned natural gas (which is mostly methane). Methane is a powerful GHG, with a climate forcing effect 28 times more potent than carbon dioxide over a 100-year period, and 84 times more potent in its first 20 years in the atmosphere.[4] Methane is also a chemically reactive gas, leading to ozone formation in the lower atmosphere. Ozone in the lower atmosphere is likewise a greenhouse gas, and is toxic to both humans and ecosystems.[5]

While Ontario tracks provincial methane emissions from sources like landfills and natural gas equipment, and requires methane capture from some landfills, it does not track methane leakage from the entire natural gas supply chain or from other sources such as agriculture or sewage treatment.

The proportion of Ontario gas supply coming from the U.S. Appalachian Basin (i.e., Marcellus and Utica plays), where hydraulic fracturing is used and may result in a higher release of methane gas, is expected to increase from an 18 per cent share in 2016 to a 71 per cent share in 2021.[6] The U.S. considers methane emissions from natural gas production and distribution to be a significant climate concern, and is developing regulations to control them.[7] While most studies agree that replacing coal with natural gas has climate benefits over the very long term, some studies estimate that in the nearer term, the greenhouse gas break-even point for natural gas, as compared to coal, is a leak rate no higher than 3 per cent. And they conclude that the U.S. natural gas sector leak rate is higher than 3 per cent.[8] Other studies suggest that much leakage comes from a small number of "super emitters."[9]

Most methane leaks reportedly occur during production and processing of the gas, very little of which occurs in Ontario. According to the Ontario Energy Board, losses during distribution of natural gas in Ontario (known as Unaccounted-for Gas, which Ontario gas utilities are compensated for as part of their regulated rate base) are less than 1 per cent and lower than the U.S. average. Leaks from the distribution system are an unknown portion of Unaccounted-for Gas. Enbridge and Union estimate that most of Unaccounted-for Gas is due to metering variations, not leaks.

Natural gas is the major source of energy used in buildings (see Figure 2.8).

The unusually cold winter of 2014 is apparent by comparing heating degree days per year (using Toronto as a representative southern city) in relation to natural gas consumption (see Figure 2.3).

The Ontario Energy Board approves targets for conserving natural gas for Ontario's two major gas distributors – Enbridge Gas Distribution and Union Gas – which deliver almost all natural gas in Ontario.[10] These targets are contained in multi-year Demand Side Management (DSM) plans which the Board must approve.

In 2014, natural gas ratepayers paid $66 million[11] for utility conservation programs that produced predicted lifetime gas savings of 2.6 billion cubic metres, for a net cost to ratepayers of 2.5 cents per cubic metre of gas saved.[12] This compares to an average residential natural gas price of 18.3 cents per cubic metre in 2014.[13]



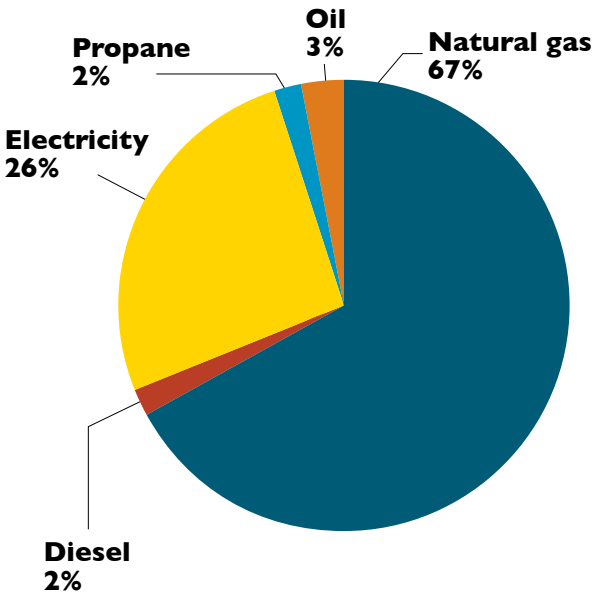


**Figure 2.8: Ontario's buildings sector energy mix, 2014**

Source: Energy use data from Statistics Canada – Catalogue no.57-003-X.

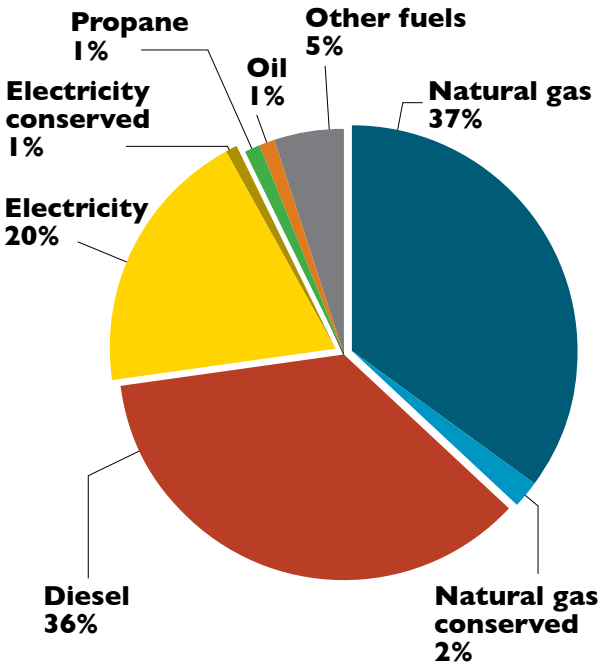


**Figure 2.9: Fuel used and conserved in Ontario in 2014**

Note: The figure totals to 103 per cent to account for conserved fuel. Fuel conserved only includes fuel conserved by way of Ontario's utility-funded programs, and is calculated from a 2006 base year (i.e., it is an addition of all utility-funded conservation measures from 2006 to 2014).[14]

'Other Fuels' refers to coke oven gas, petroleum coke, steam, etc. (These fuels do not form part of ECO's reporting mandate under the *Environmental Bill of Rights, 1993*.) 'Other Fuels' also captures any statistical difference between the total energy use data reported by Statistics Canada and the individual fuel use they report.

Source: Energy use data from Statistics Canada – Catalogue no.57-003-X and IESO. Conservation data from Enbridge and Union Gas' 2015 Demand Side Management reports and from IESO.

Key natural gas policies unveiled in 2015 were:

1. a new regulatory framework for gas conservation by utilities for 2015 to 2020;
2. a study to determine how much gas can be conserved in Ontario; and,
3. a policy to expand gas service to rural and remote areas not currently served by gas pipelines.

The Ontario Energy Board established the 2015-2020 regulatory framework for natural gas demand-side management (DSM) in late 2014, just days before its start date. Among new rules and procedures, the framework adds 15 per cent to the monetary benefits when evaluating the cost-effectiveness of conservation programs. This additional 15 per cent recognizes the environmental, climate and other non-energy benefits of conserving natural gas.

The new framework has initial targets to increase annual gas savings about 25 per cent. The gas conservation framework's budget has doubled to about $116 million per year, a total of $699 million[15] for the six years.[16] This is less than a quarter of the electricity conservation budget, although in 2014, the imbalance was even greater, with electricity conservation spending at six times the level of natural gas conservation spending.

The Minister of Energy required the Board to undertake an achievable potential conservation study to determine the amount of gas savings that can feasibly be acquired, assuming certain technical, budgetary and other influencing factors. (A similar study is being conducted for electricity.) The Board is also to consider: how the benefits of carbon reduction should be used to screen programs for approval; and, how carbon reduction should be considered in setting the utility conservation budgets in the new framework.

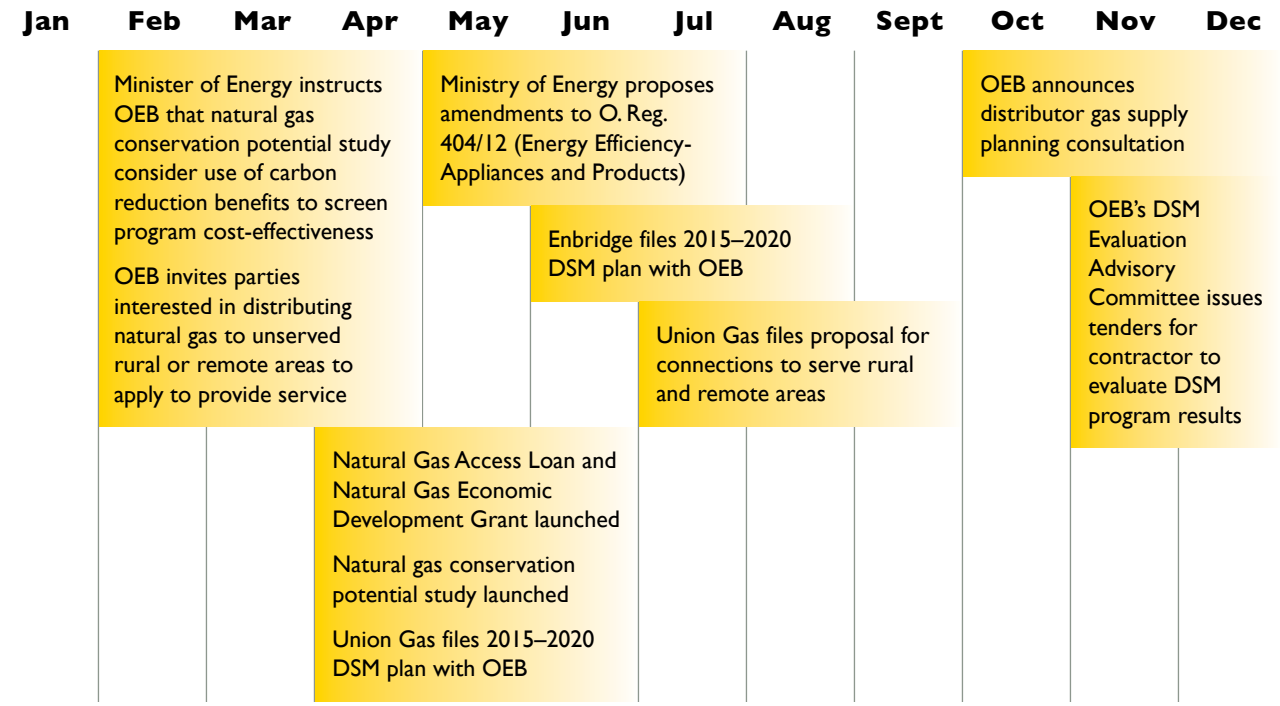


**Figure 2.10: Key natural gas initiatives in Ontario in 2015**

The government wishes to see natural gas provided to some currently unserved areas. In February 2015, the OEB invited parties interested in distributing natural gas to these areas to apply to provide service. Shortly after, the government announced a $200 million Natural Gas Access Loan and a $30 million Natural Gas Economic Development Grant for the purposes of economic development, energy diversification and support for agriculture in these communities. Union Gas applied for approval to connect up to 30 rural and First Nation communities to the gas grid.

Natural gas related initiatives in 2015 are described in more detail in Appendix A.

### 2.4.3 Electricity: Respectable Conservation Performance

**Electricity** provided 20 per cent of Ontario's energy in 2014 (see Figure 2.9) with some 9 per cent of electricity supplied by natural gas generators in 2014; the other 91 per cent came from nuclear and renewable sources (see Figure 2.11). Due to the closure of the last of Ontario Power Generation's coal plants in 2014 and the growth of renewables, Ontario has low carbon electricity and cleaner air — 2015 was the first year with no smog days recorded. Although renewable generation is growing quickly, the proportion of natural gas-fired electricity is expected to grow when nuclear units go offline for refurbishment or shut down.

**Due to the closure of … coal plants … Ontario has low carbon electricity and cleaner air — 2015 was the first year with no smog days.**

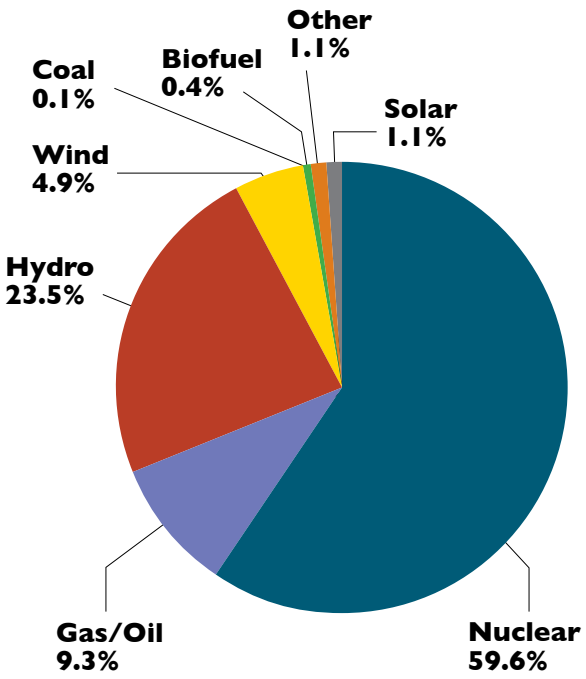


**Figure 2.11: Ontario's electricity generation by fuel type (2014)**

Note: This graph includes electricity production from both transmission- and distribution-system connected generators. The category Gas/Oil includes dual-fuel facilities that on occasion operate on oil. 'Other' refers to distribution connected resources that are not under an IESO contract or standard offer program, primarily distribution connected hydropower resources and some gas-fired generation (e.g., combined heat and power).

Source: IESO

Ontario ratepayers invest heavily in electricity conservation; electricity use and peak demand have been cut significantly. Ontario's summer peak demand dropped nearly 4,400 MW (17 per cent) from 2007 to 2014.[17]

## Ontario ratepayers invest heavily in electricity conservation; electricity use and peak demand have been cut significantly.

Electricity consumption dropped 6 per cent between 2007 and 2014, as it continued to decouple from economic growth.

On a per kilowatt-hour basis, Ontario pays more for every source of electricity generation than it pays for energy efficiency – efficiency typically costs $30 to 55/MWh which is equivalent to 3 – 5.5 cents per kilowatt-hour.[18] In 2014, electricity ratepayers paid $421 million for utility conservation programs that produced predicted lifetime energy savings of 14.6 billion kWh, for a net cost to ratepayers of 2.9 cents per kWh saved.[19] This is lower than any form of electricity generated; for example, it compares favourably to an estimated 6-9 cents per kWh for refurbished nuclear, 8-29 cents for gas-fired turbines and 13 cents for wind power.[20] In the short term, because the Independent Electricity System Operator (IESO) has contractual obligations to pay for amounts of nuclear, gas and renewable generation whether it needs the power or not, electricity conservation produces significant environmental and economic benefits only when it displaces natural gas-fired generation. This occurred one-third of the time in 2014.



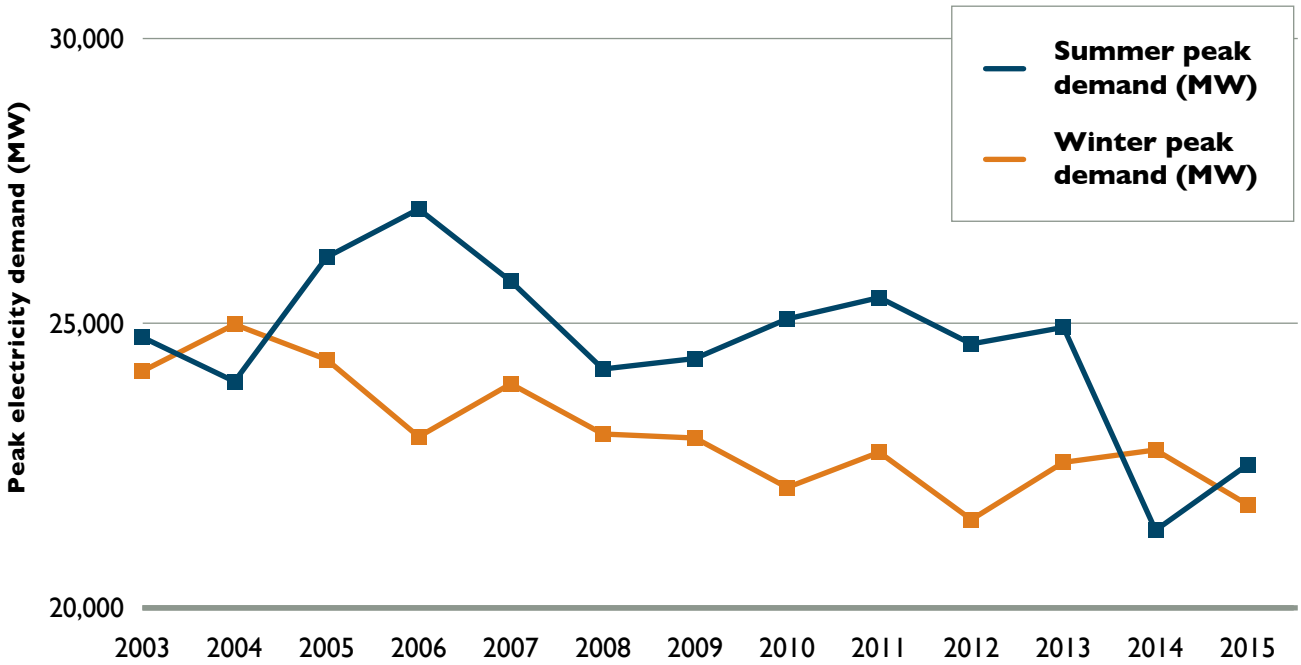


**Figure 2.12: Ontario's annual summer and winter peak electrical demand, 2003-2015**

Source: IESO

Electricity distributors had two conservation targets in the period 2011 to 2014: a total savings target and a peak demand reduction target. As a group, they met 109 per cent of the savings target, reducing total electrical consumption by 6,553 GWh, but only 70 per cent of the peak demand reduction target. Under the new conservation framework for 2015 to 2020, local electrical distributors have only a savings target, with little incentive to focus efforts in hours that will displace gas-fired generation, i.e., when they provide the greatest environmental benefit. The new framework acknowledges that most local distribution companies (LDCs) failed in meeting peak demand targets. The 2013 Long-Term Energy Plan commits Ontario to use demand response to meet 10 per cent of peak demand by 2025.[21] Demand response is being transitioned from a utility program approach to a market-based approach (a demand response auction) – according to the Ministry of Energy, this is a primary reason that peak targets were not assigned to LDCs under the new framework. The electricity conservation budget for 2015 to 2020 is $2.9 billion,[22] roughly $483 million per year, four times what Ontario spends on natural gas conservation.

The government, system operator and Ontario's energy regulator churned out a stream of electricity initiatives in 2015. From a conservation perspective, the most important changes dealt with electricity pricing, long-term electricity planning, and the delivery of electricity conservation and demand response programs. More details on these and other 2015 electricity policy developments can be found in Appendix B.

**Pricing:** Several changes affected how customers, particularly industrial consumers (see Appendix B-2), are billed for their electricity use. These pricing changes will influence how much electricity customers use, and at what time of day.

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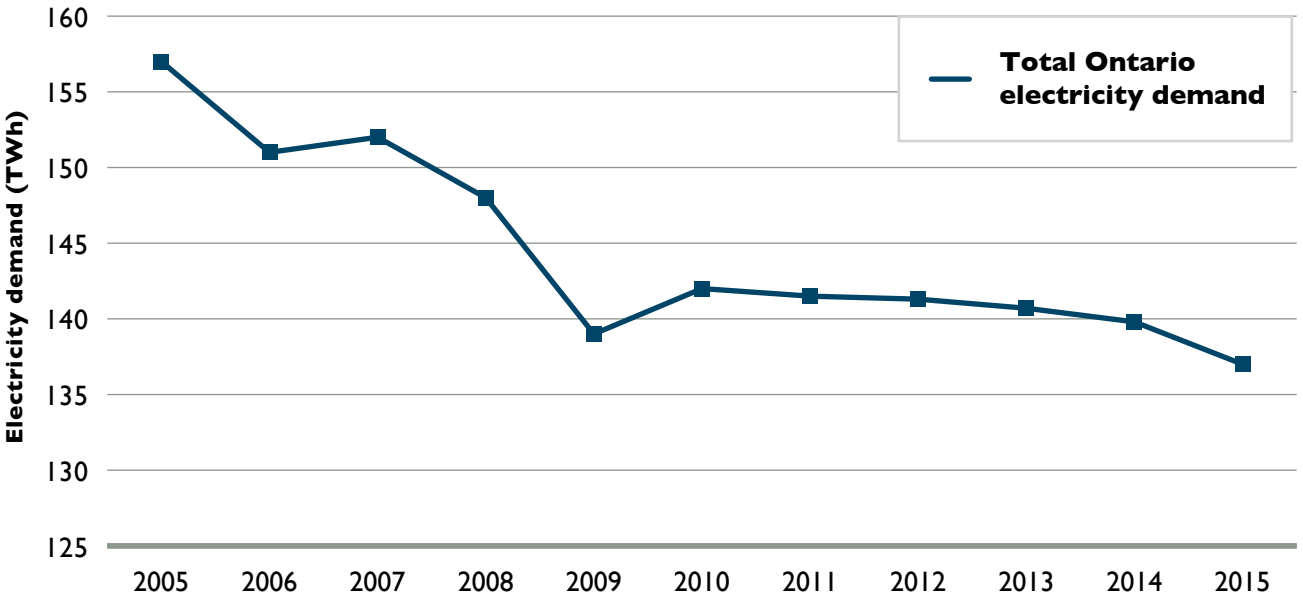



**Figure 2.13: Ontario annual electricity demand, 2005-2015**

Source: IESO

For residential customers, the Ontario Energy Board released a roadmap for the redesign of the Regulated Price Plan (RPP) over the next three to five years. Almost five million residential and small business customers are billed under the RPP under a time-of-use (TOU) structure whereby electricity used during peak hours costs more than off-peak times.

TOU is an important conservation tool because it encourages demand shifting which reduces peak demand and lessens the need for additional generation and transmission facilities in the long term. The OEB's roadmap sets out a five-point plan that is aligned with observations made in previous ECO reports on TOU pricing, and emphasizes using TOU pricing to minimize long-term system costs.

The OEB also announced a new policy for how delivery charges are set. These charges make up 20-30 per cent of the bill and recover costs of distributing electricity, such as wires, poles and transformers. The new rate design, which will take effect by 2019, replaces the current mixture of fixed charges and variable charges (tied to the amount of electricity consumed) with one wholly based on a fixed charge, regardless of the amount of electricity used. The ECO has previously commented that this approach could reduce the incentive to conserve electricity and result in higher peak demand and higher distribution costs in the long term.

Finally, residential customers saw the end of the 10 per cent discount on electricity use provided by the Ontario Clean Energy Benefit, although this was partially offset by the removal of the Debt Retirement Charge. The net impact for most customers will be a slight increase in price, which may slightly reduce electricity consumption.

**Long-Term Electricity Planning:** If passed, Bill 135, the *Energy Statute Law Amendment Act, 2015*, will formalize a new planning framework that determines how Ontario's electricity supply mix and long-term conservation targets are set. It proposes to replace the Integrated Power System Plan with the Long-Term Energy Plan to give the Ministry of Energy statutory authority for setting energy planning objectives. The IESO will provide technical advice prior to finalization of a plan, and the plan will not be subject to OEB approval. The minister's power to issue directives continues – for example on conservation programs or supply procurement – and the IESO or OEB will provide an implementation plan outlining how they will fulfill a directive.

**Conservation Program Delivery:** 2015 was a transitional year in electricity conservation program delivery to the new *Conservation First Framework*, which will give more responsibility to local distribution companies.

All local distribution companies submitted conservation plans to the IESO, and all but one plan was approved by the end of 2015. Of the entire group of 76 distributors, about two-thirds plan to meet their assigned targets and a third expects to exceed their targets. A mixture of legacy and new *Conservation First Framework* programs were delivered with half of the LDCs planning to launch *Conservation First Framework* programs in 2015 and all LDCs with approved plans had transitioned to the new framework's programs by January 2016. One type of conservation program (demand response programs) has been transitioned away from a program approach to a market-based approach overseen by the IESO, and this transition was completed in 2015. The IESO held the first auction to procure demand response capacity in December 2015.

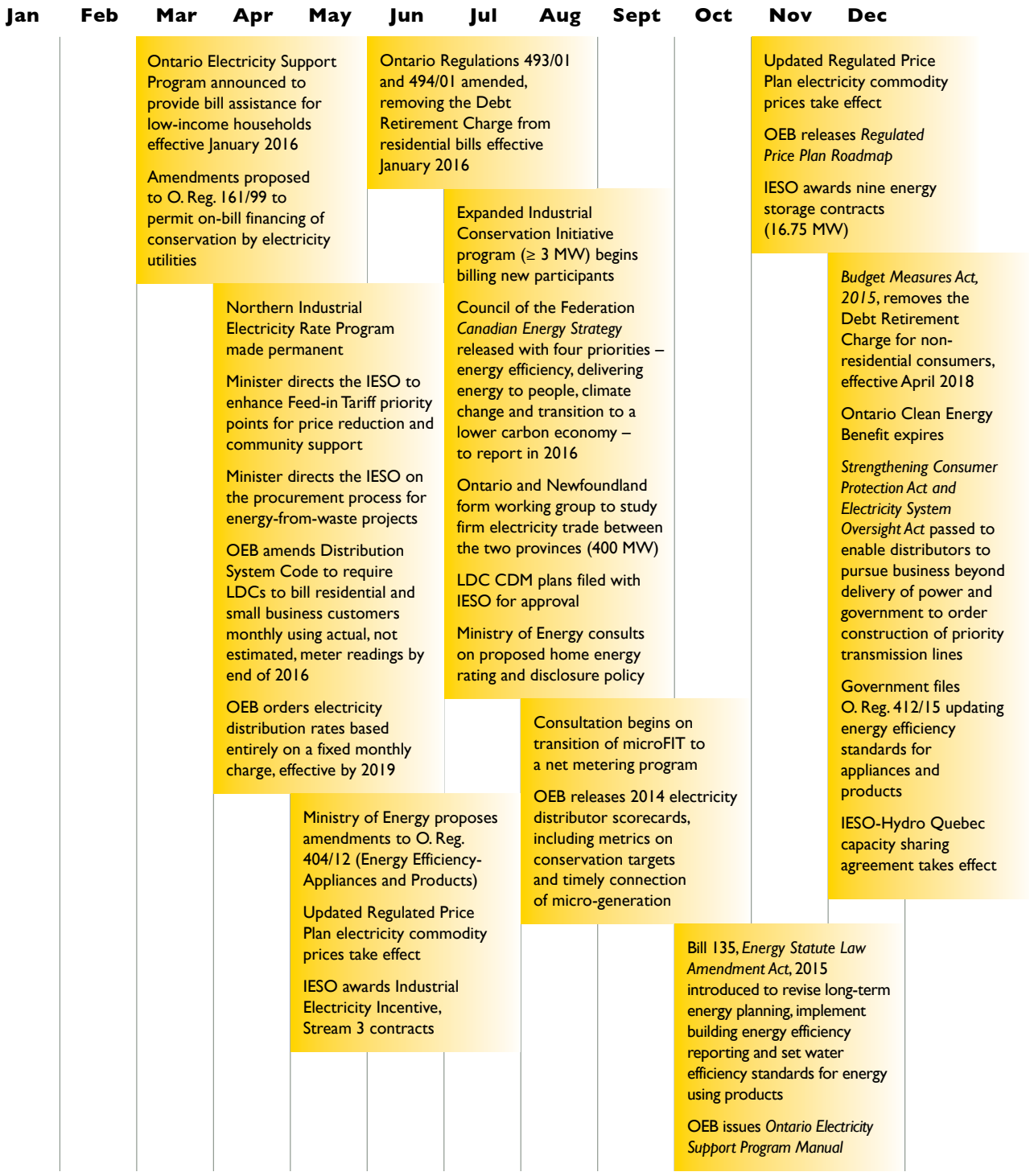



**Figure 2.14: Key electricity initiatives in Ontario in 2015**

### 2.4.4 Oil and Propane: Minimal Progress

As in years past, a lack of policy or programs characterized the government's efforts to conserve oil and propane use. This year, as in some past years, amendments to Ontario's product energy efficiency regulation (O. Reg. 404/12) included enhanced efficiency standards for oil and propane appliances and products.

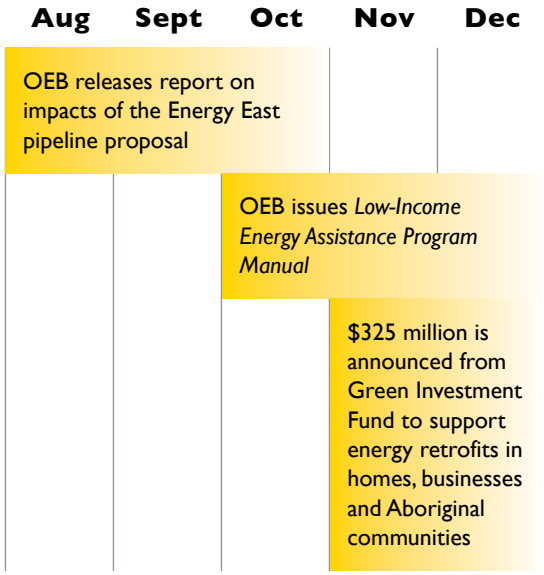



**Figure 2.15: Key oil and propane initiatives in Ontario in 2015**

### 2.4.5 Other Fuels: No Progress

As in years past, a lack of new plans or programs and inactivity characterized the government's efforts to reduce other energy use, (e.g., coke and steam) although there was activity to reduce the use of certain types of coal for reduced GHG emissions in certain energy intensive industries.

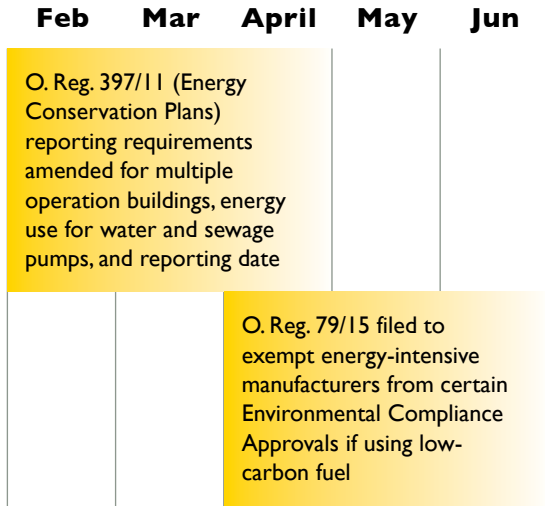



**Figure 2.16: Key 'other fuels' initiatives in Ontario in 2015**

## 2.5 Did the Government Meet its Conservation Targets?

Ontario government progress on its conservation targets was mixed at best. We gave one A, two Bs, one C+, two Ds, and one F. In three cases, it was too early to receive results and award a grade on target performance. Here is the ECO's take on how ministries, agencies and utilities did (see explanatory notes below table):

**Table 2.1: Ministry of Energy Conservation Scorecard**

| | |
|---|---|
| **Target** | **20 per cent energy efficiency improvement in Ontario by 2020.** |
| **Metrics** | Poorly defined metric (lacking baseline and methodology). |
| **Activity** | Target contained a five-point plan of measures to achieve 20 per cent: enhancing efficiency in building codes; increasing products covered by efficiency standards; adopting green building policies for government-funded construction of facilities; providing homeowners with access to audits and retrofits. |
| **Reporting** | None.<br>The ministry advised this year, for the first time, that this target is outdated and the ministry is not reporting on it.<br>The ministry states the target has been replaced by Council of the Federation's 2015 *Canadian Energy Strategy* with the goal to promote efficiency (but no reference to the 2008 target). |
| **Results** | Results not supplied and progress undetermined.<br>Some savings will have resulted from Ontario *Building Code, Green Energy Act* product standards, home energy retrofit program.<br>The ministry promised a home retrofit program results report but never provided it. |

| Target Timeline Expended | Target Realization | Grade |
|---|---|---|
| 12-year timeline (2008-2020), 67 per cent expended. | Unknown due to lack of reported data.<br>The target may or may not be met.<br>ECO assigns a low score because of poor reporting of savings from codes, standards and the home retrofit program, and the ministry's failure until this year to advise ECO that it does not intend to report on progress toward the target. | F |

*(continued)*

**Table 2.1: Continued**

| | |
|---|---|
| **Target** | **Reduce carbon intensity of transportation fuels by 10 per cent by 2020.** |
| **Metrics** | Excellent metric – clear, measurable, relevant. Mirrors California with whom Ontario signed an agreement to co-operate on implementation. |
| **Activity** | Ministry held stakeholder workshop/seminar and consulted with California.<br>Province committed to the standard in 2007's *Go Green: Ontario's Action Plan on Climate Change*.<br>No compliance pathways and reporting developed as California has done but other Ontario ministries administer low carbon fuel policies. |
| **Reporting** | None. |
| **Results** | No results have been supplied by the Ministry of Energy, and progress is undetermined.<br>Some results in reducing carbon intensity have been achieved from three policies administered by other ministries: ethanol blend gasoline mandate; biodiesel blend diesel mandate; and, EV sales incentive program, but limited data has been provided.<br>The Ministry of the Environment and Climate Change advises the 5 per cent ethanol mandate for gasoline reduces annual GHG emissions by 800,000 tonnes, and the Greener Diesel regulation (2017 mandate of 4 per cent diesel blend be bio-based with this component having 70 per cent lower GHG emissions than petroleum diesel) will reduce annual GHG emissions by about 600,000 tonnes. |

| Target Timeline Expended | Target Realization | Score |
|---|---|---|
| 13-year timeline (2007-2020), 69 per cent expended. | Unknown due to lack of reported data. No data on the carbon intensity of the total gasoline and diesel pool (and other alternative motor fuels and blend stocks) has been provided.<br>At this late point, ECO believes the target will not be met. | D |

**Table 2.2: Ministry of Transportation Conservation Scorecard**

| | |
|---|---|
| **Target** | **1 in 20 vehicles driven in 2020 be an EV.** |
| **Metrics** | Excellent metric – clear, measurable, relevant. |
| **Activity** | Two grant programs and green lane congestion policy implemented to support target.<br>Mid-term adjustments to grant funding made to increase program uptake.<br>Public charging station funding recently announced. |
| **Reporting** | Annual verified results reporting to ECO.<br>No ministry analysis of results provided. |
| **Results** | Results show modest progress.<br>(Assuming 8 million light-duty vehicles in Ontario in 2020; target will require 400,000 EVs. Currently less than 5,000 are EVs). |

| Target Timeline Expended | Target Realization | Score |
|---|---|---|
| 11-year timeline (2009-2020), 64 per cent expended. | ECO believes, based on results to date, the target will likely not be achieved. | C+ |

Explanatory Notes for Tables 2.1 to 2.4

ECO is tracking implementation and assessing program/policy effects against the following indicators:

**Metrics** – have indicators (targets) been set that are relevant, measureable, comprehensible, and at sufficient level of detail?

**Activity** – are demonstrable resources and activities being delivered to support target achievement (e.g., policy implemented, programs exist, methodologies for measurement have been created)?

**Reporting** – are activities being monitored and results verified (a ministry, agency or third party is collecting data, tracking progress and following a verification protocol)?

**Results** – are outcomes based on available data expressed quantitatively (e.g., GWh savings of electricity) or qualitatively (e.g., changes in behaviour/technology/practices/markets like number of EV purchase grants disbursed, number of high efficiency homes built) and is this made publicly available or supplied to ECO on request?

ECO then examines **progress toward the target**, assessing: the ratio of the total original target time period to the years remaining to achieve the target; the realization rate that examines the ratio of the results achieved versus results expected; and, estimates whether the target is likely to be achieved. ECO then assigns a letter grade for overall performance considering all the above factors.

**Table 2.3: Treasury Board Secretariat Conservation Scorecard**

| | |
|---|---|
| **Target** | **Annual reduction of 5 per cent for the period 2009-2014 in each of vehicle fuel consumption, air travel, and energy used in government buildings against a 2006 baseline.** |
| **Metrics** | Excellent metric, clear, measurable, relevant. However, the target completion date was clarified (fiscal not calendar year) and changed during the reporting period. |
| **Activity** | Building retrofits, fleet and travel policy. |
| **Reporting** | Results are not independently verified.<br>Some ministry analysis of results provided. |
| **Results** | Results show overall target achieved, air travel target not achieved but vehicle travel and buildings targets exceeded (see Appendix C for a breakdown of performance by final end use). |

| Target Timeline Expended | Target Realization | Score |
|---|---|---|
| 6-year timeline (2009-14), 100 per cent expended. | Target exceeded overall. | B |

| | |
|---|---|
| **Target** | **Reduce GHG emissions from the Ontario Public Service by 27 per cent by 2020/2021, compared against a 2006 baseline.** |
| **Metrics** | Excellent metric – clear, measurable, relevant. |
| **Activity** | Multiple activities continue from previous target (above). |
| **Reporting** | Awaiting first year results. |
| **Results** | Target period commenced April 2015; first year results pending. |

| Target Timeline Expended | Target Realization | Score |
|---|---|---|
| 6-year timeline (fiscal year 2015/16 to FY 2020/21). | Awaiting first year results. | **Not yet possible to grade.** |

**Table 2.4: IESO and Utilities Conservation Scorecard**

| | |
|---|---|
| **Target** | **Use Demand Response to meet 10 per cent of peak demand in 2025. Procure 2,400 MW under current forecasts.** |
| **Metrics** | Excellent metric – clear, measurable, relevant.<br>2025 target will include savings from various demand response initiatives (e.g., Capacity Based Demand Response (CBDR) transitional program, Industrial Conservation Initiative program, time-of-use rates, residential demand response and others. |
| **Activity** | Demand response programs are being transitioned to a market based approach (i.e., capacity auction). |
| **Reporting** | Annual verified results reporting to ECO.<br>IESO analysis of results will be provided. |
| **Results** | Verified results supplied but several initiatives (e.g., auction process, residential and pilot demand response, expected changes to time-of-use rates) were still being developed in 2015.<br>Forecast 2025 peak, and hence target, may be subject to change. |

| Target Timeline Expended | Target Realization | Score |
|---|---|---|
| 12-year timeline (2013-25),<br>25 per cent expended. | Awaiting results from initiatives and new programs being developed.<br>As of 2014, 526 MW enrolled in transitional CBDR program. | **Not yet possible to grade.** |

| | |
|---|---|
| **Target** | **1,330 MW of provincial peak demand reduction by 2014, and 6,000 GWh of reduced electricity consumption 2011-14.** |
| **Metrics** | Excellent metric – clear, measurable, relevant. |
| **Activity** | Multiple programs were delivered. |
| **Reporting** | Annual verified results reporting to ECO.<br>OPA/IESO/OEB analysis of results provided. |
| **Results** | Verified results supplied. |

| Target Timeline Expended | Target Realization | Score |
|---|---|---|
| 4-year timeline (2011-14),<br>100 per cent expended. | 70 per cent of peak target achieved.<br>100 per cent plus of energy target achieved. | B |

*(continued)*

**Table 2.4: Continued**

| | |
|---|---|
| **Target** | **7 TWh of electricity reduction in 2020, due to conservation activities by distribution utilities between 2015-20.** |
| **Metrics** | Excellent metric – clear, measurable, relevant. |
| **Activity** | Multiple programs, policies and regulations in place and under development. |
| **Reporting** | Annual verified results reporting to ECO.<br>IESO analysis of results will be provided. |
| **Results** | Verified results not yet supplied. |

| Target Timeline Expended | Target Realization | Score |
|---|---|---|
| 6-year timeline (2015-20),<br>17 per cent expended. | Awaiting first year results. | **Not yet possible to grade.** |

| | |
|---|---|
| **Target** | **50 MW of electrical storage capacity by 2014.** |
| **Metrics** | Excellent metric – clear, measurable, relevant. |
| **Activity** | Minister's direction and RFP developed and issued. |
| **Reporting** | Annual verified results reported to ECO.<br>IESO analysis of results provided. |
| **Results** | Verified results supplied. |

| Target Timeline Expended | Target Realization | Score |
|---|---|---|
| 2-year timeline (2013-14),<br>100 per cent expended. | 100 per cent |  |

*(continued)*

**Table 2.4: Continued**

| | |
|---|---|
| **Target** | **1.7 TWh of electricity savings from transmission-connected customers by 2020.** |
| **Metrics** | Excellent metric – clear, measurable, relevant. |
| **Activity** | 2013 Long-Term Energy Plan committed that industrial customers would continue to have access to the Industrial Accelerator Program (IAP) (then referred to as Industrial Transmission Connected Energy Efficiency Program (ITCEEP), launched in 2010 and which produced meager savings). The IAP program was launched in June 2015 with enhancements added to the previous program. |
| **Reporting** | Annual verified results reporting to ECO.<br>IESO analysis of results provided. |
| **Results** | Verified results not yet supplied. |

| Target Timeline Expended | Target Realization | Score |
|---|---|---|
| 6-year timeline (2015-20),<br>17 per cent expended. | The updated IAP program started June 23, 2015.<br>As of 2014: 4 per cent (71 GWh) of target achieved from savings from previous ITCEEP program, it is unclear whether these results will count towards the 2015-2020 target. | D |



For more details on the individual targets, see Appendix C.

## Endnotes

1. Coal is included in Figures 2.2 and 2.3 in 'Other Fuels.' It represents coal used by industries. Ontario Power Generation closed its last coal-fired generating station in 2014.

2. Ontario's Energy Use (in Petajoules) by Fuel Type (2007-2014):

| Year | Natural Gas | Transportation Fuel | Electricity | Propane | Oil | Other Fuels | Total |
|---|---|---|---|---|---|---|---|
| 2007 | 892 | 909 | 551 | 40 | 41 | 192 | 2,625 |
| 2008 | 884 | 908 | 544 | 43 | 34 | 187 | 2,643 |
| 2009 | 801 | 897 | 511 | 38 | 34 | 152 | 2,433 |
| 2010 | 776 | 918 | 518 | 41 | 34 | 173 | 2,460 |
| 2011 | 835 | 919 | 518 | 49 | 36 | 171 | 2,528 |
| 2012 | 773 | 883 | 522 | 56 | 31 | 175 | 2,440 |
| 2013 | 860 | 946 | 522 | 40 | 33 | 134 | 2,534 |
| 2014 *(preliminary)* | 957 | 926 | 518 | 37 | 34 | 138 | 2,610 |

Note: The table above reports fuel demand for energy uses only, except in the case of propane.

Source: Energy use data from Statistics Canada – Catalogue no.57-003-X and electricity data from IESO.



Heating Degree Days – Toronto and Timmins, 2007-2014:

| Year | Natural Gas (PJ) | Heating Degree Days (Toronto) | Heating Degree Days (Timmins) |
|---|---|---|---|
| 2007 | 892 | 3,719 | 5,815 |
| 2008 | 884 | 3,836 | 5,968 |
| 2009 | 801 | 3,836 | 5,991 |
| 2010 | 776 | 3,501 | 5,212 |
| 2011 | 835 | 3,647 | 5,698 |
| 2012 | 773 | 3,215 | 5,151 |
| 2013 | 860 | 3,559 | 5,688 |
| 2014 *(preliminary)* | 957 | 4,103 | 6,502 |

Note: Heating degree days are the number of degrees that a day's average temperature is below 65°Fahrenheit (18° Celsius), the temperature below which buildings need to be heated.

Source: Energy use data from Statistics Canada – Catalogue no.57-003-X and IESO. HDD and CDD data from Environment Canada

**3.** Ontario Energy Board, Interim Decision and Order, EB-2011-0242 and EB-2011-0283, *An application by Enbridge Gas Distribution Inc. [and Union Gas Ltd.] for an Order or Orders approving and setting prices for purchase of biomethane*, p.10, July 12, 2012.

**4.** IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the *Fifth Assessment Report* of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, p.87.

**5.** Drew Shindell, article, *The Case for Urgent Action on Short-Lived Climate Pollutants*, p.83, no date. sites.nicholas.duke.edu/drewshindell/files/2015/01/Dr-SHINDELL-DUKE-University-v3.pdf

**6.** Navigant Consulting Ltd. (prepared for the Ontario Energy Board), report, *2015 Natural Gas Market Review Summary Report*, p.2, December 28, 2015.

**7.** Environmental Protection Agency Administrator Per Gina McCarthy, blog, *EPA Taking Steps to Cut Methane Emissions from Existing Oil and Gas Sources*, March 10, 2016. blog.epa.gov/blog/2016/03/epa-taking-steps-to-cut-methane-emissions-from-existing-oil-and-gas-sources/

**8.** PSE Healthy Energy, Science Summary, newsletter, *Climate Impacts of Methane Losses from Modern Natural Gas and Petroleum Systems*, November 2015. psehealthyenergy.org/data/SS_Methane_Nov2015Final.pdf; Tom Wigley, periodical (Climatic Change 108), *Coal to gas: the influence of methane leakage*, pp.601-608, August 2011.

**9.** Paul Balcombe et. al., The Sustainable Gas Institute, report, *Methane and $CO_2$ Emissions from the Natural Gas Supply Chain: An Evidence Assessment*, p.iv, September 2015.

**10.** Kingston and Kitchener own municipal utilities which distribute to some parts of their cities, and Natural Resource Gas Ltd. serves several communities in southwestern Ontario.

**11.** This amount does not include shareholder incentives received by the utilities for good performance against their performance targets. In 2014, a total of $16.5 million was paid to Enbridge and Union. See Appendix A for more information.

**12.** Enbridge Gas Distribution, report, 2014 *Demand Side Management Annual Report*, October 19, 2015; Union Gas, report, Final Demand Side Management 2014 Annual Report, December 4, 2015. The economic value of energy savings in future years is not discounted.

**13.** Ontario Energy Board, web page, *Consumer Information, Natural Gas, Natural Gas Rates - Historical*, accessed April 2016. www.ontarioenergyboard.ca/OEB/Consumers/Natural+Gas/Natural+Gas+Rates/Natural+Gas+Rates+-+Historical

**14.** Independent Electricity System Operator, information provided to ECO in response to ECO inquiry, September 2015. The natural gas conservation results were calculated by the ECO to allow for comparison with electricity conservation results, based on the following assumptions:

- an average life span of a natural gas conservation measure is 17 years (Enbridge uses this assumption in their 2014 DSM report);
- annual natural gas conservation savings are constant throughout the life of the measure; and
- conservation savings persist 100 per cent from 2006 to 2014.

**15.** The total DSM budget over 6 years is $824 million (if the maximum shareholder incentives for which utilities are eligible are included.) Utilities typically have not earned their maximum incentive.

**16.** Ontario Energy Board, decision and order, EB-2015-0029/EB-2015-0049, *Union Gas Ltd. and Enbridge Gas Distribution Inc. Applications for approval of 2015-2020 demand side management plans*, p. 1, January 20, 2016.

**17.** Data points are actual peak demand unadjusted for weather effects.

**18.** Ontario Ministry of Energy, report, *Achieving Balance – Ontario's Long-Term Energy Plan*, p.22, December 2013.

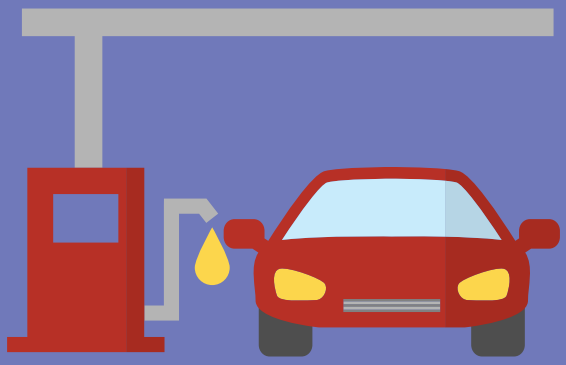
**19.** Independent Electricity System Operator, information provided to ECO in response to ECO inquiry, September 2015 (with additional calculations by ECO to compute total annual savings). The 2.9 cents represents the cost to ratepayers (for incentives and program administration) and does not include incremental cost of conservation measure paid by the program participant. The value of energy savings in future years is not discounted, so the reported cost per unit of energy saved is lower than that reported in Appendix B (3.7 c/kWh).

**20.** *Supra*, note 18.

**21.** The 2013 *Long-Term Energy Plan* forecasts that the 2032 conservation target of 30 TWh will result in peak demand savings of 5,868 MW from conservation programs and codes and standards. Peak demand savings from demand response resources, including time-of-use rates, the Industrial Conservation Initiative and IESO demand response capacity are in addition to this. The Minister of Energy's directive on the 2015-2020 *Conservation First Framework* encourages reduced demand during peak periods by instructing that conservation measures consider system value, including reductions at peak times.

**22.** This includes Global Adjustment funding of $2.2 million for distributor energy efficiency programs, $0.2 million for IESO demand response programs and $0.5 million for the IESO's Industrial Accelerator Program.

# 3 Transportation Fuel



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# 3.0 Transportation Fuel

## 3.1 Transportation: A Huge Challenge

Transportation is Ontario's largest source of greenhouse gas emissions[1] and is usually our largest energy use. In 2014, the transportation sector consumed 36 per cent of Ontario's energy (see Figure 2.4). Ontario's transportation sector is almost entirely reliant on fossil fuels. Our use of transportation fuels is higher than it was in 2007 and remains stubbornly high, although per capita fuel use is down (see Figure 2.3 and Figure 2.6).

**Transportation is Ontario's largest source of greenhouse gas emissions and is usually our largest energy use.**

In 2007, the government committed to reduce the carbon intensity of transportation fuels by 10 per cent by 2020.[2] To date, very little measurable progress had been made towards this target. Ontario needs a co-ordinated "cleaner, leaner, greener" strategy for all pieces of the transportation puzzle, including appropriate targets, transparency and incentives for land use planning, public transit, low-carbon fuels and vehicles, and active transportation. Ontario does not have such a strategy. The Ministry of Energy does not yet mention transportation fuel in its Long-Term Energy Plan.

Transportation fossil fuel is likely the toughest type of energy to conserve. But while the challenges associated with shifting the transport sector away from its high fossil fuel use are complex and multifaceted, they are not insurmountable. There are promising developments in three key areas: land use planning, shared transportation, and electrification.

## 3.2 What Matters Most: Land Use Planning

To a large degree, Ontario's transportation fuel use is a function of past land use and infrastructure decisions, especially in southern Ontario.

In the Greater Golden Horseshoe, where about 63 per cent of Ontario's population lives,[3] passenger transportation fuel demand is largely driven by urban sprawl. For decades, urban growth patterns have been designed to have mobility needs met primarily through personal motor vehicles, and to keep employment and residential land uses apart.

**In the Greater Golden Horseshoe, where about 63 per cent of Ontario's population lives, passenger transportation fuel demand is largely driven by urban sprawl.**

The Greater Golden Horseshoe has seen rapid rates of growth since the end of World War II, especially since the 1990s when the population began to grow by 100,000 to 120,000 people every year. … between 1971 and 2006, the region's urban footprint more than doubled. Much of the recent urban growth has been in the form of low-density, car-dependent suburbs, providing many residents with affordable, single-detached homes. However, this form of development, often known as urban sprawl, has resulted in loss of farmland, traffic congestion, deteriorating air and water quality, impacts on human health, and the loss of green space, habitats and biodiversity.

*Crombie Report, p.8-9*[4]

Sprawl accelerated from 1991-2001, when the urban area increased by 26 per cent, even faster than population growth (19 per cent).[5] Low density suburbs have often been built with little employment, at densities that cannot support good public transit, and with little consideration for active transportation. As a result, within the Greater Golden Horseshoe, 90 per cent of trips in the outer ring municipalities[6] (including, for example the cities of Barrie, Brantford, Guelph, Kawartha Lakes, Orillia and Peterborough) and 78 per cent of trips in the inner ring municipalities (i.e., Hamilton, Toronto, Durham, Halton, Peel and York) are made by automobile.[7] Average vehicle occupancy is low. During the morning commute, when congestion across the region is most problematic, there is an average of 1.1 people per automobile.[8]

As shown in Figure 3.1, per capita greenhouse gas emissions from transportation fuels are higher in the outer ring of the Greater Golden Horseshoe, where urban densities are lower than in the denser inner ring.

Urban sprawl has contributed to the loss of biodiversity in southern Ontario.[9] In addition, the car dependence caused by sprawl is harmful to human health. Inhaled vehicle-related air pollutants lead to cardiovascular and respiratory diseases as well as cancer.[10] Car dependence increases the stress of congestion and long commutes and reduces physical activity, which is correlated with higher rates of obesity and diabetes.[11]

Building southern Ontario this way was a choice, not a necessity. It was permitted and facilitated by public policy, and it can be changed by public policy.

## Building southern Ontario this way was a choice, not a necessity.

Population in this region is forecast to grow from about 9 to 13.5 million over the next 25 years, an astonishing increase of almost 50 per cent.[12] Where will these new residents live? How can they have affordable homes with a good quality of life? The Toronto metropolitan area already has Canada's longest average commutes,[13] which means that many people in the region have *very* long commutes indeed. With so many roads already at capacity, how much worse will congestion and air pollution be if millions more need to commute by private automobile?

Will we give our children a better future, or repeat the land use mistakes of the past?

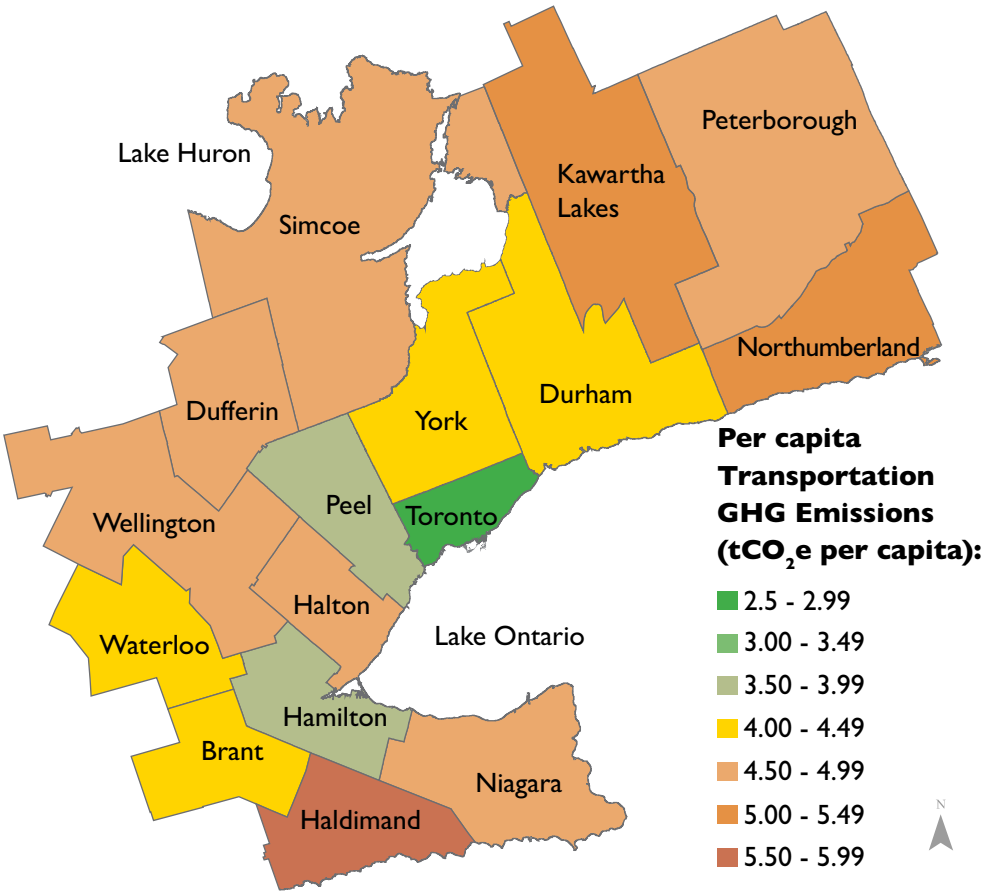


**Figure 3.1: Transportation greenhouse gas emissions per capita in the Greater Golden Horseshoe (2012)**

Source: Adapted from Advisory Panel on the Coordinated Review of the Growth Plan for the Greater Golden Horseshoe, the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan, *Planning for Health, Prosperity and Growth in the Greater Golden Horseshoe: 2015-2041* (2015), 138.



## Will we give our children a better future, or repeat the land use mistakes of the past?

### 3.3 Review of Land Use Plans: An Opportunity to Do Better

The provincial government has enacted a number of special purpose laws, plans and policies to direct development in the Greater Golden Horseshoe region, including four land use plans: the Niagara Escarpment Plan, the Oak Ridges Moraine Conservation Plan, the Greenbelt Plan, and the Growth Plan for the Greater Golden Horseshoe (the Growth Plan). These policies have had some success. Between 2001 and 2011, the population of the Greater Toronto and Hamilton Area[14] grew by 18 per cent but, unlike the previous decade, the urban area expanded more slowly, by 10 per cent.[15] Average lot sizes are also smaller in new subdivisions than before 2001.[16] It is a step in the right direction, but sprawl in the Greater Golden Horseshoe is still growing.

In 2015, the Ministry of Municipal Affairs and Housing, along with the Ministry of Natural Resources and Forestry, initiated a simultaneous review of the four land use plans. At the same time, Metrolinx is reviewing its Regional Transportation Plan (The Big Move), and the Ministry of Transportation is working on a multimodal transportation plan for the Greater Golden Horseshoe region.[17] These reviews offer Ontario a precious opportunity to get serious about land use in terms of our energy future, possibly in time to materially reduce transport fossil fuel dependence by 2050.

As part of these reviews, an advisory panel released an important report in December 2015, *Planning for Health, Prosperity and Growth in the Greater Golden Horseshoe: 2015-2041* (the 'Crombie Report'). Several of the report's recommendations are focused on creating compact, complete communities that provide local access to food, transportation, housing, recreation, education, retail and employment, by:

- Directing more new development to existing urban areas through intensification, and less to new greenfield areas
- Increasing the density of housing and job opportunities in new development to create well-designed, healthy and transit-supportive communities
- Establishing stronger criteria to control settlement area expansion
- Encouraging a greater mix of housing types, including affordable housing
- Protecting employment areas and supporting evolving economic activities.

*Crombie Report, p.12*[18]

These changes would be valuable across the entire, rapidly growing Greater Golden Horseshoe Region.

Living in complete communities has the potential to be better for most people; it is less expensive, healthier, less stressful, and provides more free time. With shops, schools, work and care facilities within easy access of homes, children could be more independent; seniors could be less isolated. A recent survey found that 81 per cent of people in the Greater Toronto Area would prefer to live somewhere walkable and with access to frequent rapid transit.[19] In contrast to post-war efforts to isolate land uses, recent research reveals that people value a diverse mix of land uses and housing types, including "a range of employment opportunities, high-quality public open space, a variety of transportation choices, and easy access to stores and services."[20] Allowing people to live closer to their places of work and other amenities could give them more free time, and increase their options to take public transit, walk or cycle.[21] It could also reduce their carbon footprint and need for personal motor vehicles. Not having to own a car could save people about $9,500 a year of after-tax income.[22] Less car-dependent communities could also save money and land that would otherwise be spent on parking, especially close to transit hubs and stations.

### 3.3.1 Enough Density for Transit

Ontario cannot realistically reduce transportation fossil fuel use if we keep building low density car-dependent suburbs.

The Growth Plan contains several important quantitative land planning targets. These targets, though an improvement on historical development patterns, still allow the majority of new development to take place in undeveloped areas. Within built-up areas, the Growth Plan sets a minimum intensification target of only 40 per cent for residential development, allowing

60 per cent of new development in greenfield areas, with a density target of only 50 residents and jobs per hectare. As Table 3.1 shows, this density will not support more than the most basic bus service (one bus every 20-30 minutes).[23] This is too infrequent for most transit users.

The government has permitted the majority of outer ring municipalities to weaken these low targets even further, by approving multiple greenfield densities below the Growth Plan minimum. One alternative target, for Haldimand County, was as low as 29 residents and jobs per hectare.[24, 25] The Minister also approved some very low intensification targets, as low as 15 per cent for Brant County.[26] As a result, present and future commuters in these areas will have to continue to commute by automobile. Only 2 per cent of commuters in the outer ring and 23 per cent in the inner ring used transit in 2011.[27]

To produce complete communities with reduced transport fuel dependence, the Plans should integrate more ambitious density and intensification targets, in order to better support planned and existing transit[28] and facilitate intensification around transit hubs. As well, greater efforts could be made to encourage low-rise developments that increase urban densities, such as laneway housing and secondary suites.[29]

**Table 3.1: Minimum Density Thresholds Capable of Supporting Different Types and Levels of Transit Service (for Areas Within a 5-10 Minute Walk of Transit)**

| Transit service type | Suggested minimum density |
|---|---|
| **Basic transit service** (One bus every 20-30 minutes) | **22 housing units per hectare/ 50 residents & jobs combined per hectare** |
| **Frequent transit service** (One bus every 10-15 minutes) | **37 housing units per hectare/ 80 residents & jobs combined per hectare** |
| **Very frequent transit service** (One bus every 5 minutes with potential for LRT or BRT) | **45 housing units per hectare/ 100 residents & jobs combined per hectare** |
| **Dedicated rapid transit service** (LRT or BRT) | **72 housing units per hectare/ 160 residents & jobs combined per hectare** |
| **Subway** | **90 housing units per hectare/ 200 residents & jobs combined per hectare** |

Source: Ministry of Transportation, *Transit-Supportive Guidelines* (2012), 24.

## 3.4 What We Can Do Faster: Transit and Shared Transportation

Land use changes can take a long time to have an impact. Ontario has opportunities for meaningful reductions in transport fuel consumption in the next 5 to 10 years from transit and other forms of shared transportation in larger urban areas where most people live.

**For the first time, Ontario is expected to spend more on transit ($3.6 billion) than on highways ($3.2 billion).**

To its credit, Ontario is already a leader in transit. Forty-four per cent of Canadian public transit ridership is in Ontario, and transit ridership in Ontario's 15 largest urban areas continues to grow.[30] Ontario is now making substantial additional investments in transit.[31] In 2015-16, for the first time, Ontario is expected to spend more on transit ($3.6 billion) than on highways ($3.2 billion) with $5.4 billion allocated for 2016-2017.

The federal government has also announced major investments in transit infrastructure; the 2016 budget allocated $3.4 billion to public transit over a three-year period. Ontario will receive $1.5 billion, the largest portion across the country.[32]

To get the most from these investments, and to make its transit infrastructure cost-effective to operate, Ontario and municipalities should (in addition to land use improvements):

- Match transit investments to reliable estimates of demand;
- Consider giving transit vehicles priority on busy arterials and highways, to make them faster and more reliable; and
- Consider on-demand shared transportation, especially in areas without enough density to support conventional transit.

When people have access to good transit, they use it.

### 3.4.1 Choosing the Right Transit

For transit to be affordable, reliable, efficient and effective in reducing fuel use, transit investments must be, among other considerations:

- appropriate to population density; and
- located to serve the greatest number of users.[33]

**Table 3.2: Ministry of Transportation Spending on Highways and Transit (in Millions of Dollars)**

| | Actual Spending | | | | | Interim | Estimates |
|---|---|---|---|---|---|---|---|
| | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 |
| TOTAL HIGHWAYS | 3,082.7 | 2,742.8 | 3,023.1 | 2,714.9 | 3,383.0 | 3,248.9 | 3,166.3 |
| TOTAL TRANSIT | 1,772.6 | 2,417.1 | 2,469.4 | 2,497.4 | 2,853.2 | 3,555.6 | 5,367.3 |

Source: Public Accounts, Public Estimates, and Ministry of Transportation

These best practices of transit planning are incorporated into Ontario's planning laws and related guidance documents,[34] but are not always followed.[35] The proposed Scarborough subway extension in Toronto is a prominent example of a major transit investment decision that was made, knowing it lacked adequate population density for economic operation.[36] Even the Toronto Sheppard subway line, which opened in 2002, will take many more years to justify the greenhouse gas emissions per capita that went into its construction. It is unclear how much it has reduced transport fuel consumption to date.[37]

### 3.4.2 Consider Priority for Transit Vehicles

Dedicated and priority transit lanes can greatly improve the speed and reliability of transit, and its connectivity with other forms of transportation. These are important factors for rider choice, and would increase the appeal of transit as compared to driving one's own vehicle.

**Dedicated and priority transit lanes can greatly improve the speed and reliability of transit.**

Ontario already has some successful dedicated transit lanes. Ottawa's Transitway (opened in 1983) was Canada's first bus rapid transit system on its own right of way. Since 1983, it has proven that buses can provide fast, reliable, inexpensive transportation if freed from congestion and adverse traffic signals.[38] Bus rapid transit networks have higher ridership and lower operating and capital costs than traditional bus systems,[39] as well as lower fuel use and emissions.[40] Several other Ontario cities have since implemented some form of bus rapid transit,[41] and they are also in use in other jurisdictions.[42] Mississauga and the Region of Waterloo are now building bus rapid transit, as well as dedicated light rail transit projects.[43] Toronto has dedicated streetcar lanes on St. Clair, Spadina and Harbourfront, and is considering them for King Street.[44]

It is possible to obtain the same benefits on existing highways without constructing a separate right of way, by allowing transit vehicles to share High Occupancy Vehicle (HOV) or High Occupancy Toll (HOT) lanes. (An HOT lane is the same as an HOV lane, except it also allows access to single-occupant vehicles for a charge.) During the 2015 Pan Am Games, Toronto's HOV lane pilot made GO bus trips during rush hour more reliable and 20-40 per cent faster.[45] However, taking a full lane away from busy highways already at capacity worsened traffic congestion for other drivers. On average, a controlled access freeway should be able to carry up to 2,400 cars per lane per hour,[46] or roughly 2,640 people. It would take an ambitious 48 buses an hour, each carrying 55 people, to replace the same capacity.

In principle, properly designed High Occupancy Toll lanes should provide rapid, reliable travel times for transit vehicles, without increasing congestion for other drivers.[47] One key is congestion-based pricing. For drivers who choose to drive alone but pay tolls, the price of access to the HOT lane has to vary enough over the day to persuade some to start their trips earlier or later than usual.[48] Experience in Minnesota suggests that HOT lanes with congestion pricing could smooth out the traffic flow enough to avoid stop and go bottlenecks in the HOT lane, increasing throughput and allowing traffic to flow smoothly at 65-80 km/h right through a somewhat longer rush hour.[49] This would benefit buses and all other vehicles in the HOT lane.[50]

Despite complaints about "Lexus lanes", U.S. research suggests that HOT lanes benefit all social classes, because people of all income levels have occasions when time-sensitive commitments make the toll worthwhile.[51] In addition, people of all income levels may benefit from faster, more reliable transit vehicles. Ontario intends to launch a HOT lane pilot later this year.[52]

A smaller scale alternative to special lanes is to give transit vehicles priority at signalized intersections.[53] A transit signal priority scheme is in use in some areas of Toronto, and a more sophisticated system is being developed at the University of Toronto.[54] The objective is to improve transit service reliability and to proactively divert transit passengers from stations and/or lines that are approaching capacity.

### 3.4.3 Shared Transportation, Beyond Transit

Ontario's personal transportation landscape is affected by the burgeoning car-sharing economy, for example, CarShare and Zipcar, and taxi alternatives Uber X and UberHop. If properly regulated, these might conserve transportation fuels by reducing the need for personal vehicle ownership[55] and parking space.[56]

Households without private vehicles use transit and active transportation more. Car sharing operations allow households to reduce their vehicle ownership and alter their transportation patterns, and contribute to an overall reduction in both fuel consumption and greenhouse gas emissions.[57] Shared vehicle systems supplement transit and active transportation use, by providing convenient options for trips to destinations that are not well served by transit and/or that require carrying cargo.[58] It is good to see the City of Toronto and the provincial government expanding their use of car share systems to replace part of their usual fleets.[59]

Municipalities and the Ministry of Transportation should consider whether real time on-demand shared transportation in smaller vehicles could provide a quick, privately-funded alternative to personal motor vehicles in areas with too little density for conventional transit. As described above, residents in low-density suburban areas have the highest consumption of transportation fuels because poor transit helps drive high levels of personal vehicle dependence.[60] Land use planning changes may eventually result in increased densities in these areas, but they don't help existing residents with their mobiliity needs in the shorter term.

Any form of personal transportation could bolster transit ridership if it helps provide the first and last kilometres of transit trips.[61] For this reason, Metrolinx aims to create mobility hubs that include connections at its stations to many forms of transportation, including bicycles and car-share vehicles.[62]

## 3.5 Potential Game Changer: Low Carbon Vehicles?

After 50 years of car-dependent development, Ontario will likely continue to need substantial motorized road transportation for mobility, freight and utility purposes. To meet this need with dramatically lower levels of fossil fuels, Ontario must supplement transit and active transportation with low-carbon fuels and vehicles.

**Ontario must supplement transit and active transportation with low-carbon fuels and vehicles.**

### Federal Emission Standards

Due to federal vehicle fuel efficiency standards, by 2025 the average fuel efficiency of new cars will have improved by 41 per cent compared with vehicles from 2010; similarly the fuel efficiency for passenger light trucks is projected to increase 37 per cent.[63] As a result of these regulations, Environment Canada has estimated the fuel savings over the lifetime operation of all 2011 to 2016 model year vehicles sold in Ontario to be 9.9 billion litres of gasoline, with a corresponding reduction of 32.6 Mt of greenhouse gases.[64] Fuel savings from 2017 to 2025 are an estimated 26.6 billion litres with greenhouse gas reductions of 61.7 Mt relative to standards for the 2016 model year.[65] Given that the average Canadian vehicle is not replaced until it is nine years old,[66] the impact of these regulations will be reflected gradually.

With regard to heavy-duty vehicles within Ontario, the federal standards are estimated to result in a reduction of 1.7 billion litres of diesel and 4.6 Mt of greenhouse gas emissions over the lifetime operation of vehicles manufactured between 2014 and 2018.[67] Nevertheless, anticipated economic growth and a continued reliance on trucking to move goods means that freight emissions, in absolute terms, are projected to continue increasing in the future.[68]

Federal standards for improved fuel efficiency will help somewhat as new vehicles replace old ones (see text box), but they could be supplemented by a California-style low-carbon fuel standard. In 2007, Ontario committed to establishing a low carbon fuel standard, which it expected would reduce the carbon intensity of transport fuels by 10 per cent by 2020. To date, no standard has been put in place and the Ministry of Energy appears to have effectively abandoned the target. The ECO has twice suggested that this responsibility be shifted to the Ministry of the Environment and Climate Change.[69]

Some initiatives, however, have been undertaken by the Ministry of the Environment and Climate Change that are designed to reduce the carbon intensity of transportation fuels. As of 2007, gasoline sold in Ontario is required to contain five per cent ethanol.[70] As well, in April 2014 MOECC filed a Greener Diesel regulation that requires diesel sold in Ontario to have a minimum of 2 per cent renewable content; this portion must be 30 per cent less greenhouse gas intensive than regular diesel. By 2017 these requirements will increase so that 4 per cent of the total volume will be 70 per cent less emissions intensive than standard diesel. The percentage reduction across the entire transportation fuel pool is likely, however, to be very minimal given the low blending percentages.[71]

Despite the lack of provincial leadership, several lower-carbon transportation technologies are competing for investment and market share, including compressed natural gas, biodiesel, hydrogen and electrification.

### 3.5.1 Electrification

Around the world, there is a growing recognition of the critical role electric vehicles (EVs)[72] will play in the global shift to a low-emissions transportation future.[73] Numerous countries made commitments, within their Intended Nationally Determined Contributions to the Paris Agreement on Climate Change,[74] to enhance the development and uptake of EVs.[75] Several national and subnational governments have recently established EV targets, and implemented policies to promote awareness, sales, and innovation of electric vehicles.[76] The impact of these initiatives can be seen in Figure 3.2, which shows the rapid growth in annual EV sales in major markets since 2009. While total numbers are still small (in 2014, EVs represented less than 0.5 per cent of annual passenger car sales globally)[77], uptake is growing quickly. EV sales worldwide in 2015 were approximately 500,000 vehicles and the millionth EV was sold in September 2015.[78] New, lower cost plug-in models have been announced by several car makers, including Ford, GM and Tesla.[79]

### 3.5.2 Huge Potential for Ontario

Ontario is exceptionally well placed to electrify transportation, because of our widely-available, low-emission electricity supply with current ample extra capacity (see Appendix B). Aggressive electrification of the sector could significantly reduce fossil fuel consumption and greenhouse gas emissions, as well as improve air quality and human health. A 10 per cent annual increase in electric passenger vehicle sales to 2020, then stabilized at one per cent of total sales, would result in approximately 45,000 EVs on the road

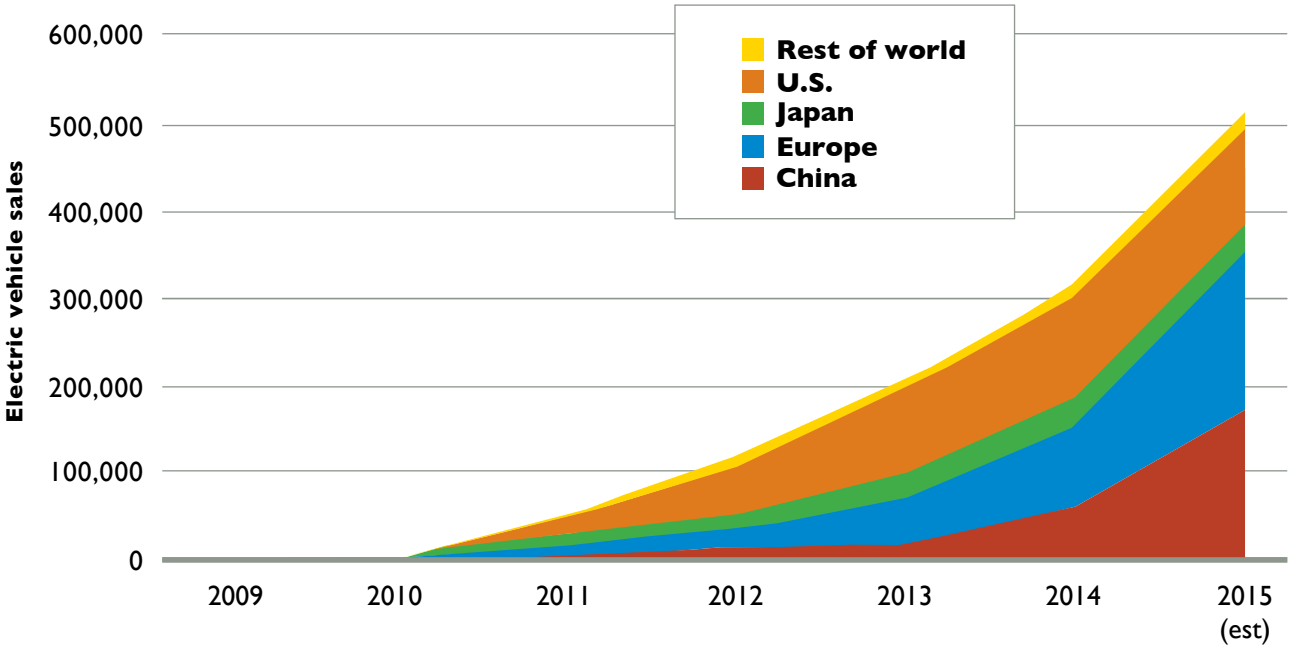


**Figure 3.2: Annual global electric vehicle sales**

Source: Adapted from Nic Lutsey, *Transitioning to an electric vehicle fleet* (January 2016), Presentation made at the UN Foundation/Ceres Investment Summit on Climate Risk, New York City.

by 2050. This penetration would lead to a cumulative reduction of almost 4 Mt of greenhouse gas emissions and 1.77 billion litres of gasoline from 2015-2050.[80] Even one million electric vehicles would add only 2.2 per cent to Ontario's grid energy demand, well within the current surplus.[81]

Nevertheless, we lag behind other jurisdictions. Only 5,649 EVs are registered in the province,[82] and as of 2014 made up 0.05 per cent of Ontario's overall passenger vehicle population. Annual sales are increasing, however, and in 2015, EVs represented 0.83 per cent of passenger vehicle sales.[83] Although annual sales are increasing, Ontario is likely to miss its target to have 5 per cent of all passenger vehicles on the road in 2020 be electric. In 2009, the provincial government committed to lead the way by adding 500 EVs to the Ontario Public Service fleet by 2020. After seven of the eleven years, the Ontario Public Service (OPS) has only 70 electric vehicles, 14 per cent of its target.[84]

### 3.5.3 What Will it Take to Achieve this Potential?

Improved technology and recent provincial initiatives are making it easier to address barriers that have limited the uptake of electric vehicles. For example, local electrical distribution utilities may face load management challenges, and may require substantial control over when vehicles are charged. This could require technology to remotely manage vehicle charging times so that local transformers and similar distribution equipment are not overloaded by having too many cars charging at once or during peak periods.

For consumers, two key concerns relate to vehicle cost and range anxiety, (uncertainty around vehicle range and battery performance). Ontario has recently moved to help with each.

### 3.5.4 Personal Vehicles: Range Anxiety

While many citizens are aware of the environmental benefits of EVs, their perceived limited range and lack of charging infrastructure remain significant concerns.[85] [86]

Most car trips fall well within the range of battery-only vehicles, even in cold weather.[87] Nevertheless, range anxiety is a real concern and so having access to public or workplace charging stations helps to encourage EV uptake.[88] The availability of a workplace charging station is especially powerful; U.S. employees with access to charging at their place of employment are six times more likely to drive a plug-in EV.[89]

Such access should start to improve in Ontario. In December 2015, the province announced $20 million to support fast-charging public facilities along highways and in high-use areas (such as retail, hospitality, workplaces, condominiums and multi-residential buildings) in urban centres.[90] The 2016 federal budget also promised accelerated capital cost allowance for electric vehicle charging stations.[91]

**The Ontario Public Service (OPS) has only 70 electric vehicles, 14 per cent of its target.**

### 3.5.5 Personal Vehicles: Cost

Historically, electric vehicles have had a substantially higher up-front expense – due primarily to battery costs – relative to a comparable gasoline car.[92] However, as shown in Figure 3.3, the number of EVs purchased has increased as battery costs have declined.

The upfront expense can be offset over time by EVs' much lower operating costs, especially if charged off-peak. Depending on electricity and gasoline prices, it can cost $2.74 to drive 100 kilometers in a battery-only electric vehicle in Ontario, versus $10.77 for a compact gasoline-powered car.[93] Annual fuel cost savings have been estimated at $1,400.[94] Maintenance costs are also lower as the battery and electronics typically require minimal attention and there are fewer moving parts.

In order to build a bridge to this new technology, some jurisdictions, including Ontario, temporarily subsidize the initial purchase of electric vehicles, and home/work charging stations. By December 31, 2015, the Ministry of Transportation had provided 4,594 EV purchase rebates ranging from $5,000 to $8,500, depending on vehicle battery size.[95] In February 2016, the government increased the rebate to $6,000 to $10,000 (depending on the vehicle model), with an additional $3,000 for EVs with larger battery capacities and an additional $1,000 for vehicles with five or more seats. A $3,000 cap exists on rebates for high-end vehicles.[96]

Such incentives may have to remain stable for several years until electric vehicles can compete in the mainstream market without them.[97] Premature cancellation of subsidies can seriously damage electric vehicle uptake, as illustrated for British Columbia in Figure 3.5.

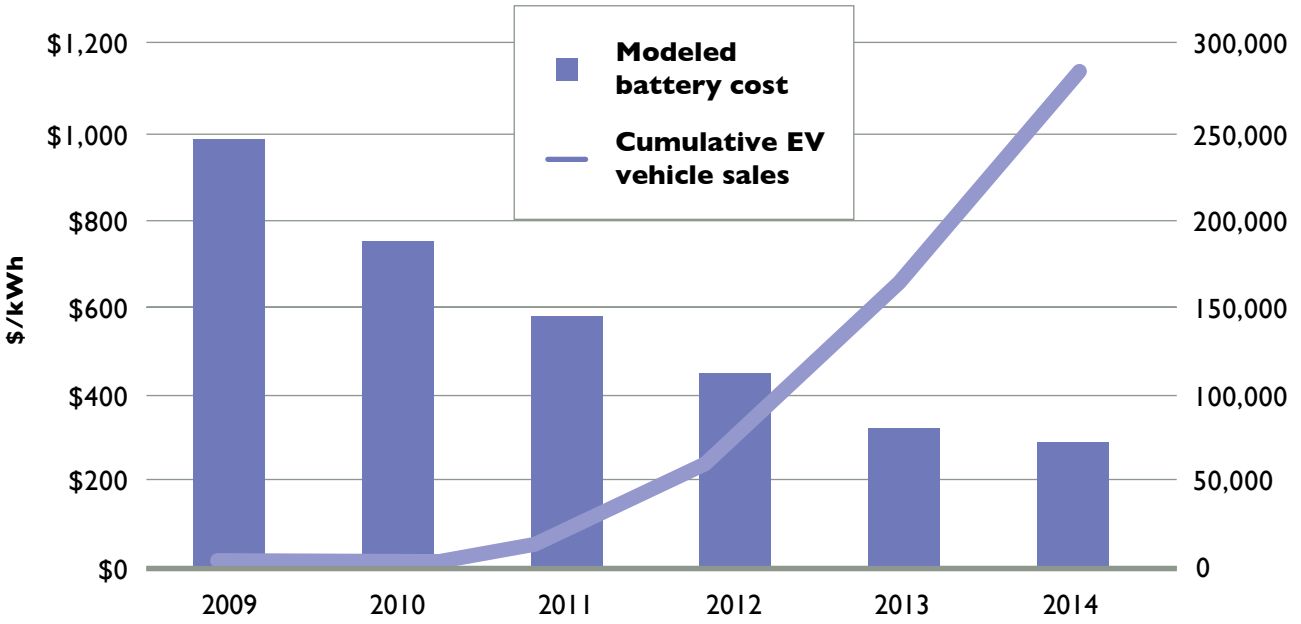


**Figure 3.3: Cumulative electric vehicle sales and battery costs in the United States**

Source: Adapted from U.S. Department of Energy, *Revolution…Now. The Future Arrives for Five Clean Energy Technologies – 2015 Update* (November 2015), 14.

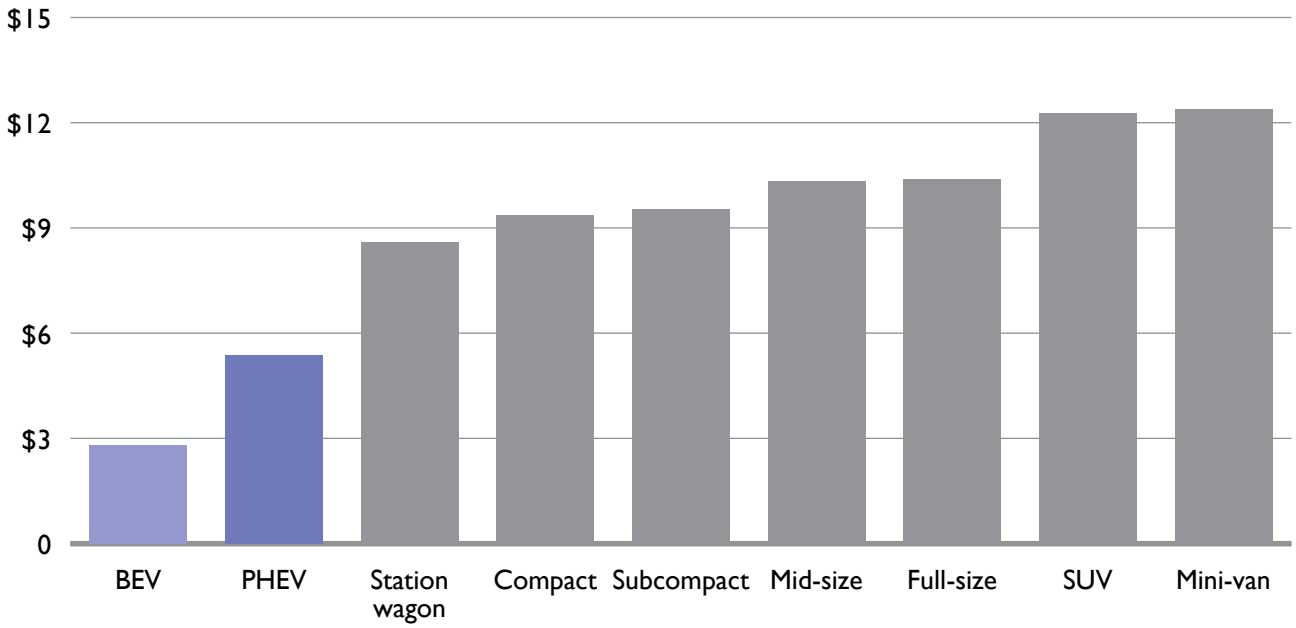


**Figure 3.4: Average cost to drive 100 kilometers in Ontario (BEV – Battery Electric Vehicle; PHEV – Plug-in Hybrid Electric Vehicle)**

Source: Plug'n Drive, (2016). All figures are based on NRCan Fuel Efficiency figures for 2015, $1.00/litre of gasoline, assuming 100 kilometers of driving and off-peak electricity pricing in Ontario.

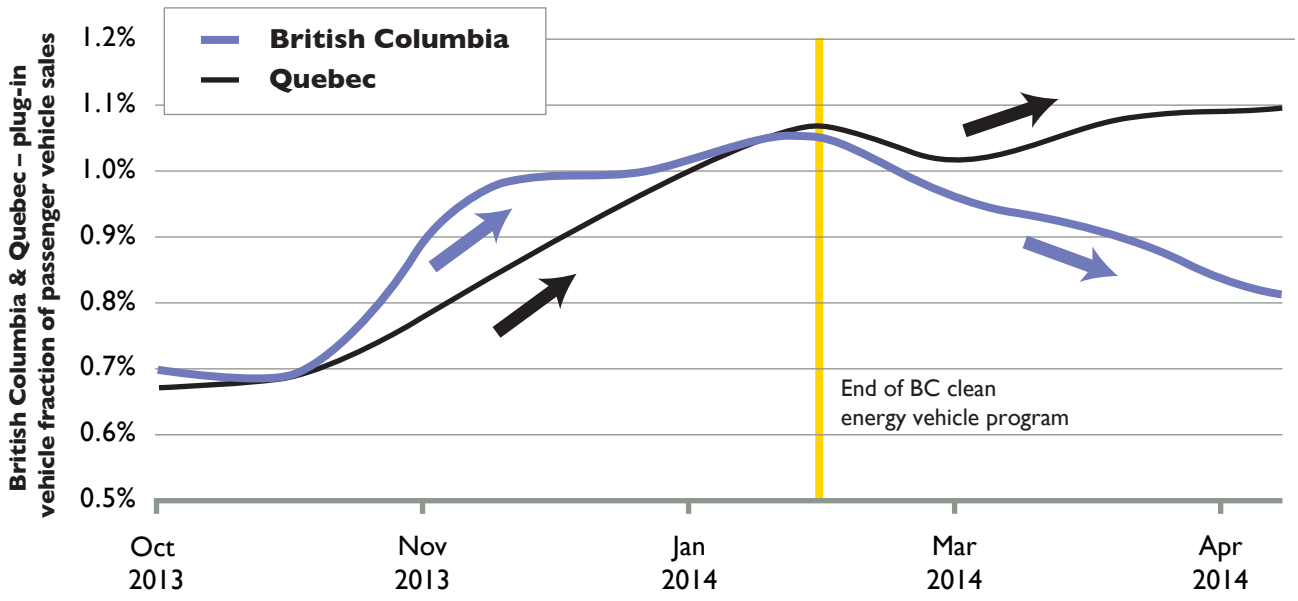


**Figure 3.5: Fraction of passenger vehicle sales that are plug-in for Quebec and British Columbia**

Source: Adapted from Electric Mobility Canada, *Submission to the British Columbia Discussion Paper – Climate Leadership Plan, July 2015* (2015), 5.

### 3.5.6 Personal Vehicles: Complementary Measures

If Ontario is serious about its five per cent electric vehicle target, other policy measures should be explored to complement the purchase incentives and public charging infrastructure grants. U.S. research shows that having a range of consumer incentives increases early EV adoption, such as preferential parking or access to priority lanes such as Ontario's proposed HOT lane.[98] These incentives would not be necessary or appropriate once electric vehicles are competing successfully in the mainstream vehicle market.

The Ministry of Municipal Affairs and Housing should consider amending the Building Code to require large commercial and residential buildings and parking facilities to provide charging facilities, and to require that single-detached dwellings be built EV ready, as some other jurisdictions do.[99] Retrofitting existing buildings and parking facilities to accommodate EV charging can be both expensive and complicated, while designing it in is cheap. For example, a basic rough-in designed into a single-family residence (a conduit from the garage to the electrical panel) costs about $125. For about $600, a fast-charging 150 amp service can be included.[100]

Electric vehicles benefit our electrical system and urban air most if they are charged off-peak. Ontario's current system of time-of-use electric pricing does not provide enough incentive to ensure this. In a recent study, 50 per cent of the participants charged their vehicles, at least in part, on-peak.[101] As the ECO has long requested, the Ontario Energy Board has begun work to redesign time-of-use pricing. Local electric utilities may need significant remote control of vehicle charging times to avoid overloading local transformers and other infrastructure. Car owners may also want convenient ways to control when their vehicles start charging, so that they can buy power off-peak, not the expensive power that may be flowing when they get home and plug in the car.

### 3.5.7 Beyond Personal Vehicles

Beyond personal vehicles, major opportunities exist for electric and other low carbon fleets, utility vehicles, and other forms of transportation.

In April 2015, Ontario committed funding to electrify more than half the GO Transit commuter rail network as part of its Regional Express Rail plan.[103] An electrified system will offer faster travel times and more frequent service, with air quality improvements and greenhouse gas reductions as co-benefits. Metrolinx is calculating the emissions reductions benefits associated with moving to electrification and will incorporate them into future decision making.[104]

#### What About Freight?

Ontario's robust freight transportation needs are largely met through fossil-fuel intensive trucking, due in large part to industry's preference for just-in-time delivery. High levels of public investment that have been made in road, as opposed to rail and marine, infrastructure have supported this preference.[102] We'll look at freight fuel conservation in a future report.

About five per cent of all road vehicles within the province – around 360,000 – are part of a service fleet.[105] This includes taxis, trade and urban delivery vehicles, utility vehicles, corporate and municipal fleets, including buses. Fleet vehicles are often heavily used and therefore may more quickly pay back the higher capital cost of electric or other low carbon vehicles from operational savings. One Ontario innovator is helping fleet managers identify the best applications for electric vehicles (see text box).

Ontario could, and should, track and disclose fleet energy use. Under O. Reg. 397/11, *Energy Conservation and Demand Management Plans*, [106] public agencies must report the annual energy consumption and greenhouse gas emissions of their buildings, and create energy conservation and demand management plans for them. As shown in Chapter 4, mandatory reporting of building energy use promotes energy conservation. This requirement could easily be extended to include broader public sector fleets (the Ontario government fleet's use of energy is already reported), and would likely contribute to an improved focus on their energy use.[107] Low carbon fleets can also improve air quality and reduce noise, both of which can benefit human health.

## Potential benefits for children's health make electrification of school buses appealing.

Some Ontario fleets are converting to lower carbon fuels other than electricity. For example, Emterra Group converted part of its waste management fleet to biodiesel, and another part to compressed natural gas. In 2015, Emterra opened a $50 million fast-fill compressed natural gas fuelling station and maintenance facility for heavy trucks in Peel Region.[116] [117]

### Using Data to Transition Fleets to Electric

FleetCarma helps fleet managers evaluate whether electric vehicles are suitable for their fleets and to monitor their usage once purchased. It provides direct in-service vehicle data-logging and tracking systems, and compares the total cost of ownership with gasoline vehicles.

FleetCarma tools help fleet managers monitor EV usage and battery charging patterns. For example, battery-only EVs are generally underutilized, and plug-in hybrid vehicles are often driven using gasoline, rather than electricity. Detecting these patterns allows them to be corrected.

The company is also working with electrical utilities to integrate EVs onto the grid; it currently has 17 smart-charging pilot projects underway around the world. Using FleetCarma's monitoring technology, EV owners and operators can set certain parameters with respect to their charging needs (i.e., the vehicle must be fully charged by 6:00 a.m.). A third-party, such as a local utility or building owner, is then also granted the ability to delay or reduce the charging as necessary. The result is that vehicle owners have a fully-charged vehicle at the time they require, but the timing of that charging is optimized for other factors such as the impact on the grid, the cost of power, and the carbon intensity of power generation.

### School Buses

Every school day approximately 16,000 school buses[108] – most of which are diesel powered[109] – ply the roads in Ontario. These buses emit carbon dioxide, and a wide range of other air pollutants.[110] This can unnecessarily expose children, who ride the buses, to fine particulate matter, nitrogen oxides and diesel particulate matter, which are harmful to human health.[111] Air pollution in diesel buses is better than it used to be, due to more stringent federal engine emission standards, the replacement of older buses, and driver education,[112] but the potential benefits for children's health make electrification of school buses appealing.

For the most part, school buses drive relatively short distances, stop frequently and are used for only a few hours a day. Such driving patterns suit electric vehicles. Conversion of the school bus fleet to electric may therefore represent an important opportunity; replacing each diesel school bus with an electric alternative could cut 23 tonnes of greenhouse gas emissions per year.[113] Other jurisdictions are currently exploring this opportunity. For example, within its recently released Transportation Electrification Plan, the Quebec government has allocated $30 million over a five-year period to support the acquisition of electric school buses by providing purchase rebates.[114] Some school districts within California are also buying electric school buses.[115]

## 3.6 Recommendations

Reducing the use of fossil-based transportation fuels is an enormous but essential challenge.

3

1. **The Minister of Transportation and municipal councils should reduce transportation fuel consumption by:**
   i. **Accommodating population growth within complete communities served by good transit and active transportation infrastructure;**
   ii. **Making transit faster and more reliable, through cost-effective transit investments and by granting transit vehicles priority on key arterials and highways; and**
   iii. **Supporting the rapid growth of low carbon transportation vehicles and fuels, including electrification.**
2. **Public bodies should report the energy use of their fleets.**
3. **The next Ontario Building Code should require conduits in new buildings so that electric vehicle charging infrastructure can be conveniently and cost effectively added by occupants.**
4. **The Ontario Energy Board and utilities should encourage electric vehicle charging during off-peak hours, through enhanced time of use rates and load control technology.**

## Endnotes

**1.** Environment Canada, report, *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, 1990-2013*, Part 3, Table A10-12, 2015.

**2.** Government of Ontario, report, *Go Green: Ontario's Action Plan on Climate Change*, 2007.

**3.** Total population in Ontario is 13,792,052 as per Ministry of Finance Ontario Fact Sheet March 2016. The population in the Greater Golden Horseshoe is about 8.7 million. Statistics Canada, *Human Activity and the Environment*, Table 3.3, Population, Greater Golden Horseshoe, 1971, 2001 and 2011.

**4.** Advisory Panel on the Coordinated Review of the Growth Plan for the Greater Golden Horseshoe, the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan, report, *Planning for Health, Prosperity and Growth in the Greater Golden Horseshoe: 2015-2041*, (the 'Crombie Report'), 2015.

**5.** *Ibid*, p.24-25.

**6.** These include the cities of Barrie, Brantford, Guelph, Kawartha Lakes, Orillia and Peterborough; the Counties of Brant, Dufferin, Haldimand, Northumberland, Peterborough, Simcoe, and Wellington; and the Regions of Niagara and Waterloo.

**7.** Ministry of Municipal Affairs and Housing, report, *Performance Indicators for the Growth Plan for the Greater Golden Horseshoe, 2006*, p.30, 2015.

**8.** *Ibid.* Across all trips, the rate is slightly higher at 1.25 occupants per vehicle.

**9.** Environmental Commissioner of Ontario, report, *Developing Sustainability, Annual Report, 2001-02*, pp.153-157.

**10.** Numerous studies have documented the association between traffic-related air pollution and respiratory and cardiovascular health, including the increased risk of breast and prostate cancer. See, for example, C. Arden Pope III, et al., periodical (Journal of the American Medical Association, 287: 9), *Lung Cancer, Cardiopulmonary Mortality, and Long-Term Exposure to Fine Particulate Air Pollution*, pp.1132-1141, 2002; Dan Crouse, et al., periodical (Environmental Health Perspectives, 118:11), *Postmenopausal Breast Cancer Is Associated with Exposure to Traffic-Related Air Pollution in Montreal, Canada: A Case-Control Study*, pp.1578-1583, November 2010; Marie-Élise Parent, et al., periodical (Occupational and Environmental Medicine, 70:7), *Traffic-Related Air Pollution and Prostate Cancer Risk: A Case– Control Study in Montreal*, pp. 511-518, 2013.

**11.** Medical Officers of Health in the GTHA, report, *Improving Health by Design in the Greater Toronto-Hamilton Area*, May 2014.

**12.** *Supra*, note 4, p.9.

**13.** Statistics Canada, report, *Commuting to work. National Household Survey, 2011*, Table 2: Usual commuting time to work, census metropolitan areas, 2011. www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-012-x/99-012-x2011003_1-eng.pdf

**14.** The Greater Toronto and Hamilton Area, which encompasses the Cities of Toronto and Hamilton, and the Regions of Peel, Halton, York and Durham, is generally referred to as the inner ring, whereas the rest of the region is referred to as the outer ring.

**15.** *Supra*, note 4, p.24.

**16.** *Supra*, note 7, p.14.

**17.** Ministry of Transportation, website, *Greater Golden Horseshoe Transportation Plan*, accessed April 2016. www.mto.gov.on.ca/english/transit/greater-golden-horseshoe-transportation-plan.shtml

**18.** *Supra*, note 4.

**19.** Pembina Institute and the Royal Bank of Canada, report, 2014 *Home Location Preference Survey: Understanding where GTA residents prefer to live and commute*, p.3, 2014.

**20.** *Supra*, note 4, p.11.

**21.** *Supra*, note 7, p.32.

**22.** Yearly ownership costs for an average compact car. See the Canadian Automobile Association, news release, *CAA provides real picture of annual driving costs*, February 25, 2013.

**23.** The Crombie Report indicates that this target is not enough to encourage a significant modal shift from private vehicle to transit and recommended that the province increase intensification targets and density targets from designated greenfield areas to better support increased frequency of transit (Recommendations 10 and 14). *Supra*, note 4, pp.65-68. See also, Pembina Institute, report, *Driving Down Carbon: Reducing GHG Emissions from the Personal Transportation Sector in Ontario*, p.21, 2010.

**24.** Environmental Commissioner of Ontario, report, *Managing New Challenges, ECO Annual Report, 2013/2014*, pp.147-154, October 2014; See also *Supra*, note 7, p.12.

**25.** The Pembina Institute recommends that the Growth Plan's intensification (i.e., 60 per cent of new growth should occur within the built boundary, instead of 40 per cent) and density targets should be increased, and that incentives should be created "for employment development in existing Urban Growth Centres and intensification areas (transit nodes)", and that additional policies should prioritize and reward residential and employment development, "in particular mixed-use development along existing and proposed transit lines." *Supra*, note 23, pp.38-39. See also *Supra*, note 4, pp.64-65, which mirrors the Pembina recommendations, and also recommends that municipalities should have to report on progress towards meeting those targets.

**26.** *Supra*, note 24, p.152.

**27.** *Supra*, note 7, p.30.

**28.** *Supra*, note 4, p.64.

**29.** Pembina Institute and Ontario Home Builders Association, report, *Make Way for Laneway: Providing more housing options for the Greater Toronto Area*, October 2015.

**30.** Ministry of Transportation, *Estimates Briefing Book 2015-16*.

**31.** The 2015 Ontario Budget increased projected dedicated funds by $2.6 billion, to $31.5 billion available over 10 years for infrastructure projects including public transit, roads, bridges and highways across the province. About $16 billion will be invested in transit projects in the Greater Toronto and Hamilton Area and about $15 billion will be invested in transportation projects (such as roads, bridges, transit) outside the GTHA. See also the 2016 Ontario Budget, www.fin.gov.on.ca/en/budget/ontariobudgets/2016/bk2.html.

**32.** Government of Canada 2016 Budget, *Building Strong Cities Through Investments in Public Transit*, Chapter 2 – Growth for the Middle Class. The details of the program criteria have yet to be confirmed.

**33.** Other considerations are also important. Affordability also depends upon fare and income levels, and fares are a function of the level of transit subsidy provided. Reliability, as stated elsewhere in the report, can depend on transit priority measures, and is also determined by service levels. Other public policy goals exist, such as providing accessible and reliable transportation across an entire municipality.

**34.** Such laws and documents include, for example: the *Provincial Policy Statement, 2014*, the Ministry of Transportation's *Transit-Supportive Guidelines, and the Growth Plan for the Greater Golden Horseshoe*.

**35.** Cherise Burda, blog, *Getting Intense over Sprawl: Nine Lessons from the Crombie Report*, February 26, 2016. www.ryerson.ca/citybuilding/blog/getting_intense_over_sprawl.html?mc_cid=95996329f6&mc_eid=ac13e697cf

**36.** John Lorinc, Spacing Toronto, *Spacing Investigation, Part 3: Ignoring the projected high costs and low ridership*, May 30, 2014. spacing.ca/toronto/2014/05/30/spacing-investigation-part-3/

**37.** Shoshanna Saxe, Heather Cruickshank, and Eric Miller, periodical (Transportation Research Record 2502), *Greenhouse Gas Impact of Ridership on Sheppard Subway Line, Toronto, Canada*, pp.62-70, 2015.

**38.** Transport Canada, website, *Transit Priority Program: Putting Buses First*, accessed April 2016. data.tc.gc.ca/archive/eng/programs/environment-utsp-puttingbusesfirst-996.htm

**39.** Transportation Research Board of the National Academies, report 90, *Bus Rapid Transit, Volume 1: Case studies in Bus Rapid Transit*, p.16, 2003.

**40.** Ahsan Alam, Ehab Diab, Ahmed M. El-Geneidy, Marianne Hatzopoulou, periodical (Transportation Research Part D, 31), *A simulation of transit bus emissions along an urban corridor: Evaluating changes under various service improvement strategies*, pp.189-198, 2014.

**41.** Canadian Urban Transit Association, Issue Paper 25, *Bus Rapid Transit: A Canadian Perspective*, November 2007.

**42.** Bogata is a well-known example.

**43.** See generally: Region of Waterloo Rapid Transit System (www.grt.ca/en/travelwithus/ION.asp); the Mississauga dedicated bus corridor (www.mississauga.ca/portal/miway/transitwayconstruction); and the Hurontario LRT project (lrt-mississauga.brampton.ca/en/About-LRT/Pages/Welcome.aspx).

**44.** Edward Keenan, Toronto Star, article, *Plan in the works to redesign `King Street – and quickly*, January, 18, 2016. Public consultations will begin in the spring of 2016; recommendations will be made in the fall; and pilot projects will begin soon thereafter.

**45.** Jake Schabas, Metrolinx, presentation given at Transport Futures Conference, *GTHA Transit: A HOT Opportunity to Improve Service?*, January 22, 2016.

**46.** Transit Research Board, book, *Highway Capacity Manual 2010*, p.11.24.

**47.** Doug MacDonald, U.S. Secretary of Transportation, video, *Rice and Traffic Congestion*, April 20, 2007. www.youtube.com/watch?v=8G7ViTTuwno

**48.** Jonathan D. Hall, University of Toronto Economics Department working paper 548, *Pareto Improvements from Lexus Lanes: The effects of pricing a portion of the lanes on congested highways*, October 15, 2015.

**49.** Canada's Ecofiscal Commission, report, *We can't get there from here: Why pricing traffic congestion is critical to beating it*, November 2015.

**50.** Research in the United States has found that there are several benefits when transit operations are properly integrated with HOT lanes, including increased funding, faster travel speeds and higher ridership levels. Gregory Newmark, periodical (Journal of Public Transportation 17:3), *HOT for Transit? Transit's Experience of High-Occupancy Toll Lanes*.

**51.** Edward Sullivan, periodical (Transportation Research Record: Journal of the Transportation Research Board 1812:37–42), *State Route 91 Value-Priced Express Lanes: Updated Observations*, 2002.

**52.** A HOT lane pilot project will begin on a section of the QEW between Trafalgar Road in Oakville and Guelph Line in Burlington in 2016. news.ontario.ca/mto/en/2015/12/ontarios-plan-for-high-occupancy-toll-lanes.html

**53.** This and other service improvements could also affect air emissions from diesel buses. See Alam, A. and M. Hatzopoulou. Transportation Land Use Planning and Air Quality Conference, North Carolina, conference proceedings, *Quantifying the influencing factors of transit bus emissions and evaluating the potential of service improvements and alternative fuels on emission reductions*, 2014.

**54.** Part of a project funded by the Ontario Research Fund: iCity - Urban Informatics for Sustainable Metropolitan Growth.news.engineering.utoronto.ca/on-the-right-track-new-icity-collaboration-addresses-torontos-transit-woes/

**55.** See for example, Metro Vancouver, study, *The Metro Vancouver Car Share Study, Technical Report*, November 2014; See also, Elliot Martin and Susah Shaheen, report, *The Impact of Carsharing on Household Vehicle Ownership*, 2011.

**56.** Adam Cohen, Susan Shaheen, and Ryan McKenzie, report, *Carsharing: A Guide for Local Planners*, p.8, May/June 2008.

**57.** While individual car share members may experience a net rise in personal emissions, there is an overall total reduction. Elliot Martin and Susan Shaheen, periodical (IEEE Transactions on Intelligent Transportation System 12:4), *Greenhouse Gas Emission Impacts of Carsharing in North America*, December 2011.

**58.** Metro Vancouver, *supra*, note 55.

**59.** City of Toronto, staff report, *Use of Province of Ontario's Vendor of Record for Car Share Services*, March 16, 2016.

**60.** Other key drivers are individual preferences for personal vehicle ownership and the land patterns and street networks that inhibit active transportation alternatives.

**61.** Metro Vancouver, *supra*, note 55.

**62.** Metrolinx, website, *The Big Move, Strategies*, at 7.2, accessed April 2016. www.metrolinx.com/thebigmove/en/strategies/strategy7.aspx

**63.** Pursuant to the *Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations* that came into effect in 2010, and were subsequently amended in 2014, the fuel efficiency of passenger vehicles and light trucks will progressively improve until 2025. Environment Canada, report, *Canada's Emissions Trends, 2014*, pp.16-17, 2014.

**64.** Environment Canada, information provided to the ECO in response to ECO inquiry, February 5 and April 15, 2016.

**65.** *Ibid.*

**66.** TD Economics, report, *Canadian Auto Sales to Downshift From Fifth to Fourth Gear*, October 27, 2014.

**67.** *Supra*, note 64.

**68.** *Supra*, note 63, p.17.

**69.** Environmental Commissioner of Ontario, report, *Building Momentum: Results, Annual Energy Conservation Progress Report – 2012 (Volume One); Looking for Leadership: The Costs of Climate Inaction, Annual Greenhouse Gas Progress Report – 2014.*

**70.** Ethanol used in gasoline in Ontario is corn-based. Questions exist as to whether there is an overall benefit associated with the use of ethanol as replacement fuel. On the basis of an attributional life-cycle analysis (which takes into consideration environmental impacts associated with inputs, such as fertilizer), ethanol results in a reduction of energy and greenhouse gas emissions. A consequential life-cycle analysis (which would incorporate indirect impacts such as land use changes) has not been conducted in Ontario to determine the extent of the benefit, or conditions where there may not be a benefit, once these indirect effects are evaluated and taken into account. Heather MacLean, Professor, Department of Civil Engineering, University of Toronto, information provided to the ECO in response to ECO inquiry, April 2016.

**71.** O. Reg. 535/05 (Ethanol in Gasoline), made under the *Environmental Protection Act*, came into effect in 2007. In April 2014, O.Reg. 97/14 (Greener Diesel – Renewable Fuel Content Requirements for Petroleum Diesel Fuel), made under the *Environmental Protection Act* was filed. According to Figure 2-9 of the 1990-2013 *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, Part 1*, across Canada there has been very minimal impact on the overall emissions associated with light-duty vehicles when fuels are switched to less carbon-intensive ones.

**72.** The term 'electric vehicle' used in this report includes both battery electric vehicles (powered solely by electricity) and plug-in hybrid electric vehicles (which can be powered by both electricity and gasoline).

**73.** The International Council on Clean Transportation, report, *Transition to a Global Zero-Emission Vehicle Fleet: A Collaborative Agenda for Governments*, September 2015.

**74.** These are the plans that were submitted by each country prior to the United Nations climate change conference in Paris that outlined the post-2020 actions that each country intends to take to mitigate their emissions.

**75.** United Nations Framework Convention on Climate Change, *INDCs Synthesis Report*, Compilation of INDCs as communicated by 1st October 2015. unfccc.int/focus/indc_portal/items/9240.php

**76.** For example, the U.S. Department of Energy runs a program called EV Everywhere, the goal of which is to increase the adoption and use of plug-in electric vehicles across the country. energy.gov/eere/eveverywhere/ev-everywhere-get-connected

**77.** In 2014, 68 million passenger cars were sold worldwide; just over 300,000 of these were electric vehicles as per *supra*, note 73, p.2.

**78.** Nic Lutsey, International Council on Clean Transportation, presentation given at the UN Foundation/Ceres Investment Summit on Climate Risk, New York City, *Transitioning to an electric vehicle fleet*, January 27, 2016.

**79.** As of April 7, 2016, over 325,000 advance orders had been placed for Tesla's Model 3, with deliveries scheduled to begin in late 2017. www.teslamotors.com/blog

**80.** Plug'n Drive, report, *Electric Vehicles: Reducing Ontario's Greenhouse Gas Emissions*, p.5, May 2015.

**81.** IESO, document prepared for discussion with the IESO Stakeholder Advisory Committee, *Preliminary Outlook and Discussion: Ontario Supply/Demand Balance to 2035*, March 23, 2016.

**82.** Ontario Ministry of Transportation, information provided to the ECO in response to ECO inquiry, April 2016. This number represents vehicles registered as of December 31, 2015.

**83.** In 2015, total EV sales in Ontario were 2,363 while total passenger car sales were 284,202. PlugnDrive information provided to the ECO on Monday, April 25, 2016.

**84.** Ontario Ministry of Transportation, information provided to the ECO in response to ECO inquiry, March 30, 2016.

**85.** See generally Pollution Probe's Electric Mobility Adoption and Prediction reports, www.pollutionprobe.org/transportation/emap-reports/

**86.** The Canadian average daily distance driven is 47.6 kilometers; within Ontario it is slightly higher at 50.6 kilometers. As well, 77.5 per cent of all trips are under 11 kilometers in distance. These distances are within the range of a typical charge of a battery; for example, the range of the Nissan Leaf is well over 100 kilometers. Successive generations of electric cars are achieving longer ranges. Transport Canada, *Transportation in Canada 2014*. Statistical Addendum. Table RO4: Canadian Vehicle Use Study, Light Vehicle Statistics, Annual Averages Per Vehicle, 2014 and RO5: Canadian Vehicle Use Study, Light Vehicle Statistics, Averages Per Trip, 2014. Obtained from Transport Canada.

**87.** Megan Allen, Fleetcarma website, *Electric Range for the Nissan Leaf and Chevrolet Volt in Cold Weather*, December 16, 2013. www.fleetcarma.com/nissan-leaf-chevrolet-volt-cold-weather-range-loss-electric-vehicle/

**88.** Nic Lutsey, Stephanie Searle, Sarah Chambliss, Anup Bandivadekar, The International Council on Clean Transportation, report, *Assessment of Leading Electric Vehicle Promotion Activities in United States Cities*, July 2015.

**89.** U.S. Department of Energy's EV Everywhere Workplace Charging Challenge, Mid-Program Review: *Employees Plug In*, page 4.

**90.** Ontario Newsroom, news release, *More Electric Vehicle Charging Stations On the Way*, December 8, 2015.

**91.** As per the 2016 federal budget, electric vehicle charging stations are generally included in Class 8, which provides a CCA rate of 20 per cent. The budget proposes to expand Classes 43.1 and 43.2 by making electric vehicle charging stations eligible for inclusion, based upon whether they meet certain power thresholds. Electric vehicle charging stations set up to supply at least 90 kilowatts of continuous power will be eligible for inclusion in Class 43.2. Those charging stations set up to supply more than 10 kilowatts but less than 90 kilowatts of continuous power will be eligible for inclusion in Class 43.1. These two classes have a CCA of 30 per cent. 2016 Federal Budget, Chapter 4 – A Clean Growth Economy. www.budget.gc.ca/2016/docs/plan/toc-tdm-en.html

**92.** WWF, report, *Transportation rEVolution: Electric Vehicle Status Update 2013*.

**93.** These calculations are based on NRCan Fuel Efficiency figures for 2014 and assume off-peak electricity pricing in Ontario as of January 2016. Plug'n Drive, booklet, *Electrify Your Ride*, January 2016.

**94.** 2016 Ontario Budget, *Jobs for Today and Tomorrow*, Chapter I: Building Prosperity and Creating Jobs, p.28.

**95.** Ontario Ministry of Transportation, information provided to the ECO in response to ECO inquiry, April 8, 2016.

**96.** Ontario Newsroom, news release, *New Rebates on the Way for Electric Vehicles*, February 10, 2016.

**97.** *Supra*, note 73, p.23.

**98.** *Supra*, note 73.

**99.** Environmental Commissioner of Ontario, report, *Looking for Leadership: The Costs of Climate Inaction, Annual Greenhouse Gas Progress Report – 2014*.

**100.** Mattamy Homes, information provided to the ECO. One of the barriers is not having clear standards for the construction and interim capping of conduits.

**101.** Fleetcarma, information provided to ECO and based on a study that Fleetcarma conducted in conjunction with Toronto Hydro.

**102.** For example, the operating and capital expenditures for rail and marine in 2014/2015 were $0.8 and $14.1 million respectively. Operating and capital expenditures for road were $1,475.4 million. Transport Canada, *Transportation in Canada 2014*. Statistical Addendum. Table G6: Detailed Provincial/Territorial Expenditures by Mode and by Province/Territory, 2005/06 - 2014/15. Obtained from Transport Canada.

**103.** Ontario Newsroom, news release, *Ontario Increasing GO Transit Service Along All Corridors*, April 17, 2015.

**104.** Metrolinx, information provided to the ECO on October 30, 2015.

**105.** Pollution Probe, report, *Business Case for Electric Vehicle Use in Service Vehicle Fleets*, June 2013, p.8.

**106.** Made under the *Green Energy Act, 2009*.

**107.** Environmental Commissioner of Ontario, report, *Restoring Balance: A Review of the First Three Years of the Green Energy Act, Annual Energy Conservation Progress Report – 2011 (Volume One)*.

**108.** Ministry of Transportation, website, *School Bus Safety*, www.mto.gov.on.ca/english/safety/school-bus-safety.shtml

**109.** Ontario Public Health Association, report, School Buses, Air Pollution & Children's Health: Follow-up Report, October 2010.

**110.** *Ibid.*

**111.** Ontario Public Health Association, report, *School Buses, Air Pollution & Children's Health: Improving Children's Health & Local Air Quality by Reducing School Bus Emissions*, November 2005.

**112.** *Supra*, note 109.

**113.** Depending on the electricity grid; this estimate is based on Quebec calculations. Ministère des Transports du Québec, report, *Propelling Quebec Forward With Electricity, Quebec Transportation Electrification Action Plan 2015-2020*.

**114.** Ministère des Transports du Québec, report, *Propelling Quebec Forward With Electricity, Quebec Transportation Electrification Action Plan 2015-2020*, October 2015.

**115.** PR Newswire, website, *America's Only All-Electric School Bus Transports Students, Saving California School District Over $10,000 a Year in Fuel and Maintenance*, March 3, 2014. www.prnewswire.com/news-releases/americas-only-all-electric-school-bus-transports-students-saving-california-school-district-over-10000-a-year-in-fuel-and-maintenance-248168111.html; Clean Technica, website, *All-Electric School Bus Approved In One Day In California,* August 24 2014. cleantechnica.com/2014/08/24/electric-school-bus-approved-one-day-california/

**116.** Emterra Group, website, *Emterra Group and Partners Invest $50M in Largest Natural Gas Fleet Fuelling Station and Operation in Canada Open to Public.* www.emterra.ca/news/news-release/emterra-group-and-partners-invest-50m-largest-natural-gas-fleet-fuelling-station

**117.** At time of writing, the Ontario Legislature was considering Bill 76, *Natural Gas Superhighway Act, 2016*, an Act to encourage the purchase of vehicles that use natural gas as a fuel.

# 4 Public Buildings

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# 4.0 Public Buildings

This section of the report discusses the importance of improving energy efficiency within Ontario's existing buildings. We review and analyse the first three years of energy use data for the province's broader public sector buildings and assess the potential for benchmarking this data. We then explore further opportunities and financial mechanisms to facilitate and encourage energy efficiency upgrades within Ontario's public buildings.

## 4.1 Energy Reporting and Benchmarking in Ontario's Broader Public Sector (BPS) Buildings: What Have We Learned?

### 4.1.1 Introduction

Due in part to the cold winter of 2014, approximately 37 per cent of the energy consumed in Ontario was used in the building sector, which includes everything from single-family homes to large office buildings; this was up from 35 per cent in 2013. The share of energy used by commercial, institutional, and public administration buildings is shown on Figure 4.1. Most of this energy demand is from fossil fuels, primarily natural gas, used for comfort and water heating. Buildings also use electricity for lighting, cooling, powering office equipment, etc.

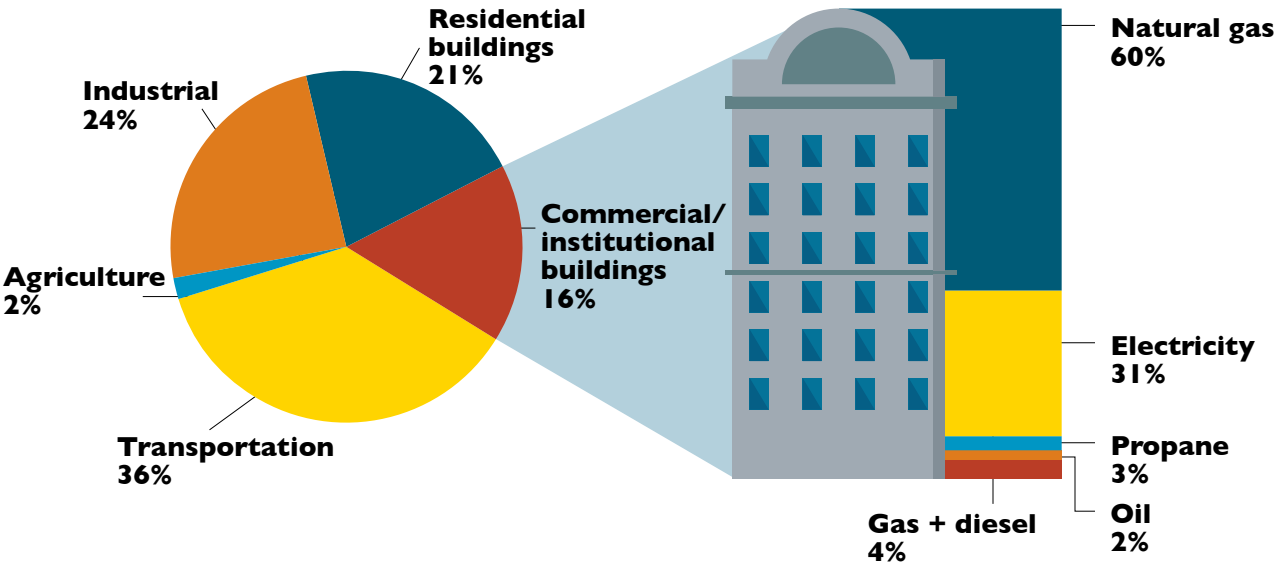



**Figure 4.1: Ontario's total energy use for commercial and institutional buildings (2014)**

Source: Statistics Canada Catalogue No. 57-003-X preliminary 2014 data.

On average, commercial and institutional buildings in Ontario still use most of their energy for space heating, although this has dropped slightly since 1990:

**Table 4.1: Ontario's Commercial/Institutional Sector Energy Use by End Use (1990 and 2013)**

| Energy Use by End Use | 1990 (%) | 2013 (%) |
|---|---|---|
| Space Heating | 61.6 | 57.6 |
| Water Heating | 8.2 | 8.3 |
| Auxiliary Equipment | 6.5 | 13.0 |
| Auxiliary Motors | 7.6 | 4.6 |
| Lighting | 9.5 | 10.1 |
| Space Cooling | 5.4 | 5.7 |
| Street Lighting | 1.1 | 0.6 |

Source: Natural Ressources Canada, Office of Energy Efficiency, Comprehensive Energy Use Database, C/I Sector, Table 2

Ontario's public and broader public sector owns or leases a substantial amount of provincial building space — about 19 per cent[1] of all commercial and institution building space. In other words, these public buildings use about 3 per cent of the province's energy supply, and about 8 per cent of the energy used in all buildings in Ontario.[2]

Ontario public buildings fall into two main groups:

1. Those used by the Ontario government, including Crown agencies, boards and commissions (sometimes referred to as the Ontario public service or OPS) – about 45 million square feet;[3] and
2. Those owned by the broader public sector (BPS), meaning public bodies that receive provincial funding but are not part of the provincial government, such as municipalities, hospitals, universities, colleges, and school boards – about 590 million square feet of floor space.[4]

Since 2012, O.Reg. 397/11, under the *Green Energy Act, 2009*, has required mandatory annual energy reporting and public disclosure for each prescribed building in the BPS. As a result, Ontario now has three years' worth of energy data for thousands of individual BPS buildings.[5]

Our analysis of this valuable data suggests that:

- mandatory building energy reporting will help Ontario reduce its energy use and greenhouse gas emissions; and
- there are large opportunities for improved energy efficiency in Ontario's public buildings.

Both conclusions likely apply equally to private buildings, which account for over 90 per cent of energy used in Ontario's buildings.

### 4.1.2 Mandatory Energy Reporting in Ontario's Public Buildings

Energy conservation in existing buildings is an important public priority and will help our building sector become cleaner, leaner and greener because:

- Ontario's existing building stock uses a significant amount of energy, the majority from fossil fuels. Commercial, institutional, and residential buildings are the third largest source of Ontario's greenhouse gas emissions. These three types of buildings were responsible for 33 megatonnes, or 19 per cent of total provincial greenhouse gas emissions in 2013.[6]
- Buildings use a significant amount of electricity during the hot summer months to cool indoor spaces. In fact, Ontario's summer peak is primarily driven by air conditioning load.[7] Power plants and transmission lines are designed to meet this demand, so if the peak grows, then Ontario may require more energy infrastructure.
- Improving energy efficiency often brings co-benefits, including reduced energy bills, increased occupant comfort, and improved indoor and outdoor air quality.
- Buildings last for decades – the majority of buildings in Ontario universities, for example, are already over 30 years old.[8] Inefficient buildings that remain inefficient will be a long-term source of waste for the province's energy system.

Government has implemented few policies to reduce energy consumption in existing buildings. The Ontario Building Code's energy efficiency requirements only apply to new buildings or major expansions. Ontario's electricity and natural gas utilities offer voluntary conservation programs to building managers, but relatively few building owners and managers participate.[9]

**An accurate picture requires mandatory energy measurement and reporting.**

The indispensable first step towards improving energy efficiency in existing buildings is to determine how much energy they use– we can't manage what we don't measure. While voluntary programs can help,[10] an accurate picture requires mandatory energy measurement and reporting. Ontario did just this for BPS buildings through O. Reg. 397/11.

**The indispensable first step towards improving energy efficiency in existing buildings is to determine how much energy they use.**

### 4.1.3 Why Mandate Public Energy Reporting for the BPS?

## Snapshot of BPS Buildings[11]

| 590 million Square Feet | Across 15,000 facilities | Using 18.6 billion ekWh/year |
|---|---|---|

The BPS represents an enormous opportunity for energy savings and cultural shift. The promise to "green" broader public sector buildings, including the development of energy conservation plans, was one of the first promises made to Ontarians when the government introduced the *Green Energy Act* in 2009.[12] This is because broader public sector buildings are ideal candidates to demonstrate energy efficiency and support a culture of conservation. Improving energy efficiency in these buildings demonstrates responsible use of public funds because energy efficient buildings cost less to run over time. These buildings provide community services that are used by virtually everyone at one time or another, so making energy conservation more socially visible at these locations helps create a culture of conservation.[13] Through advancements in technology, it is becoming easier and cheaper for building owners and managers to track, monitor, and report energy consumption – refer to the text box *Green Button and Data Automation will Make Energy Reporting Easier* for more details.

**Broader public sector buildings are ideal candidates to demonstrate energy efficiency and support a culture of conservation.**

### Green Button and Data Automation will Make Energy Reporting Easier

Ontario has taken an important step to produce more customer value from utility meter data through the "Green Button" initiative. Green Button establishes a standard, open data format for energy and water utility data. Software developers can then use this standard to develop applications that help customers manage their energy and water costs or reduce their environmental impact. No special utility meter is needed, but utilities must be able to track customer consumption electronically to use this standard.[14]

Green Button, as well as other data automation tools, can potentially assist with building benchmarking programs. Several U.S. utilities have developed ways to automatically upload building energy consumption information into benchmarking software programs.[15] Through automating this process, it is easier for building owners to report energy consumption, there is less labor and time needed to input information, and there is less opportunity for human error.[16]

By making data collection easier, there will be an opportunity to collect monthly or seasonal energy reports for buildings. Building owners and operators can then use this data to understand how well their heating and cooling systems operate, and identify opportunities to conserve.

## 4.1.4 Who Must Report?

O. Reg. 397/11 applies to every:

- municipality,
- municipal service board,
- post-secondary educational institution,
- public hospital, and
- school board.[17]

The regulation calls these "public agencies". They are also commonly referred to as the MUSH sector (municipalities, universities, schools, hospitals) or BPS. Public agencies must report for every building[18] they own or lease of 22 specified types, if the building is either:

(a) heated or cooled, or

(b) related to water or sewage treatment;

and, if the public agency pays for the building's energy consumption.[19]

## 4.1.5 What Must the BPS Report?

Since 2012, the BPS has reported an enormous amount of raw data. For each of the buildings, the annual report must include the year's energy consumption, as well as:

- the address;
- the type of operation carried on;
- its indoor floor space;
- its days and hours of operation, and seasonal period if applicable;
- the amount of each type of energy purchased;
- its greenhouse gas emissions from each type of energy; and
- total greenhouse gas emissions.[20]

### 4.1.6 What Good is all that Data?

Collecting data is of little value unless it leads to action. As noted by the Ministry of Energy, benchmarking is a key purpose of the regulation:

"Energy reporting and conservation planning will help public agencies:

- manage electricity use and costs
- identify best practices and energy-saving opportunities
- evaluate results by comparing to similar facilities across the province
- assist in setting goals by providing a benchmark
- measure improvement over time.

Energy reporting will also inform the Ontario government about energy use in the broader public sector. The information will help Ontario to develop and enhance policies and programs in the future."[21]



The large amount of BPS data also allows each public agency to:

1. track changes, over time, in the energy used by individual buildings. This can help identify maintenance and operational problems, and the effects of any conservation measures that have been taken; and
2. publish and implement the energy conservation and demand management plan for each building every five years, starting in 2014.[22] These plans are not required to contain any targets.

### 4.1.7 Choosing a Benchmark

Using this data effectively requires BPS building managers to benchmark their buildings, but against what? Although the *Green Energy Act, 2009* allows the province to require the public sector to meet energy efficiency standards, this power has not yet been used.

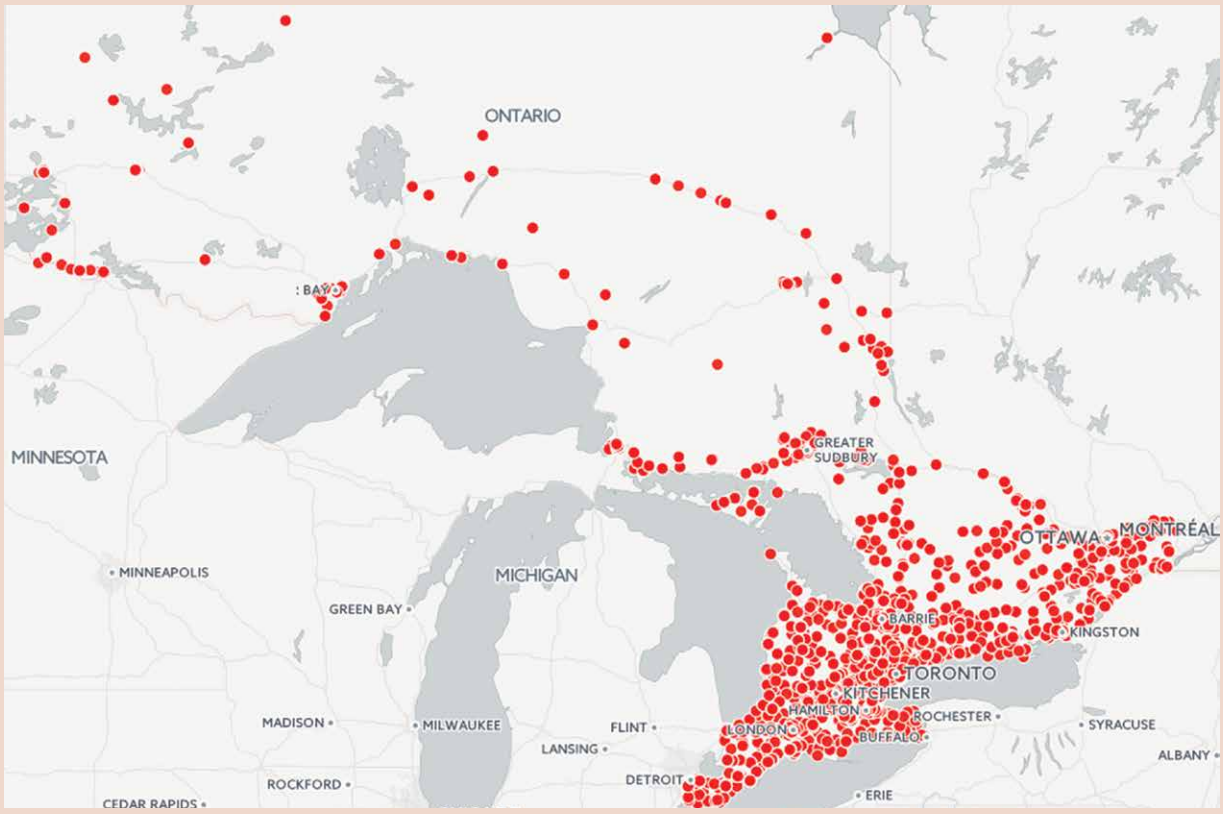
A building can be benchmarked externally against industry norms or peers for similar building types, or internally against its own historical energy use. Possible benchmarks for Ontario or Canadian buildings include the Ontario Association of Architects' benchmark list of building types and their EUI for their 2030 Challenge program (see text box *What is Energy Use Intensity (EUI) and Why is it Important?*)[23] and Natural Resources Canada's Survey of Commercial and Institutional Energy Use in Buildings, which underpins Portfolio Manager in Canada.[24] There are many other voluntary programs and data sets that can be used to benchmark buildings in Canada and the U.S.[25] Some BPS organizations set their own voluntary targets in the conservation plans they submitted under O. Reg. 397/11.

Some jurisdictions with building energy reporting laws benchmark against peers to estimate potential energy savings.[26] Ontario's Ministry of Energy has also begun to explore benchmarking and comparing building energy use within the BPS. In this chapter, we explore this initial benchmarking work and take it a few steps further to estimate potential energy savings from these buildings.[27]

**Collecting data is of little value unless it leads to action.**

## See for Yourself: Map of Energy Use in BPS Buildings

Taxpayers could use the data to see the efficiency of buildings in their community, i.e., to see if their tax money being used for energy is being carefully spent. While the province makes the raw data available in a massive spreadsheet, most people would find it difficult to use. The ECO has therefore created an interactive GIS-based map which makes the entire BPS energy use database easily searchable by location. High energy users are visible through our ranking system. (**eco.on.ca/reports/2016-lets-get-serious/**). Our map also includes the normalized energy data for 2011, 2012, and 2013, taken directly from the government's Open Data website.[28] Check it out!



### Success Story: Ottawa Catholic School Board[29]

The Ottawa Catholic School Board (OCSB) oversees 82 schools with approximately 38,000 students and over 4,000 employees. Faced with rising utility bills and budget pressures, the school board looked for ways to save money without sacrificing students' education.

Their solution: an energy management and conservation framework that reduces utility bills without sacrificing student comfort. One important tool was a benchmark analysis combined with considering the physical features of each building. This allowed them to estimate each building's energy savings potential, and to assign each building an annual energy conservation target.

Their results are impressive. To save money, OCSB voluntarily reduced their electricity use by 30 per cent, and their consumption of natural gas by 25 per cent, compared to a 2003-2004 baseline. So far, through their energy conservation program, they have avoided $24 million in utility costs.

## 4.1.8 What Did We Learn?

4

The following estimates and analyses are based on a benchmark study that was commissioned by the Ministry of Energy and shared with our office. The purpose of the Ministry of Energy's study was to develop a system that compares relative energy efficiencies and GHG emissions within several BPS building categories (see the categories listed in Figure 4.2). The consultant normalized the data reported by building owners/operators under O. Reg. 397/11 (primarily using size and location information). It then performed a benchmark analysis using the 2011 data for about 15,000 BPS facilities. Due to the report's technical nature, only the summary graphs from the report were shared with BPS organizations. A summary version of the normalized data for multiple calendar years – 2011, 2012, and 2013 – has since been posted to the government's website and the raw data is also available for the public to download.[30]

Based on the 2011 data and analysis undertaken by the Ministry of Energy, schools, universities and hospitals account for just over 70 per cent of BPS floor area, and almost two-thirds of BPS energy use and greenhouse gas emissions.

Unsurprisingly, different types of buildings have different average energy demands (see Table 4.2).

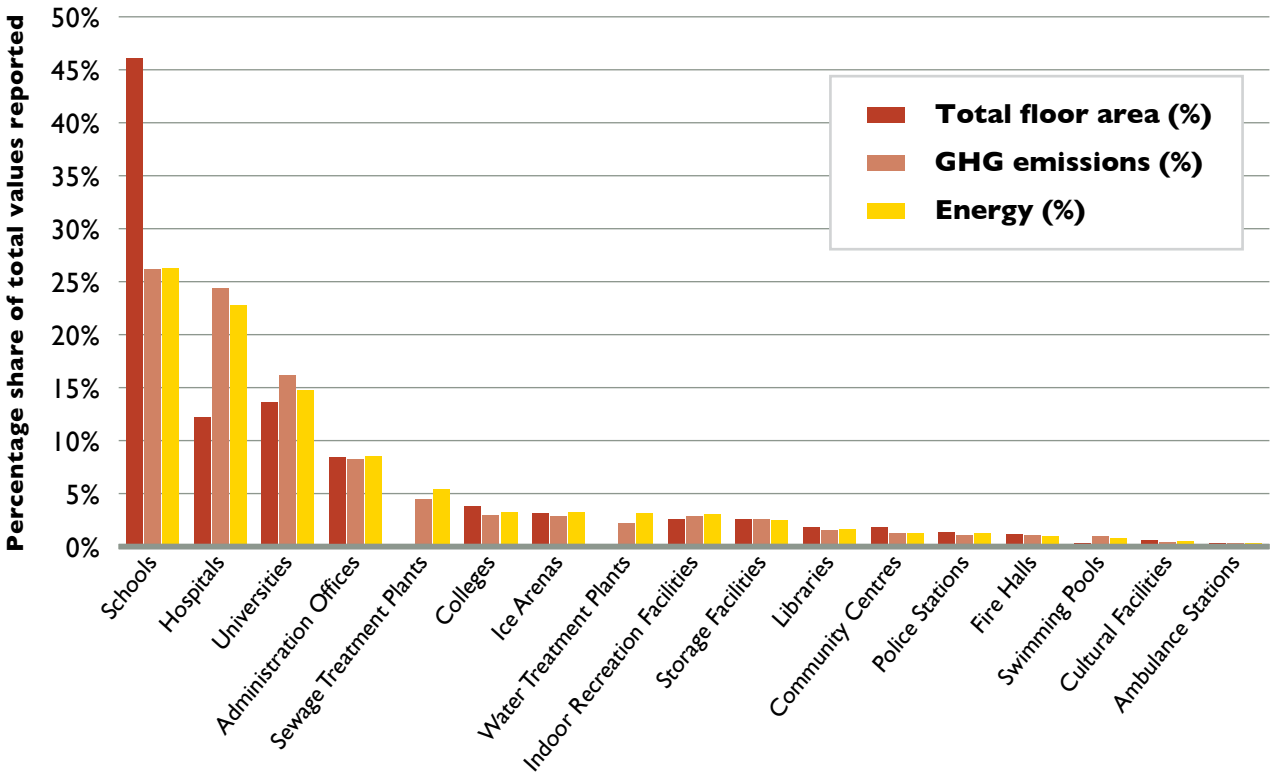



**Figure 4.2: Square footage, energy, and GHG emissions by property type in 2011 as a percentage share of the total values reported.**

Note: The floor area for Sewage Treatment and Water Treatment operations is not shown because energy consumption within these facilities is primarily influenced by the volume of water treated and not by the conditioned floor area.

**Table 4.2: Average Energy Use Intensities for BPS Buildings, 2011**

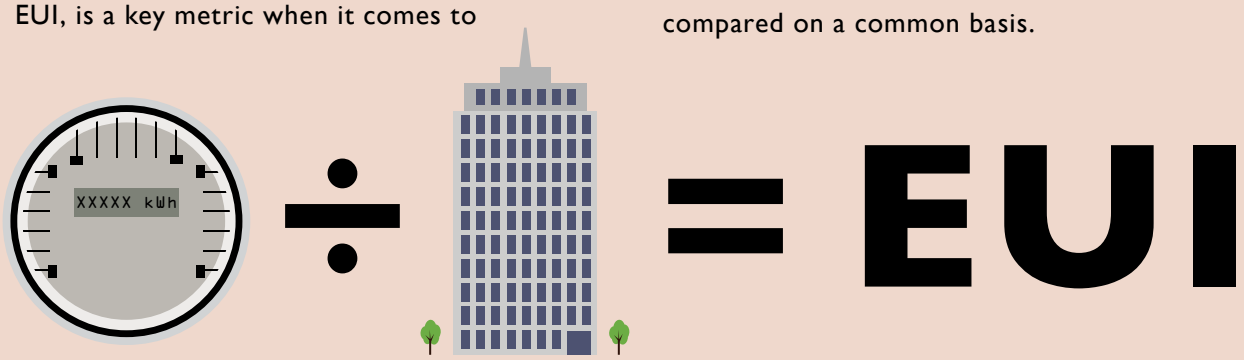
| Building Type | Average Energy Use Intensity (ekWh/ft²/yr) | Building Type | Average Energy Use Intensity (ekWh/ft²/yr) |
|---|---|---|---|
| Administration Offices | 28.2 | Libraries | 23.9 |
| Ambulance Stations | 30.7 | Police Stations | 32.5 |
| Colleges | 26.5 | Schools | 16.3 |
| Community Centres | 22.8 | Sewage Treatment | 1,046.5 ekWh/ML |
| Cultural Facilities | 24.1 | Storage Garages | 27.5 |
| Fire Stations | 23.4 | Swimming Pools | 66.7 |
| Hospitals | 49.5 | Universities | 33.4 |
| Ice Arenas | 28.2 | Water Treatment | 1,207.2 ekWh/ML |
| Indoor Recreation Facilities | 34.2 | Note: these have been normalized to Toronto weather using a heating degree day of 3358.3 | |

Predictably, swimming pools have the highest average energy consumption, given their significant heating and air handling demands. Hospitals have the second highest energy intensity of all building categories. Schools for students aged kindergarten through grade 12 have a relatively low average energy use intensity. These results are consistent with other published studies.[31]

What is much more useful is this: How much does energy use intensity vary between similar buildings?

## What is Energy Use Intensity (EUI) and Why is it Important?

Energy use intensity, also referred to as EUI, is a key metric when it comes to building energy reporting. It expresses a building's annual energy consumption[32] as a function of a defining characteristic – usually floor area[33] – and allows buildings to be compared on a common basis.




EUI can be expressed using several different units, all of which convey the same information: total energy consumed per year per key characteristic.[34]

| **Unit** | $\frac{ekWh}{ft^2yr}$ | $\frac{ekWh}{m^2yr}$ | $\frac{GJ}{m^2yr}$ | $\frac{kBtu}{ft^2yr}$ |
|---|---|---|---|---|
| **Description** | Equivalent kilowatt-hours per square foot per year | Equivalent kilowatt-hours per square metre per year | Gigajoules per square metre per year | Thousand British thermal units of energy per square foot per year |
| **When This is Used** | In Canada for existing buildings | In Canada for new buildings | In reports from Natural Resources Canada | In the U.S. for both new and existing buildings |

Also, when using EUI as a metric, the data are typically normalized (i.e., adjusted to exclude the impact of weather or other factors that can significantly affect the amount of energy used in any given year). This provides a twofold benefit: it enables monitoring successive years of annual energy consumption to identify trends; and it allows comparison between buildings independently of the impact of weather or location (e.g., northern versus southern Ontario). Using EUI also

allows conservation targets to be set as a percentage improvement in intensity, regardless of the different intensity ratings for buildings. Ultimately, it can lead to setting operational standards per unit of space occupied.

Under O. Reg. 397/11, EUI is calculated using indoor floor area. The Ministry of Energy also includes heating degree day (HDD) as a key characteristic for its EUI measurement. Heating degree day is a measurement that helps determine the amount of energy needed to heat a building as a result of outside air temperatures.

### 4.1.9 EUI is Highly Variable

Energy use intensity is highly variable within building types, and different building types use energy in different ways. For example, the energy consumption curve for Ontario schools shows a normal distribution curve with a small positive skew (Figure 4.3).

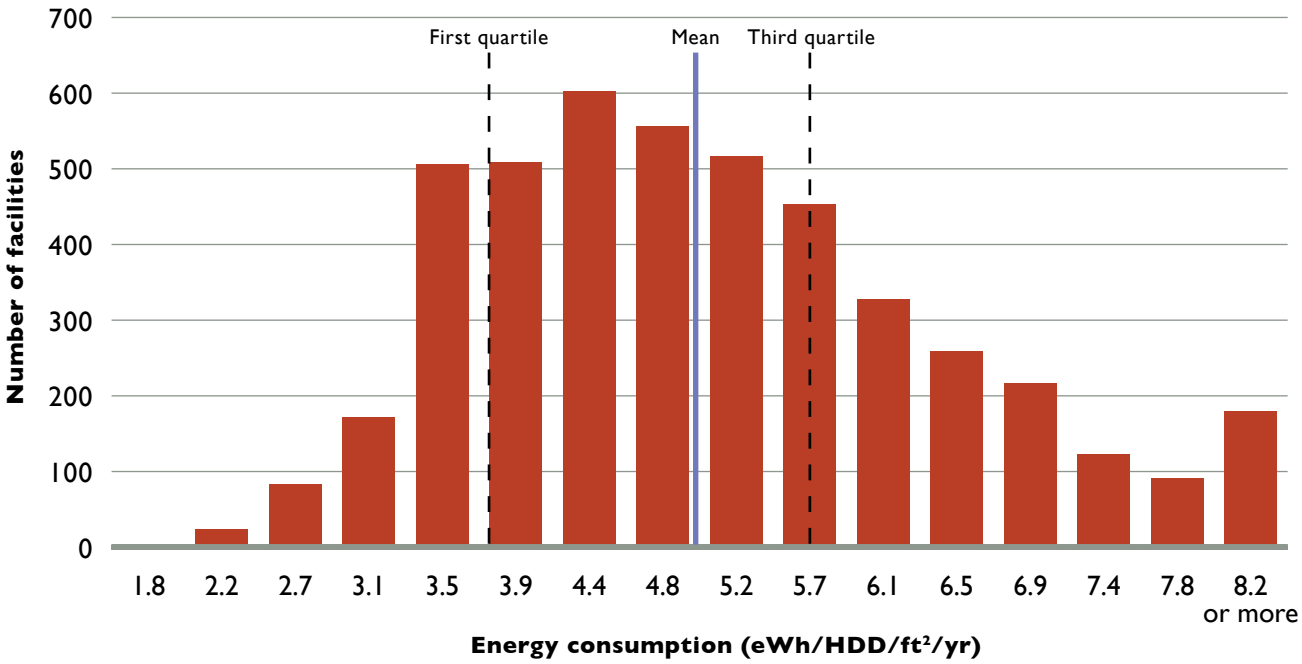



**Figure 4.3: Energy consumption curve for Ontario schools – 2011**

Note: Energy Consumption is shown as equivalent watt-hours per heating degree day per square foot because both area and weather (heating degree day) influenced the amount of energy used within each Ontario school. The above histogram is based on energy data for over 4,600 buildings.

On the other hand, the energy consumption curve for Ontario hospitals shows a large but differently distributed range in energy performance (Figure 4.4).

The City of Toronto ranked its buildings by EUIs, and found that the worst performing buildings had EUIs that were several times higher than the best performing buildings of the same type. For example, as shown in Figure 4.5, the least efficient Toronto library's EUI is more than eight times larger than the EUI for its most efficient library.[35]

Similar results have been seen elsewhere, such as in BOMA BESt's study of the EUI of Canadian office buildings (BOMA stands for the Building Owners and Managers Association; see Figure 4.6).

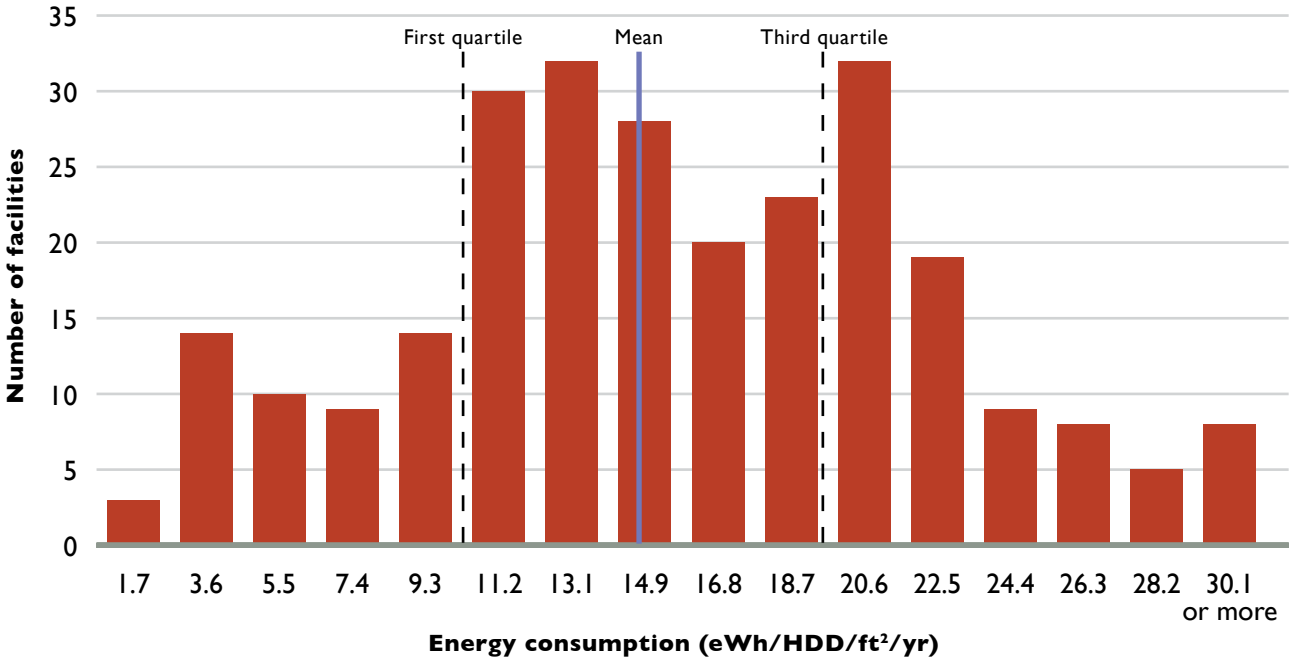



**Figure 4.4: Energy consumption curve for Ontario's hospitals – 2011**

Note: Energy Consumption is shown as equivalent watt-hours per heating degree day per square foot because both area and weather (heating degree day) influenced the amount of energy used within each Ontario hospital. The above histogram is based on energy data from 264 sites.

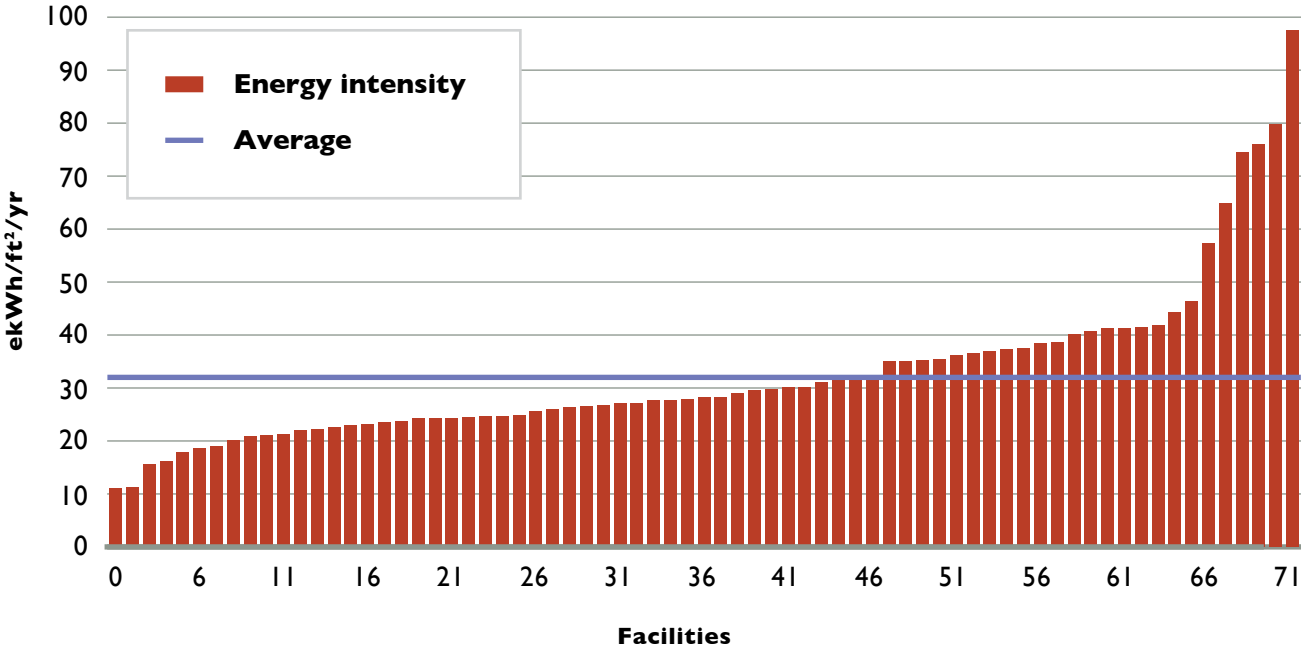



**Figure 4.5: EUI for Toronto's public libraries – 2011**

Source: City of Toronto, *Annual Energy Consumption & Greenhouse Gas Emissions Report*, p.17, 2011.

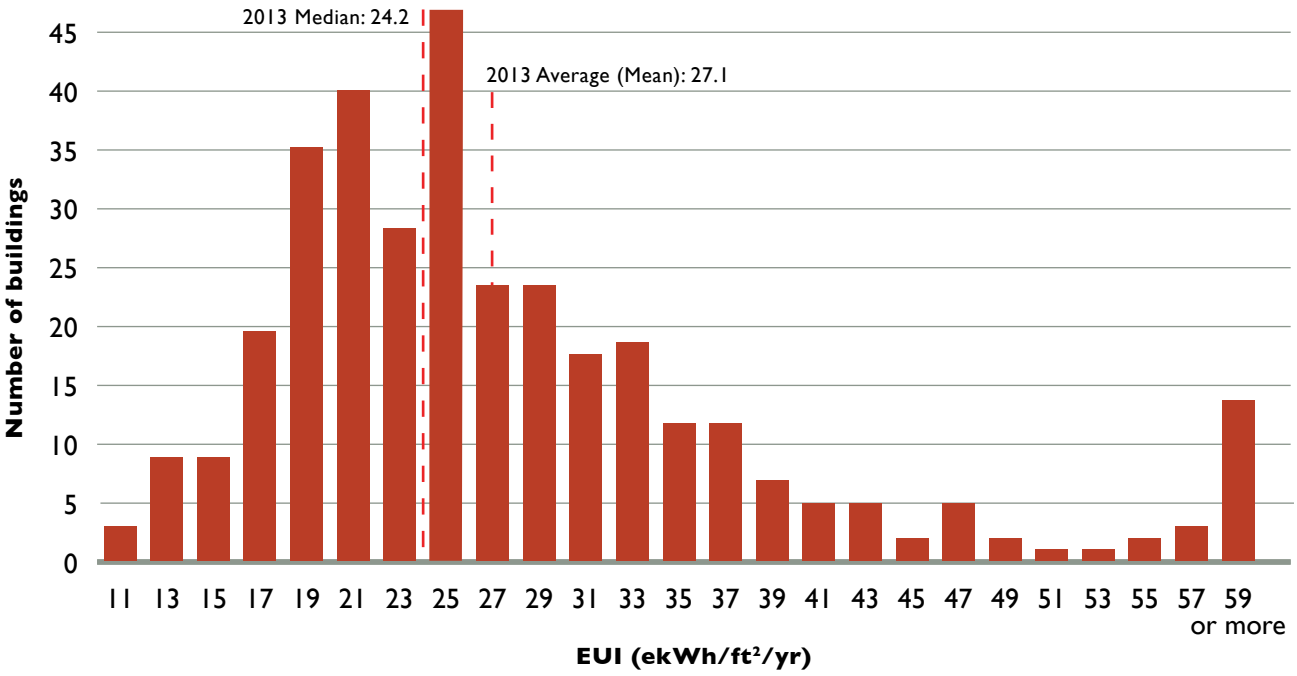



**Figure 4.6: EUI distribution for office buildings**

Source: BOMA BESt Report (2014); *Energy Use Intensity for Canada, Office Buildings.*

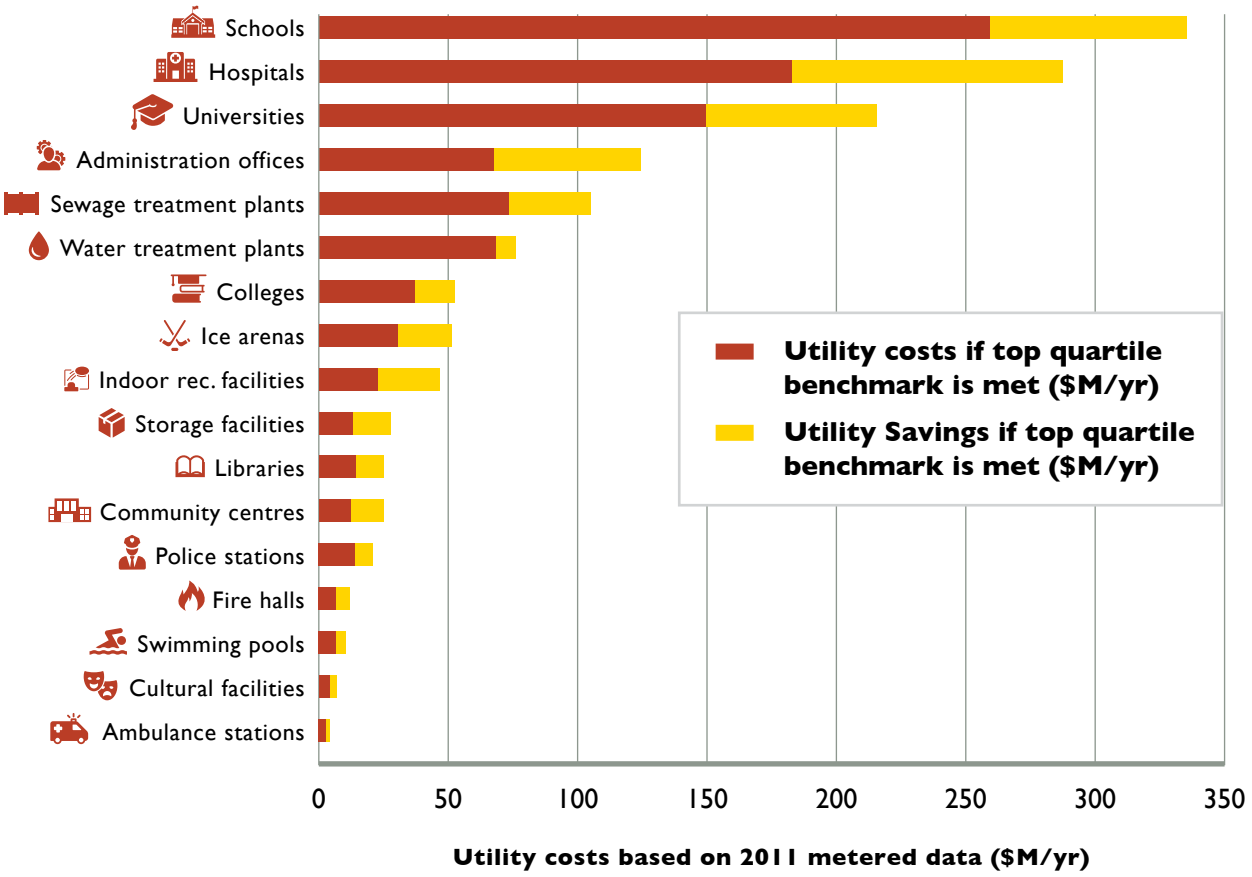



**Figure 4.7: Energy used in Ontario's BPS buildings in 2011 and potential energy savings if top quartile benchmark is met**

Note: Utility bill amounts were estimated using $0.14 per kWh for electricity and $0.26 per cubic meter of natural gas; all non-electricity energy consumption was treated as natural gas for the purpose of this analysis.

4

## 4.1.10 Why Does EUI Vary So Much?

A building's energy demands depend on a wide range of interrelated factors, such as building management, occupant behaviour, and the types of services provided within a facility (see Figure 4.7). Ontario's BPS buildings serve many different purposes and come in a huge assortment of sizes, shapes, and locations.[36] Energy requirements are likewise heavily influenced by method of construction and condition of the building envelope (the walls, roof, windows, doors, and foundation). Even orientation of a building on its lot can affect the amount of energy needed to maintain indoor comfort. Human error can also introduce inaccuracies during energy reporting. Data entry mistakes may result in incorrect information being submitted, and difficulty adjusting for a building's energy use if it serves multiple purposes.

Detailed attention to the worst performing buildings can result in important savings. For example, human error can increase energy use within buildings. People can adjust settings on mechanical equipment, which can affect overall energy efficiency. This is one operational problem that building benchmarking can quickly help to

resolve, because these types of inefficiencies may otherwise go unnoticed. The Low-Income Energy Affordability Network (LEAN) in Massachusetts benchmarks affordable housing throughout the state and shares this information with utilities.[37] Energy retrofits for the worst-performing buildings are prioritized under this program. By matching energy retrofits to the worst performers, LEAN has produced more energy savings than if retrofits were done on a first-come-first-serve basis.

**Detailed attention to the worst performing buildings can result in important savings.**

### 4.1.11 Potential for Energy Savings

To calculate potential energy savings for Ontario's BPS buildings, we benchmarked each building's energy performance against all other buildings in the same category using data collected under O. Reg. 397/11.[40]

The ECO estimated the potential energy savings if all Ontario BPS buildings performed at least as well as the current top quartile, median, and third quartile performers in their category. Using top quartile energy performance as a benchmark is ambitious, but could produce the largest gains. Toronto is benchmarking its buildings against top quartile performance in each category.[41]

Benchmarking against the median can be thought of as encouraging the lower half of buildings to undertake strategic improvements, while the top half of all buildings can continue to operate as usual. The most conservative approach used – using third quartile energy performance as a benchmark – estimates energy savings potential from modest improvements in the worst-performing facilities in each category.

The ECO's analysis of the reported data shows that:

- if all Ontario BPS buildings became as efficient as the top quartile performers in their category, energy consumption could be reduced by 35 per cent, saving 1 megatonne of GHG emissions and about $450 million in utility bills every year.[42]
- if all Ontario BPS buildings reach at least median energy efficiency for their category, energy consumption could decrease by 21 per cent, providing 0.6 megatonnes of GHG savings and approximately $250 million in utility cost savings.
- if all Ontario BPS buildings perform at least as well as the third quartile performers, then energy consumption could be lowered by 8 per cent, along with 0.3 megatonnes of GHG emissions and about $150 million in utility costs.

**If all Ontario BPS buildings became as efficient as the top quartile performers in their category, energy consumption could be reduced by 35 per cent, saving 1 megatonne of GHG emissions and about $450 million in utility bills every year.**

### Success Story: Grand River Hospital in Kitchener-Waterloo

In 2012, Kitchener-Waterloo's Grand River Hospital joined the Greening Health Care program.[38] This program helps hospitals share energy knowledge and best practices, and assists with submissions required under O. Reg. 397/11. The program used the hospital's utility data to identify large energy conservation opportunities for the Freeport Site, located at 3570 King St E., Kitchener.[39] The hospital took a series of steps to lower its energy use, including simple actions such as making seasonal adjustments to some equipment. In total, after spending less than $100,000 on external project costs, the Freeport Site was able to save $273,000 in utility bills in 2015, and reduce electricity and natural gas consumption by 20 per cent and 30 per cent, respectively.

## 4.1.12 Can All Buildings Improve Their Energy Performance at a Reasonable Cost?

Not necessarily. However, evidence from other jurisdictions suggests that energy reporting helps building managers identify good opportunities to save energy. A 2012 U.S. Environmental Protection Agency study of 35,000 buildings using the ENERGY STAR® Portfolio Manager™ benchmarking system revealed annual energy savings of 2.4 per cent, and energy savings of 7 per cent in just three years.[43] The largest energy savings came from poor-performing buildings with the lowest ENERGY STAR® scores (Figure 4.8).

Similarly, New York City's benchmarking policy has helped save 5.7 per cent in energy use between 2010 and 2013.[44] San Francisco saw its EUIs improve by about 7.4 per cent between 2009 and 2013.[45] Knowing how a building's EUI compares to its peers will help BPS building managers focus their conservation efforts and identify projects worth pursuing.

We can already see the impact in some Ontario facilities, where the regulation has helped increase interest in voluntary programs, such as Greening Health Care. This initiative helps hospitals share knowledge and best practices, as well as manage energy data and submit reports under O. Reg. 397/11 (see text box on the Grand River Hospital in Kitchener-Waterloo for one example). Currently, 41 of Ontario's 264 hospitals participate in this program.[46] Participants have saved almost $4 million in utility costs in just over two years (2013 – 2015).[47]

Similarly, some universities are sharing their best practices and working on a common energy reporting and monitoring system to file their regulatory reports.[48]

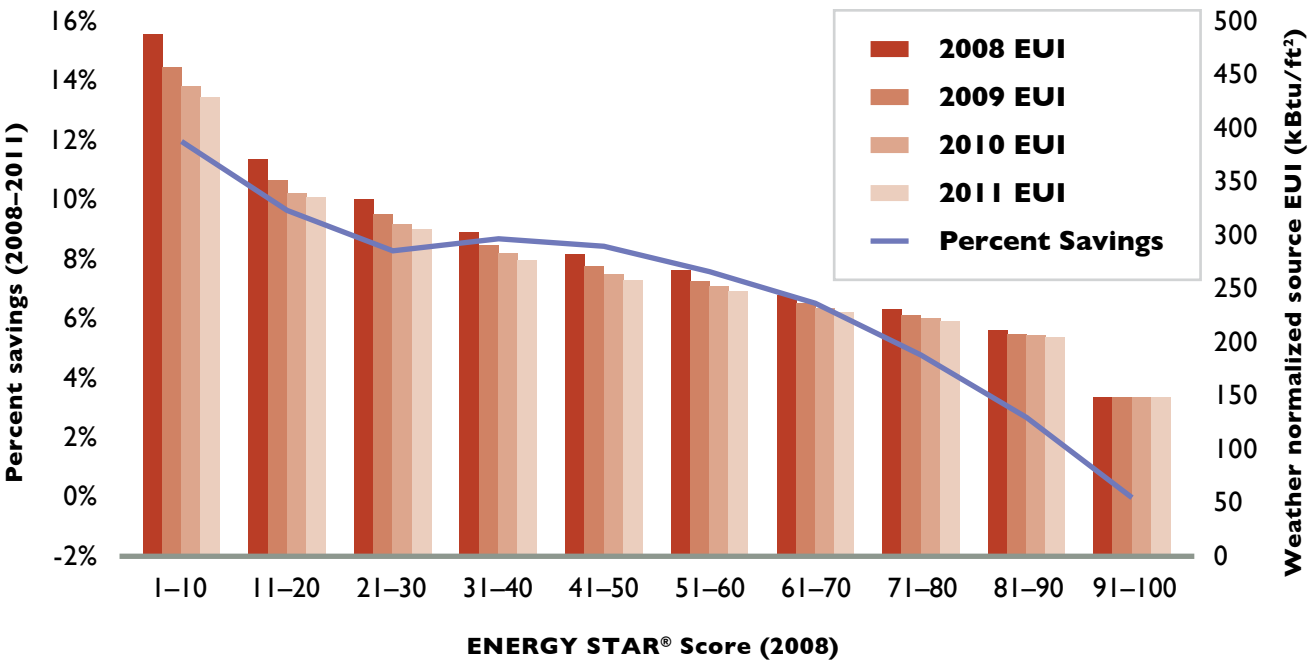



**Figure 4.8: Energy savings vary depending on ENERGY STAR® score**

Source: U.S. Environmental Protection Agency, ENERGY STAR® Portfolio Manager™ Data Trends Report, *Benchmarking and Energy Savings*, October 2012.

### 4.1.13 How Else Has Mandatory Reporting Helped?

Ontario Regulation 397/11 has helped bring attention to the otherwise hidden issue of energy consumption within Ontario's BPS buildings. As a result of this regulation, Ontario's BPS buildings must report energy consumption and greenhouse gas emissions annually to both the Ministry of Energy and to the public. This requirement allows *anyone* to review all BPS data and identify trends – something that was impossible to do prior to this regulation. The annual reports for building energy consumption have drawn building operators' attention to energy use. Similarly, the requirement to obtain senior management approval for the five-year energy conservation plans has drawn senior managements' attention to energy use as well as energy conservation opportunities.[49]

Overall, mandatory energy reporting in the BPS is supporting a culture of conservation and creating a virtuous circle: it creates awareness of energy use, drives interest in conservation activities, which in turn helps develop Ontario expertise in energy management companies. This can lead to technological improvements and more opportunities for local green jobs.

### Success Story: Rainy River Health Centre

The Rainy River Health Centre, located near Manitoba's border, is performing well against various benchmarks. Its EUI is less than the NRCan average for Ontario hospitals and, according to the data collected under O. Reg. 397/11, it is in the top quartile of all Ontario hospitals.[50]

Rainy River is part of the larger Riverside Health Care network. This network is composed of three different facilities and serves the needs of northwestern Ontario communities. To date, the Riverside Health Care network has taken steps to manage energy efficiency across all three of its facilities, including: installing variable frequency drives on pumps and boilers; installing building automation systems; using efficient air chillers; using efficient fume hoods; and proactively managing and maintaining building mechanical systems and equipment.[51] As discussed in its five year Conservation and Demand Management Plan, the health network recently conducted an energy audit to identify specific additional energy conservation strategies for each building. According to the audit, the Rainy River facility would likely further improve its energy efficiency by upgrading both interior and exterior lighting, installing a heat reclaim system and reinsulating the building envelope. Rainy River provides an example for all BPS facilities. Even though it is already a top quartile performer, it continues to seek opportunities to improve its energy use.

## 4.1.14 Are Voluntary Programs Sufficient?



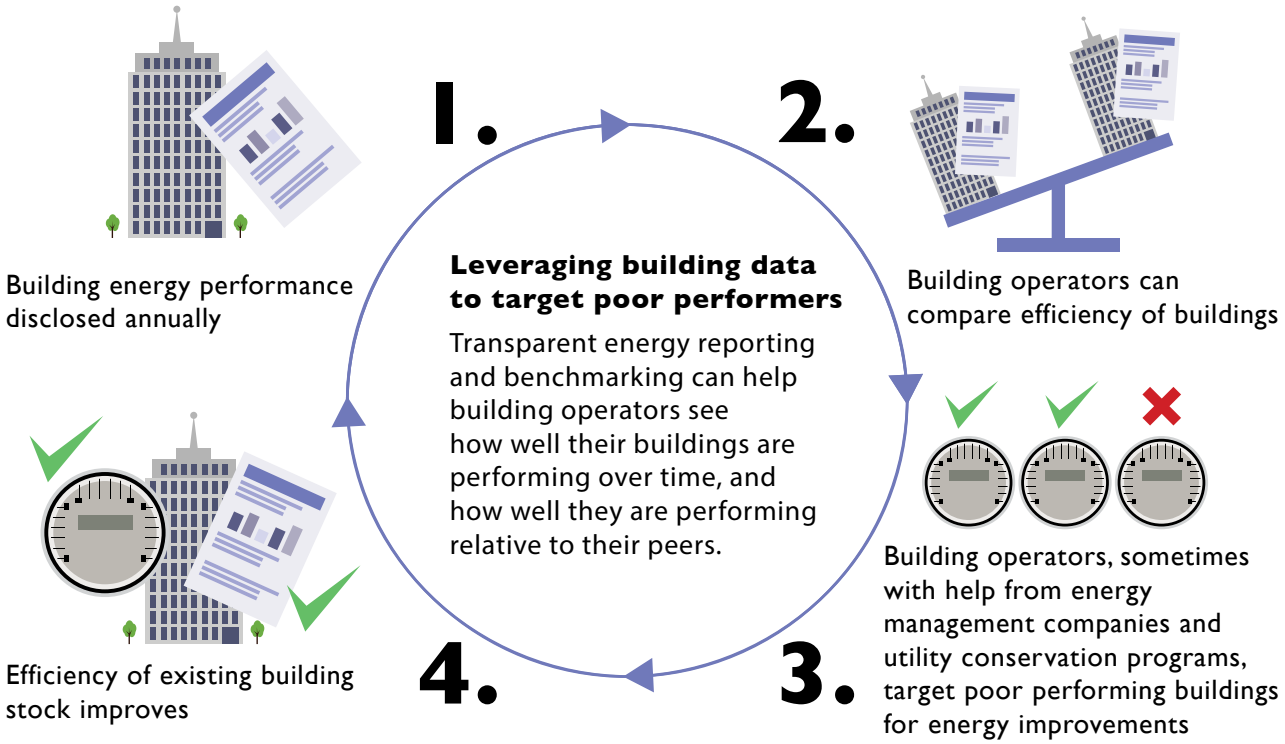
Voluntary programs have grown in recent years due to higher energy costs and increased climate consciousness. In fact, several large private property owners and managers benchmark their own buildings to improve competitiveness, increase building value and/or to reduce costs.[52]

Successful voluntary programs include:

1. **Sustainable Buildings Canada** has helped deliver Enbridge's Savings By Design – a green building program for new buildings to help participants improve energy efficiency 25 per cent above the Ontario Building Code requirements.
2. Canada Green Building Council through **LEED certification** provides independent, third-party verification of a building's energy design.
3. **BOMA BEST®** is an environmental certification program for commercial buildings.
4. **CivicAction's Race to Reduce** ran from 2011 to 2014 in the Greater Toronto and Hamilton area. It was a friendly corporate challenge aimed to reduce total energy use in participating office buildings by 10 per cent in four years.

5. **Mayors' Megawatt Challenge** has been helping municipalities improve energy efficiency and environmental performance in their buildings since 2003. In 2011, the program went national with a Town Hall Challenge – member municipalities were challenged to reach a target of 20 ekWh/ft$^2$/year by 2015. A Community Centre Challenge is expected to be released in 2016.

6. **REALpac 20 x 15** is an energy consumption target for office buildings of 20 ekWh/ft$^2$/year to be achieved by 2015. REALpac collects energy and building data for existing office towers and normalizes it for a variety of different factors.



Overall, these voluntary initiatives are producing measurable results. For example, CivicAction's Race to Reduce exceeded its target by achieving a collective 12.1 per cent energy reduction from participating buildings across the Greater Toronto and Hamilton area in just four years.[53]

However, while voluntary programs make an important contribution to energy conservation, they impact only a fraction of Ontario's buildings. The fact that only 16 per cent of Ontario hospitals participate in Greening Health Care is telling. Even the successful ENERGY STAR® program[54] affects only 32 per cent of new homes.[55] Voluntary programs alone will not achieve Ontario's energy efficiency goals.

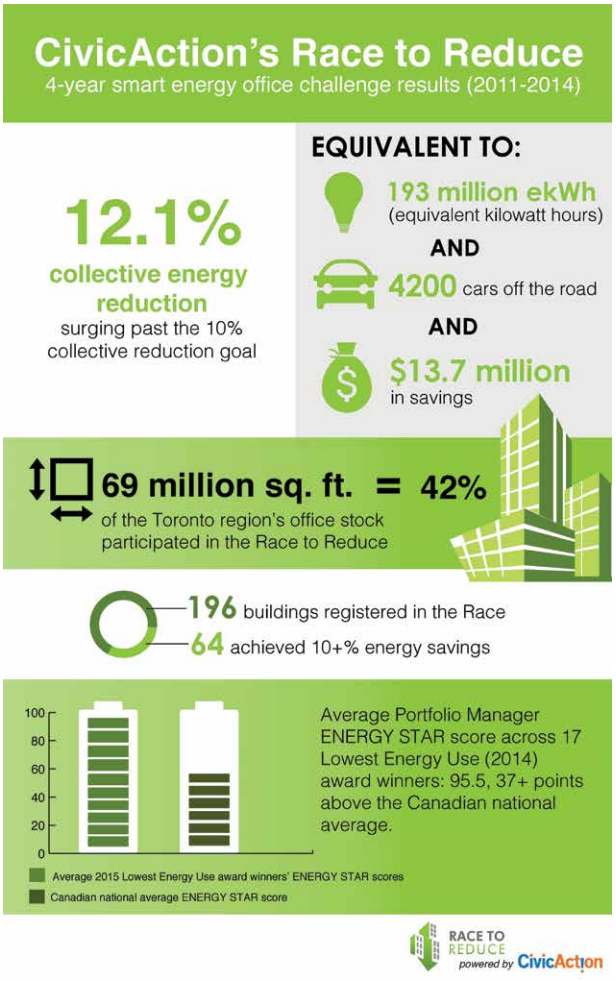
**Voluntary programs alone will not achieve Ontario's energy efficiency goals.**

### Energy Reporting and Benchmarking in Private Buildings?

Provincial public buildings use only 8 per cent of the energy used in all Ontario buildings. For real progress, Ontario must get serious about energy efficiency in private buildings, including offices, industries and housing.

Since 2009, the *Green Energy Act* has authorized the Ontario government to give homebuyers the right to fair disclosure of energy consumption and efficiency data before purchase.[56] The government has not implemented this valuable consumer protection right. Realtor concerns that this right could delay property listings are unfounded - the information would be required to be provided before an agreement of purchase and sale is signed, not before listing.[57] And it need not cost the vendor anything to provide this information. Depending on the regulations, the vendor could do as little as handing over a year's worth of energy bills.

Owners, buyers and tenants of very large privately owned buildings may soon get energy and water disclosure. Bill 135, the *Energy Statute Law Amendment Act*, would amend the *Green Energy Act, 2009* to enable a mandatory energy and water reporting and benchmarking regulation for privately owned buildings, as proposed in the 2013 Conservation First white paper.[58] The Ministry of Energy proposes to use this authority to require energy reporting and benchmarking for existing privately owned buildings (commercial, multi-unit residential, and some industrial) that are 50,000 square feet or larger (Environmental Registry # 012-6904).[59]




Source: CivicAction Race to Reduce, report, *Over the Finish Line*.

## 4.1.15 Recommendations

Ontario Regulation 397/11 was an important public initiative. Mandatory energy reporting in the broader public sector is already producing public benefits, both environmental and financial. The ECO's analysis of this valuable data suggests that there are large opportunities for improved energy efficiency in Ontario's public buildings; and mandatory building energy reporting can help Ontario reduce its energy use and greenhouse gas emissions.

Similar benefits can be expected from benchmarking and reporting in private sector buildings, which consume over 90 per cent of Ontario's building energy. The Ministry of Energy should promote energy efficiency in private buildings by implementing *Green Energy Act, 2009* provisions to protect consumers by mandatory home energy use disclosure prior to sale, and require large building energy use disclosure.

However, collecting and reporting data is only useful if it leads to action. To date, the actions taken by BPS facilities are mixed. Based on their five-year conservation plans submitted under O. Reg. 397/11, some organizations have set measurable targets to improve future energy performance, while others have not.

**The Minister of Energy should:**

- **disclose the energy used in Ontario government buildings in a user-friendly format;**
- **set energy use intensity targets for all public buildings;**
- **implement Green Energy Act, 2009 provisions that protect consumers by mandating home energy use disclosure prior to sale; and**
- **require large private sector buildings to disclose their energy intensity.**

## 4.2 Unlocking Energy Efficiency Upgrades of Public Buildings

The comprehensive data now available on energy use in Ontario's public buildings therefore shows a significant potential for energy efficiency improvements. Improved energy efficiency of existing public buildings would have many benefits, including reduced operating costs, less demand on energy infrastructure, more green jobs, and reduced greenhouse gas emissions.

What would it take to unlock this potential and make public buildings cleaner, leaner, and greener?

### 4.2.1 Improve Access to Energy Conservation Program Information

Broader public sector (BPS) organizations were surveyed about their experiences in collecting data and developing conservation plans under O. Reg. 397/11.[60] Eighty per cent of them had accessed funding for energy conservation, but 86 per cent would find more information about funding and incentives helpful.[61] Similarly, it can be difficult and time consuming for organizations to select a reliable and appropriate energy efficiency company, and to predict whether financial, energy and emissions savings are reasonably achievable.

The provincial government could do more to help by:

- providing a single clearinghouse of reliable information;
- accrediting qualified, experienced energy service providers, perhaps on the basis of mandatory training and regular refreshers; and
- endorsing acceptable methodologies for predicting financial, energy and emissions savings.

For example, since 1991 Natural Resources Canada has provided a program called the Federal Buildings Initiative, which features guidance materials and facilitation services for federal organizations.[62] Through this program, NRCan has facilitated over 80 upgrades of federal buildings.[63]



**Figure 4.9: In 2012, the FBI program facilitated an energy retrofit project at the National Research Council building (100 Sussex Drive, Ottawa). An investment of $9 million dollars resulted in annual utility and maintenance savings of $920 thousand dollars.**

Source: Information from NRCan, photo from National Research Council of Canada

### 4.2.2 Set Energy Efficiency Targets for the BPS

The *Green Energy Act, 2009* was designed with an integrated set of tools to enable the provincial government to incent improved energy efficiency in existing buildings. With the exception of O. Reg. 397/11, Ontario has not yet used these powers. Using these existing tools could help pave the way for Ontario to get serious about energy efficiency in public buildings.

As authorized under section 6(4), the Ministry of Energy should set EUI targets for the BPS and should require the manager of each building to do the same, which could be enacted through O. Reg. 397/11. Targets and standards are a well-established and powerful tool to guide and incent action.

### 4.2.3 Improve Transparency of Building Energy Use Intensity

The public should be able to hold the government accountable for its energy use. This means that public sector building energy consumption data should be easily accessible and user-friendly, consistent with the Open Government initiative.[64]

**The public should be able to hold the government accountable for its energy use.**

The entire public sector could do a much better job to make its energy consumption data accessible and understandable. As we demonstrated earlier in this chapter when discussing energy reporting and benchmarking for BPS buildings, there are many opportunities to more clearly and meaningfully present the data collected under O. Reg. 397/11. One simple but powerful tool would be for each public building to post its energy consumption in a user-friendly manner both online and in the lobby. Clear and effective public energy disclosure has contributed to excellent results in other jurisdictions.[65]

Clear communication of a building's energy performance to the public will also enable the energy efficiency industry to target public buildings that have substantial energy savings opportunities.

### 4.2.4 Make Energy a Factor in All Capital Projects

As authorized by section 8(2) of the *Green Energy Act, 2009* Ontario can and should compel all public bodies to consider energy upgrades when making capital investments in buildings or infrastructure. It was a step in the right direction in 2015 when the Ontario government established a *Directive for Major Public Infrastructure Projects*. It requires that any request for planning approval demonstrate how the project "[promotes] the achievement of the government's other policy objectives or priorities, such as climate change…"[66]

In addition, the strength of a BPS organization's conservation plan could be among the considerations when evaluating capital or operating funding requests to the province.[67]

### 4.2.5 Facilitate Energy Upgrade Financing

Many opportunities for improving efficiency (such as operational changes) require little capital investment. However, others require significant capital investments and long payback periods. In an era of chronic government financial constraint, limited access to financing may block retrofits that make both environmental and economic sense.

Unlike other jurisdictions, Ontario has not set aside dedicated funding for energy efficiency projects in the public sector.[68] Some existing programs could provide funding for energy efficiency retrofits of Ontario public buildings, principally:

- Natural gas and electric utilities offer conservation programs funded by ratepayers (see Appendices A and B). Some of these include financial incentives for replacing equipment like furnaces, boilers, motors, chillers and air conditioners, as well as building envelope improvements (insulation, doors and windows);[69]
- The Ontario Financing Authority can provide long-term loans for capital improvements, such as energy efficiency upgrades, to "consolidated-public entities", such as hospitals, school boards and colleges, as well as provincial corporations, boards and commissions;[70] and
- Infrastructure Ontario can also provide energy efficiency upgrade loans to "non-consolidated public entities" such as municipalities and universities.

These utility-based conservation programs and the two government-sponsored loan programs are required to meet a huge range of needs.

Private property owners can borrow in the conventional financial markets to fund energy efficiency upgrades, and rely on the energy savings to repay the loan. However, this option is less available to managers of Ontario public buildings. In particular:

- Section 28 of the *Financial Administration Act* restricts the government and "public entities" from incurring debt without permission from the Minister of Finance. This permission is granted where the Minister of Finance deems that the borrower is capable of repaying the loan. This applies to the government and all its boards, commissions and corporations, which include colleges[71], Ontario Lottery and Gaming, the Liquor Control Board of Ontario, the Royal Ontario Museum, and some convention centres (note, not municipalities, school boards, universities and hospitals).[72, 73]

In addition, according to the Ministry of Economic Development, Employment and Infrastructure it can be difficult for OPS building managers to access energy savings to help pay for energy upgrades.

**Ontario could potentially unlock millions in financial, energy and climate savings by facilitating financing of energy efficiency upgrades for existing public buildings.**

If the right conditions are in place, these hurdles could be lowered. Ontario could potentially unlock millions in financial, energy and climate savings by facilitating financing of energy efficiency upgrades for existing public buildings. This requires resolution of at least two key barriers:

### Ensure Access to Savings

In many OPS buildings, the capital costs of upgrades do not come out of the same funding envelope (or from the same public body) as the operational and maintenance costs. This accounting issue is akin to a "split incentive" situation, where a building owner or tenant that funds and undertakes an energy retrofit does not directly benefit from it. This can seriously

discourage energy upgrades, and can make it difficult for energy savings to be used to pay for the upgrades that produce them.[74] The province should find a way to allow public bodies to use their energy cost savings to pay for efficiency upgrades in the buildings that they occupy.

### Exempt Qualified Projects From Provincial Red Tape

Borrowing to fund energy efficiency upgrades in public buildings has one critical feature that distinguishes it from other types of public debt: well-designed upgrades will produce a reliable flow of energy and financial savings with which to repay the loan. For this reason, some energy efficiency upgrade loans deserve different treatment than other forms of public debt which must be repaid with tax dollars. Reasonable and prudent private loans for energy efficiency upgrades should therefore be exempt from, or more readily approved under, section 28 of the *Financial Administration Act (FAA)*. To date, the Minister of Finance has looked positively upon such requests, having approved all three energy efficiency-related applications it has received over the years. This policy should be made explicit as the Minister has the power to do under section 28 of the *FAA* to avoid some of the existing confusion among stakeholders.

**Well-designed upgrades will produce a reliable flow of energy and financial savings with which to repay the loan.**

In cooperation with the Ministry of Energy[75] and the Ministry of Economic Development, Employment and Infrastructure,[76] the Minister of Finance should formally determine standard terms and conditions for energy efficiency loans that would not require the typical provincial approval process under the *FAA*. The standard terms might include: what types of buildings should be upgraded;[77] the method used for predicting the minimum energy and financial savings;[78] minimum qualifications for the energy service provider or a system to accredit providers;[79] what minimum and maximum payback periods are acceptable; and reporting and transparency requirements.

Model energy upgrade contracts might also be stipulated, and may reduce transaction and legal costs where appropriate. Standard energy contracts have been successfully used by the Canadian and U.S. federal governments. The U.S. government goes farther by explicitly authorizing government agencies to borrow to fund energy savings performance contracts for public buildings.[80] Enabling legislation authorizes U.S. agencies to enter these contracts and established an office to assist departments and agencies undertaking such contracts.[81]

## 4.2.6 Recommendation

**The Minister of Finance should remove barriers that prevent public bodies from borrowing to upgrade the energy efficiency of their buildings, and from using the resulting energy bill savings to repay the loan.**

## Endnotes

1. According to MEDEI, the OPS owns or leases approximately 45 million square feet of building space. In addition, based on data from O. Reg. 397/11, broader public sector organizations (BPS) occupy roughly 590 million square feet of space. Therefore, total floor space for both types of buildings is 635 million square feet. Considering that total Ontario commercial and institutional (C/I) floor space is approximately 3,426 million square feet, OPS and BPS building space therefore represents about 19 per cent of total C/I floor space in Ontario. (Ministry of Economic Development, Employment and Infrastructure, response to Ministry fact-check of ECO report, April 12, 2016; Ontario Power Authority, Power System Planning Division, presentation, Ontario Electricity Demand 2012 Annual Long Term Outlook, slide 63, Summer 2012. 2011 data for the BPS was collected by the Ministry of Energy under O. Reg. 397/11, cleansed for duplicate entries and other anomalies, and shared with the ECO.)

2. Sixteen per cent of all provincial energy use occurs in C/I buildings. Therefore, assuming that public buildings consume energy at the same rate as other C/I buildings, and knowing that 19 per cent of total C/I buildings are occupied by public floor space, then Ontario public buildings account for 3 per cent of the province's energy needs (19 per cent of 16 per cent). Expanding this logic, C/I buildings account for roughly 43 per cent of all building energy demand (16 per cent out of the total 37 per cent of building energy use by C/I buildings). Therefore, provincial public buildings account for 8 per cent of energy used across all building types (19 per cent of 37 per cent).

3. Ministry of Economic Development, Employment and Infrastructure, response to Ministry fact-check of ECO report, April 12, 2016.

4. *Supra*, note 1.

5. OPS buildings have been tracking their energy consumption for nine years. Ontario publishes total energy use information for OPS buildings, and tracks it on an individual building basis; building-specific energy data is not currently published. Instead, the Ministry of Infrastructure rolls up all building-specific information and reports against government-wide energy conservation targets. They are currently working on an annual 2 per cent equivalent kilowatt-hour reduction in energy use and a 27 per cent by 2020 greenhouse gas reduction over a 2006 baseline. (Ministry of Infrastructure, *2014 Energy Consumption and Greenhouse Gas Emissions Report*)

6. Ontario Ministry of the Environment and Climate Change, policy paper, *Ontario's Climate Change Strategy*, p. 25, November 24, 2015.

7. Independent Electricity System Operator, report, *Ontario Demand Forecast*, p.14, December 14, 2015.

8. Council of Ontario Universities, report, *Inventory of Physical Facilities of Ontario Universities*, p.2, May 2015.

9. As per Enbridge's 2015-2020 DSM application, only 4 per cent of commercial customers have participated in their natural gas DSM program. (Enbridge Gas Distribution Inc., report, *EB-2015-0049 Multi-Year Demand Side Management Plan (2015 to 2020) Corrected Evidence*, Ex.B, Tab 2, Sch.1, p.15, June 26, 2015.)

10. See Section 4.1.14 of this report: *Are Voluntary Programs Sufficient?*

11. Based on 2011 cleansed data collected from O. Reg. 397/11.

12. Government of Ontario, news release, *Ontario's Bold New Plan for a Green Economy*, February 29, 2009.

13. S.J. Norrie and P. Love, paper, *Creating a culture of conservation in Ontario: Approaches, challenges and opportunities*, 2009 IEEE Power & Energy Society General Meeting, 2009.

14. For more information on the Green Button, see: www.greenbuttondata.org/faq/

15. Andrea Krukowski and Cliff Majersik, Institute of Market Transformation report commissioned by the Energy Efficient Building Hub, *Utilities' Guide to Data Access for Building Benchmarking*, p.11, March 1, 2013.

16. A recent white paper that discusses utility billing accessibility from a Canadian perspective can be found online. See the Utility Billing Data Access Working Group, *Transforming Energy Management in Canada*, published April 2016.

17. See definition of "public agency" in s. 3 of O. Reg. 397/11.

18. Or part of a building.

19. See O. Reg. 397/11, s. 5 (1).

20. See O. Reg. 397/11, s. 5 (3).

**21.** Ontario Ministry of Energy, website, *Conservation for Public Agencies*, accessed April 2016. www.energy.gov.on.ca/en/green-energy-act/conservation-for-public-agencies/

**22.** See O. Reg. 397/11, s. 4.

**23.** Ontario Association of Architects and Bob Bach, summary table, *2030 Challenge – Ontario Data*, 2014. www.oaa.on.ca/oaamedia/documents/2030%2TARGETS_ONTARIO%20DATA_FINAL%20%28ekWh%29.pdf

**24.** The first Survey of Commercial and Institutional Energy Use was performed in 2010 using 2009 calendar year data. The two resulting reports are available from: www.nrcan.gc.ca/energy/efficiency/buildings/energy-benchmarking/update/getready/16731

**25.** Examples include: the U.S. Department of Energy's Energy Information Administration and their Commercial Buildings Energy Consumption Survey and Residential Energy Consumption Survey; and Natural Resources Canada's Survey of Commercial and Institutional Energy Use, and National Energy Use Database. Also, Portfolio Manager lets facility managers enter building and utility bill information, where it is automatically compared against national building databases to give each facility an ENERGY STAR® score between 1 – 100 [where 1 is a bottom performer and 100 is a top performer]. The Canadian version summarizes national median reference EUIs for many building categories, and uses U.S. data when Canadian information is unavailable. (For more information, refer to: portfoliomanager.energystar.gov/pdf/reference/Canadian%20National%20Median%20Table.pdf )

**26.** Seattle and New York City used data reported under their local laws to calculate how much energy could be saved annually if poorer-performing buildings improved their EUIs. New York City estimated that its total annual energy use could be reduced by 18 per cent if buildings performed at least as well as the reported average; and annual energy consumption could be reduced by 31 per cent if all buildings performed as well as the reported top quartile. Seattle estimated its annual energy use could be reduced by 25 per cent if all buildings performed at least as well as the median. (The City of New York, report, *New York City Local Law 84 Benchmarking Report*, p.16, August 2012. Seattle Office of Sustainability & Environment, report, *2011/2012 Seattle Building Energy Benchmarking Analysis Report*, p.4, January 2014.)

**27.** The Canada Green Building Council recently published a white paper that provides an overview of key considerations and challenges in implementing benchmarking policies in Canada. See the Canada Green Building Council, *Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework*, April 2016.

**28.** Government of Ontario, website, *Energy use and greenhouse gas emissions for the Broader Public Sector*, accessed April 2016. www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector

**29.** Ottawa Catholic District School Board, information provided to the ECO in response to ECO inquiry, March 2, 2016.

**30.** Government of Ontario, website, *Energy use and greenhouse gas emissions for the Broader Public Sector*, accessed April 2016. www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector

**31.** Karen Palmer and Margaret Walls, paper prepared for the MIT Energy Initiative Symposium, Can *Benchmarking and Disclosure laws Provide Incentives for Energy Efficiency Improvements in Commercial Buildings?*, p.18, May 12, 2014. Local Authority Services, report, Energy Performance Benchmarking of Ontario's Municipal Sector, 2010.

**32.** The annual energy consumption number reported in EUI is a combination of all sources of energy used in the building.

**33.** In the case of some buildings, like water treatment plants, energy use intensity may not be reported in terms of building area, but in terms of another key characteristic such as volume of water treated.

**34.** Most references eliminate the "yr" because this is assumed.

**35.** Bryan Purcell, Toronto Atmospheric Fund, blog, *First annual benchmarking report on City facilities*, November 6, 2013. www.toatmosphericfund.ca/2013/11/06/first-annual-benchmarking-report-on-city-facilities/

**36.** In terms of locations, weather is known to influence building energy needs.

**37.** American Council for an Energy-Efficient Economy, report, *Recommendations and Best Practices for Benchmarking Multifamily Buildings*, p.7, May 2014.

**38.** Greening Health Care, report, *2014 Annual Report*, p.2, June 2015. ghc.enerlife.com/Files/GHC-AnnualReport-%20Program%202014.pdf

**39.** Enerlife Consulting Inc., information provided to the ECO in response to ECO inquiry, March 31, 2016.

**40.** This approach follows that used by New York City and Seattle to estimate potential annual energy savings. It also corresponds with part of the rationale for the regulation, to evaluate results by comparing buildings to similar facilities across the province.

**41.** Comparing energy consumption to top quartile performance has been done by other offices. (The City of New York, report, *New York City Local Law 84 Benchmarking Report*, p.16, August 2012; The City of Toronto, report, *Energy Conservation and Demand Management Plan (2014-2019)*, p.2, July 2014.)

**42.** The calculated energy, greenhouse gas, and utility savings describe annual savings once energy improvements are made, not cumulative savings. We calculated the amount of potential energy savings by taking the difference between an individual facility's energy consumption and the top quartile, median, or third quartile energy consumption for that facility type. This difference represented the rate of potential energy savings for an Ontario facility. This rate of potential energy savings was then multiplied by the facility's area and weather information to calculate actual expected energy savings for a facility (megalitres of treated water was used in the case of sewage and water treatment). The expected energy savings value was turned into a percentage by comparing this value to the actual amount of energy used by the facility in 2011. Greenhouse gas savings were determined by assuming that GHG savings would be proportional to calculated energy savings. Finally, utility bill amounts were estimated using $0.14 per kWh for electricity and $0.26 per cubic meter for natural gas; all non-electricity energy consumption was treated as natural gas for the purposes of this analysis.

**43.** U.S. Environmental Protection Agency, report, *ENERGY STAR® Portfolio Manager™ Data Trends Report – Benchmarking and Energy Savings*, October 2012.

**44.** Navigant Consulting, Inc., Steven Winter Associates Inc., and Newport Partners, LLC (prepared for the U.S. Department of Energy), report, *New York City Benchmarking and Transparency Policy Impact Evaluation Report*, p.ii, May 2015.

**45.** San Francisco Water Power Sewer, report, 2013 *Energy Benchmarking Report San Francisco Municipal Buildings*, p.5, September 2014.

**46.** While there are only 24 hospital organizations involved, some of these organizations have more than one building. Therefore, there are 41 separate hospital sites in Ontario participating in Greening Health Care.

**47.** Greening Health Care, website, *Making Savings - Results as of December 31, 2015*, accessed April 2016. ghc.enerlife.com/LoginGHC.aspx?ReturnUrl=%2fdefault.aspx

**48.** This is co-ordinated through the Ontario Association of Physical Plant Administrator's Energy Committee. The committee oversees energy operations within 18 Ontario universities. For more information, refer to Brock University's Conservation and Demand Management plan, available from: www.brocku.ca/webfm_send/31987.

**49.** The second requirement under the regulation – that, beginning in 2014, BPS organizations must prepare five-year energy conservation and demand management plans with approval from senior management and make these plans available to the public – gives building operators the opportunity to raise energy issues with senior management. See O. Reg. 397/11, s. 6 (1).

**50.** According to their energy report, and based on data from the calendar year 2011.

**51.** Riverside Health Care Facilities, report, *Conservation & Demand Management Plan – 397-11*: Phase 2, June 19, 2014.

**52.** For example, Oxford Properties and Bentall Kennedy.

**53.** CivicAction Race to Reduce, report, *Over the Finish Line*, p.3, December 2015.

**54.** ENERGY STAR® for New Homes is a residential green building program. Homes that qualify for the program are built to be on average 20 per cent more energy efficient than the minimum building code requirement.

**55.** enerQUALITY, website, *ENERGY STAR® For New Homes*, accessed April 2016. www.enerquality.ca/program/energy-star-for-new-homes/

**56.** See section 3 of the *Green Energy Act, 2009*. This section remains un-proclaimed, and the necessary regulations have not been adopted.

**57.** While some realtors have told the ECO that they are concerned about delays with property listings, some organizations working in this sector are supportive of mandatory energy labelling for homes (e.g., the Canadian Home Builders' Association)

**58.** Part of Ontario's Long-Term Energy Plan from 2013, which committed to putting conservation first before building new generation and transmission infrastructure, where cost-effective. The white paper is available from: www.energy.gov.on.ca/en/conservation-first/

**59.** Some stakeholders have raised concerns about the cost of compliance, and confidentiality. BPS experience does not suggest that the cost of compliance should be a significant barrier.

**60.** O. Reg. 397/11 – (Energy Conservation and Demand Management Plans), made under the *Green Energy Act, 2009*.

**61.** IndEco strategic Consulting Inc., report for the Ontario Ministry of Energy, *Analysis of Broader Public Sector 5-year Energy Conservation and Demand Management Plans*, p.6 & 8, December 21, 2015.

**62.** Natural Resources Canada, website, *Energy Efficiency for Federal Buildings*, accessed April 2016. http://www.nrcan.gc.ca/energy/efficiency/buildings/eefb/4121

**63.** Based on information request from NRCan.

**64.** Government of Ontario, website, *Open Government*, accessed April 2016. www.ontario.ca/page/open-government

**65.** See, for example the *New York City Energy & Water Performance Map* at benchmarking.cityofnewyork.us/.

**66.** The Directive for Major Public Infrastructure Planning Projects, at 5.1, adopted in the summer of 2015.

**67.** The Ministry of Energy has publicly stated it is considering this option. (Ministry of Energy, website, *Conservation First*, accessed April 2016. www.energy.gov.on.ca/en/conservation-first/)

**68.** For example, the U.S. federal government's dedicated funding for environmental savings performance contracts projects. (In December 2011, a Presidential Memorandum: *Implementation of Energy Savings Projects and Performance-Based Contracting for Energy Savings*, committed a minimum of $2 billion to energy savings performance contracts for government departments and agencies (see: www.whitehouse.gov/the-press-office/2011/12/02/presidential-memorandum-implementation-energy-savings-projects-and-perfo); $2 billion more were added in the 2015 Presidential Climate Action Plan.) See also, the U.K. Green Investment Fund, www.greeninvestmentbank.com/investment-sectors/energy-efficiency/. Other state-sponsored green banks include: the Connecticut Green Bank, NY Green Bank, the Green Fund (Japan), Malaysian Green Technology Corporation and Clean Energy Finance Corporation (Australia).

**69.** See for example some of the incentives offered by Toronto Hydro, at: www.torontohydro.com/sites/electricsystem/electricityconservation/residentialconservation/Pages/default.aspx

**70.** According to the Ministry of Finance, there is no limit placed on the amount of long-term financing that the OFA can provide to public bodies. The limiting factor is not the amount of financing available, but rather an assessment of the ability of the borrower to repay the loan. [*Ontario's Capital Investment Plan Act, 1993*, defines "Public Bodies" as meaning

(a) a corporation referred to in section 2 or another Crown agency,

(b) a hospital as defined in the Public Hospitals Act or another facility receiving funding for capital purposes from the Minister of Health and Long-Term Care,

(c) a municipality,

(d) a university that receives regular and ongoing operating funds from the Crown in right of Ontario for the purposes of providing post-secondary education, a college of applied arts and technology established under the Ontario Colleges of Applied Arts and Technology Act, 2002, Algoma University College, le Collège de Hearst or the Ontario College of Art & Design,

(e) a school board, or

(f) an entity named or described as a public body in the regulations made under this Act]

**71.** According to the Ministry of Training, Colleges and Universities, section 28 of the *FAA* requires that colleges obtain the written approval of the Minister of Finance prior to entering into any financial arrangement, financial commitment, guarantee, indemnity or similar transaction that will increase the indebtedness or the contingent liabilities of the Province. (However, first the college needs MTCU to approve their application.) As section 28 does not establish any materiality thresholds, a significant number of college transactions require section 28 approval. The 2015 Budget introduced amendments to the *FAA* that allow the Minister of Finance/President of Treasury Board to exempt broad classes of transactions from the application of section 28 by regulation. MTCU has been working with Ministry of Finance and Treasury Board Secretariat on the class exemption.

**72.** The Energy Service Association of Canada perceived section 28 of the *FAA* to be a barrier to undertaking more energy upgrades in Ontario's public sector buildings. However, according to the Ministry of Finance, "section 28 of the FAA should not be seen as the limiting factor for a loan, but rather an assessment of the ability of the borrower to repay the loan. Such an assessment would be expected to be affected by any savings impact on the ability to repay."

**73.** Section 1 of the *Financial Administration Act* defines 'public entities' as follows.

"public entity" means,

(a) a Crown agency,

(b) a corporation, with or without share capital, that is not a Crown agency but is owned, operated or controlled by the Crown,

(c) any other board, commission, authority or unincorporated body of the Crown;

Note, this definition does not include municipalities, universities, schools boards or hospitals.

**74.** See the U.S. Department of Energy's Better Building Initiative, website, *Leasing & Split Incentives*, accessed April 2016. www4.eere.energy.gov/alliance/activities/market-solutions-teams/leasing-split-incentive

**75.** For buildings managed by the Broader Public Sector, including hospitals, universities and municipalities.

**76.** For buildings managed by the Ontario Public Service.

**77.** See the benchmarking data provided in chapter 4.1.

**78.** One model to consider is the U.S. Investor Confidence Project (ICP), a project of the U.S. Environmental Defense Fund, which promotes investor confidence in energy efficiency opportunities. It reduces transaction costs by assembling existing standards and practices into a consistent and transparent process that promotes efficient markets. The ICP provides six protocols to address different building types and project size/scope. Project developers select the most appropriate and recent version of an ICP protocol at project inception. Similar to an appraisal pack in a commercial real estate deal, each defined energy performance protocol creates a standard set of documentation that will help standardize project performance underwriting, leading to better data on performance and a more efficient marketplace with less duplicative engineering and lower transaction costs. The result should be an increase in deal flow and a more transparent efficient market. The Ministry of Energy is currently working with the MaRS Advanced Energy Centre to adopt the U.S. based ICP standards to Canada and to develop a broader implementation strategy.

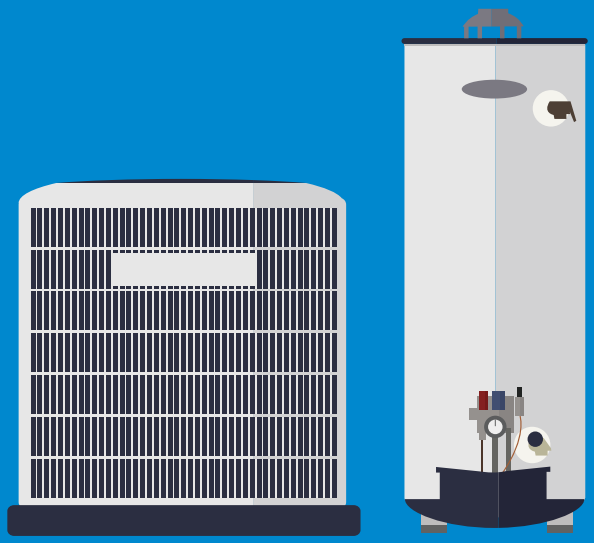
**79.** Accrediting or pre-approving a list of qualified, experienced energy service providers could save time and reduce the risk of poor results. Mandatory training, regular refreshers and audits of results could be pre-requisites for inclusion on the list. This tool has been used by the Canadian and U.S. federal governments.

**80.** The U.S. federal government enables federal agencies to take on liability for guaranteed energy savings pursuant by 42 U.S. Code, s.8287 (a)(2)(C):

Federal agencies may incur obligations pursuant to such contracts to finance energy conservation measures provided guaranteed savings exceed the debt service requirements.

**81.** The U.S. Office of Energy Efficiency & Renewable Energy, website, *Energy Savings Performance Contracts for Federal Agencies*, accessed April 2016. energy.gov/eere/femp/energy-savings-performance-contracts-federal-agencies

# 5 Codes and Standards



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# 5.0 Codes and Standards

## 5.1 Introduction

Energy codes and standards are key tools for energy conservation in Ontario. They can be either voluntary or mandatory, and can apply to many types of energy use, including buildings, vehicles and appliances.

Some voluntary standards including, for example, LEED and ENERGY STAR®, play an important role in proving the technical and financial feasibility of innovations, and in developing market demand for more efficient buildings and products. But these voluntary standards are generally adopted by the best performers. Driving large-scale energy efficiency improvements down to weaker performers typically requires regulation.

Ontario's mandatory energy codes and standards are the Ontario Building Code (covering new buildings) and a regulation under the *Green Energy Act, 2009* (covering appliances and products); while vehicle standards are set by the federal government. The Building Code is discussed briefly in the text box below, and has been covered in previous ECO reports. See chapter 3 of this report for a text box about federal vehicle fuel efficiency standards.

**Driving large-scale energy efficiency improvements down to weaker performers typically requires regulation.**

### Continuous Improvement in Energy Performance of New Buildings Through the Ontario Building Code

The energy efficiency requirements in the Ontario Building Code apply to new buildings and extensions of existing buildings.

Ontario has been a leader in energy efficiency provisions in its Building Code. The current levels of efficiency in the Ontario Code exceed most other jurisdictions for both homes (where Ontario requires Energuide 80 performance) and large buildings (where Ontario requirements are stricter than the commonly used ASHRAE 90.1-2010 standard, and roughly equivalent to Canada's National Energy Code for Buildings (2011), which was recently adopted by several provinces).

The Code will soon require new buildings to be even more efficient, as higher efficiency levels already in law will come into effect on January 1, 2017 that will increase energy efficiency requirements by an additional 15 per cent for low-rise housing, and 13 per cent for large buildings. The Building Code Conservation Advisory Council has noted that each five-year Code update since 1997 has delivered approximately a 13 per cent improvement in predicted energy efficiency (this is for large buildings, although the trend for low-rise housing is similar) and has recommended that this 13 per cent rate of improvement over each Code cycle

continue. The rate of improvement and impact on building energy use intensity (energy used per square foot of building space) is shown in Figure 5.1. A new building built to Code in 2017 is predicted to use approximately 35 per cent less energy than a building built to Code in 1997.

The Ministry of Municipal Affairs and Housing (MMAH) is expected to begin consultation in 2016 on the next edition of the Building Code, which will set the next round of energy efficiency levels (likely to come into effect in 2022).

In addition to the new overall building energy performance requirements, it will be interesting to see whether MMAH proposes additional changes to the Code, that could improve building energy performance, which have been noted in previous ECO reports:

- Introducing energy efficiency requirements for renovations of existing buildings;
- Requiring buildings to be built "renewables-ready" for technologies such as electric vehicles and solar energy.
- Addressing the global warming impact of building material choices, such as insulation.
- Requiring building commissioning or other operational practices that could improve energy performance.
- Ensuring building construction practices and workmanship do not compromise energy performance, for example, requiring blower door testing to guarantee adequate air-tightness.

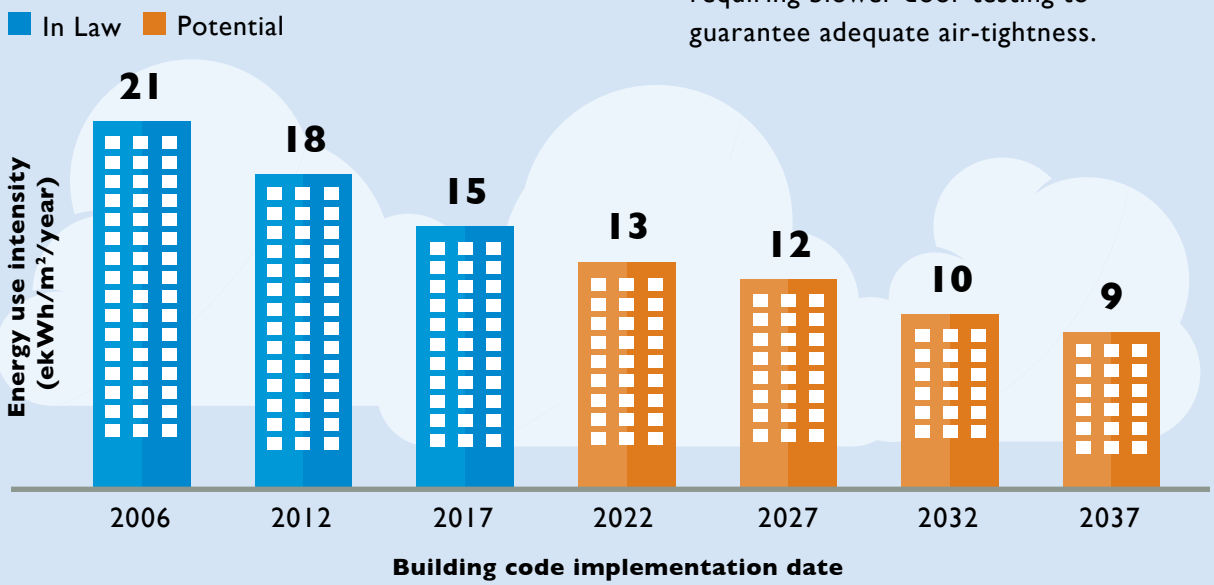


**Figure 5.1: Average predicted energy use intensity of new buildings built to Ontario Building Code requirements**

Note: Energy use intensities are sector-weighted averages for buildings built to the Ontario Building Code's minimum energy efficiency requirements for part 3 (large) buildings. All fuels used in building energy use are converted into a common energy unit (ekWh: equivalent kilowatt-hours). "Potential" future energy use intensities assume that energy efficiency requirements will improve by 13 per cent in each five-year Code cycle, matching the rate of improvement in recent Code updates.

Source: Building Code Conservation Advisory Council

This chapter examines recent changes in minimum energy performance standards (MEPS) for appliances and products sold in Ontario. These standards do not apply retroactively to products already in use, but they do compel higher efficiency as old products wear out and are replaced. They allow Ontario to run leaner, achieving the same product services with less energy use.

The amount of energy (both from electricity and fossil fuels) this can save is significant, because of the broad scope of energy standards. Energy standards in the U.S. regulate products responsible for about 90 per cent of home energy use, about 60 per cent of commercial building use, and about 30 per cent of industrial energy use, percentages that are likely similar for Ontario.[1] The IESO estimates that product standards and changes to the Ontario Building Code will deliver 10.2 TWh of electricity savings by 2032 (85 per cent of which must come from new codes and standards that were not in effect as of 2012), approximately one third of the Long-Term Energy Plan's target for all electricity savings by 2032.[2] The government does not have a target for the amount of natural gas savings that product standards can deliver.

## 5.2 Product Standards: Who Does What?

The Ontario *Green Energy Act, 2009*, prohibits the sale of products in Ontario that do not meet prescribed efficiency standards. The list of products covered and the efficiency requirements for each product are set in O. Reg. 404/12. The *Green Energy Act, 2009* and its regulations are administered by the Ontario Ministry of Energy.

Ontario rarely sets energy efficiency product standards by itself. The federal government regulates products moving across provincial borders within Canada and across national borders, while the Ontario government regulates products sold in Ontario. Where Canadian and Ontario standards both apply, the product must meet both standards.

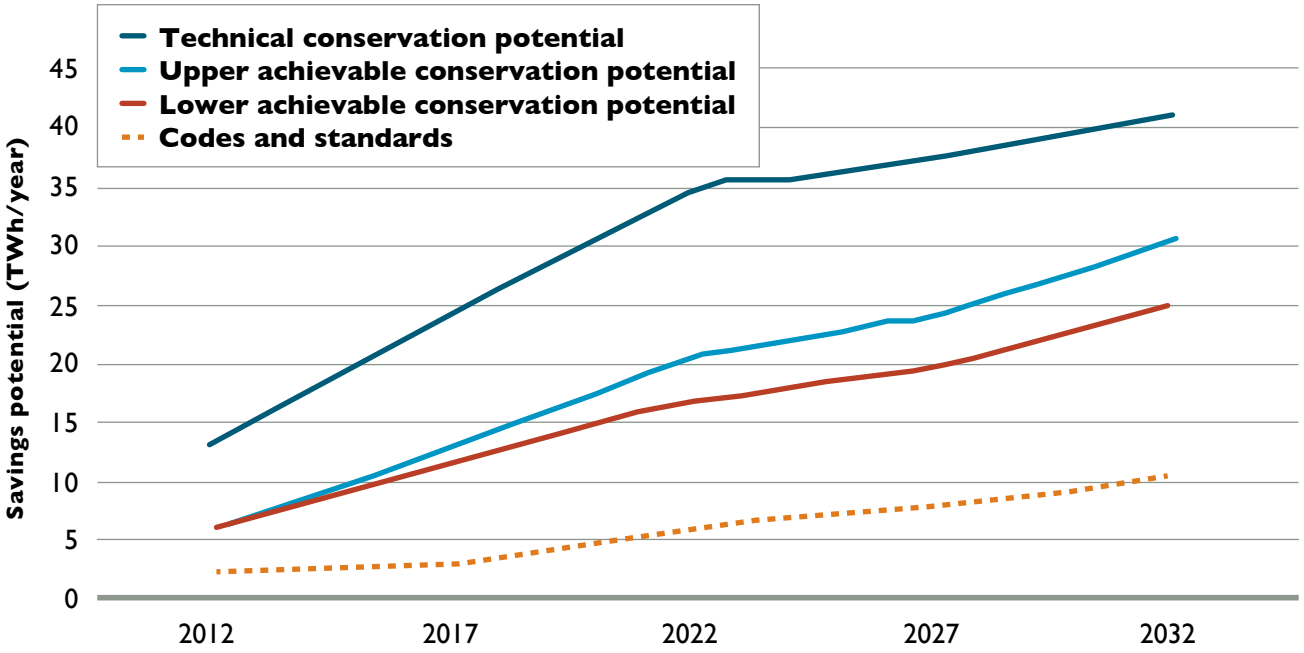


**Figure 5.2: Potential electricity savings from codes and standards**

Source: ICF Marbek

# Ontario rarely sets energy efficiency product standards by itself.

Both Canada and Ontario have the option to set their own independent standards, or to harmonize with efficiency standards set elsewhere. In the past, Canada has chosen to harmonize efficiency standards for certain products with standards set by the United States Department of Energy (DOE). DOE standards have no legal authority in Ontario, but, because of the size of the U.S. market, they influence manufacturer product lines, affecting what is offered for sale in Ontario.

Canadian and U.S. standards may be harmonized in one or many details, including the minimum energy performance level, which products are subject to a standard, and/or the test method used to measure compliance.

Historically, Ontario and other provinces have harmonized their efficiency standards for most products with the Canadian federal government. This extends the scope of the federal standard, so that it applies not only to products imported into the province, but also to products that are both manufactured and sold in Ontario. This type of harmonization was often helpful to Ontario manufacturers. If all provinces harmonize with federal standards, a single compliant product can be made in Ontario and sold across the country.

**Table 5.1: Who Does What?**

| Organization | Role in Energy Efficiency Standards Development, and Impact on Ontario |
|---|---|
| Ontario provincial government (Ministry of Energy) | Sets minimum product efficiency standards through O. Reg. 404/12, under the *Green Energy Act, 2009*. Standards apply to any regulated products sold in Ontario. |
| Canadian federal government (Natural Resources Canada) | Sets minimum product efficiency standards through the *Energy Efficiency Regulations* under the *Energy Efficiency Act*. Standards apply to products imported into Canada or products manufactured in Canada and moved across provincial borders for sale, but not to products that are both manufactured and sold in Ontario. NRCan also requires dealers to submit product energy efficiency reports and to affix energy labels (EnerGuide) for certain products. |
| U.S. federal government (Department of Energy) | Sets minimum efficiency standards for products sold in the United States, indirectly impacting supply chain for products sold in Ontario. |
| Other sub-national jurisdictions | May set minimum efficiency standards that apply within the jurisdiction, and which Ontario may choose to adopt. In the United States, individual states can only set efficiency standards for products that are not regulated federally (with some exceptions). This restriction does not apply in Canada. Ontario, California and British Columbia have been quite active in standards development. California has long been a leader in standards development, and has continued to be very active in developing new standards in recent years.[3] |

On occasion, prior to 2013, Ontario adopted standards set by the U.S. DOE (that were not matched by Canada), or by a sub-national jurisdiction, such as California.

## 5.3 What's New Since 2013?

The Ministry of Energy has made four amendments to its energy efficiency standards regulation since 2013, when the ECO last reviewed Ontario's actions on product standards.[4] The products addressed through each of the four amendments are generally different (standards for any given product are typically reviewed on an approximate five-year cycle).

The four regulatory amendments are summarized briefly in Table 5.2. All four regulatory amendments were posted on the Environmental Registry for comment prior to being finalized. They received very few comments, mostly from manufacturers and other industry stakeholders.

**Table 5.2: Recent Amendments to O. Reg. 404/12 (Energy Efficiency – Appliances and Products)**

| Regulatory Amendment | Date of Amendment | Environmental Registry # | Key Implications |
|---|---|---|---|
| O. Reg. 337/13 | December 11, 2013 | 011-9337 | • New or updated efficiency standards for 25 products (mostly harmonizing with U.S. standards), seven of which are newly regulated products for Ontario<br>• Introduced "rolling incorporation" (for one product test method only) to automatically update Ontario law to harmonize with standards updates in other jurisdiction (U.S. DOE) |
| O. Reg. 93/14 | March 26, 2014 | 012-0728 | • Temporary harmonization (through December 31, 2014) with U.S./ Canada standard for general service lighting (after 2014, Ontario-specific standard will apply) |
| O. Reg. 298/14 | December 10, 2014 | 012-2479 | • New or updated efficiency standards for 21 products (mostly harmonizing with U.S. standards), three of which are newly regulated products for Ontario<br>• Expansion of "rolling incorporation" with U.S. standards for 10 additional products |

*(continued)*

**Table 5.2: Continued**

| Regulatory Amendment | Date of Amendment | Environmental Registry # | Key Implications |
|---|---|---|---|
| O. Reg. 412/15 | December 11, 2015 | 012-4146 | • New or updated efficiency standards for 18 products<br>  • Harmonization and rolling incorporation with U.S. standards for 12 products<br>• Ontario-specific standards (higher than U.S./Canada levels) for five products, including commercial boilers and general service incandescent lighting<br>  • Preceded by Ministry study to identify opportunities for Ontario-specific standards |

## 5.4 Setting Standards: Harmonize or Set Our Own?

### 5.4.1 Harmonization: Whom Should we Follow?

As indicated above, Ontario historically harmonized its energy efficiency standards to Canadian federal standards, some of which in turn were harmonized to U.S. DOE standards. However, Canadian federal standards have been falling behind since 2010. With the exception of a regulation on general service lighting, Canada's federal energy regulations were not updated since October 2011.

Meanwhile, the U.S. DOE has been very active, passing 40 new or updated standards since 2009, with many more standards under review. By U.S. law, the DOE is required to set standards that achieve the maximum improvement in energy efficiency that is determined to be technologically feasible and economically justified. It follows a rigorous process that considers different potential efficiency levels, and assesses what impact these levels would have on product manufacturers and customers before setting a final standard. The standards adopted by DOE in recent years have been quite aggressive, setting high minimum levels of efficiency.

**Canadian federal standards have been falling behind since 2010.**

In the four recent amendments, Ontario has mostly harmonized its standards directly to the newer DOE standards, instead of to the older,

lower Canadian federal standards. In addition, Ontario now has "rolling incorporation" with DOE standards, for certain products only. "Rolling incorporation" means that the Ontario regulation references the applicable U.S. standard "as it read on the date the particular appliance or product is manufactured." As a result, updates to U.S. standards are automatically incorporated into Ontario law as soon as they happen, without waiting for an Ontario regulatory amendment. Prior to this change, it often took Ontario several years to update its regulation to harmonize with new U.S. (or Canadian) standards.

Some recent Ontario standards also harmonize to standards set by California or British Columbia. Adopting the standards of other leading jurisdictions has advantages, as the first adopter has already dealt with any implementation challenges associated with the new standard. Ontario adopted the efficiency level set by British Columbia for gas-fired residential water heaters, which is a slightly higher efficiency than the federal standard. O. Reg. 337/13 harmonized Ontario's MEPS for televisions with a standard originally set by California (no MEPS for televisions exists at the federal level in the U.S. or Canada, with the exception of a maximum standby power limit).[5] More significantly, O. Reg. 412/15 harmonized its general service incandescent lamp requirements with a California requirement that, as of 2018, all general service lamps must meet a minimum efficiency level of 45 lumens per watt, which is roughly double the efficiency level of the current MEPS. The evolution of Ontario lighting standards is discussed in the textbox *Case Study 2: The Phase-Out of Inefficient Lighting – Round Two*.

Meanwhile, the Canadian government may be starting to catch up. In December 2015, Natural Resources Canada (NRCan) posted a new regulatory proposal which, if adopted, will increase minimum efficiency standards for many products to match U.S. DOE standards, with a plan to introduce additional regulatory amendments in future years.[6] NRCan has announced its intention to work with the U.S. through the U.S. – Canada Regulatory Cooperation Council to align new and updated energy efficiency standards and test methods where possible.[7]

### 5.4.2 Challenges with Harmonization

Harmonization is not always the right choice for Ontario. If an existing standard is not suitable, Ontario can attempt to work with the Canadian government to develop a new, improved standard that can be applied provincially and federally, which is often a preferred approach. However, sometimes, the costs and benefits of a standard are different for Ontario than for the U.S. or Canada as a whole, because of factors like:

- Differences in energy prices (which affect the payback period for energy conservation);
- Differences in the importance of on-peak vs. off-peak electricity conservation (e.g., Ontario's low carbon electricity system can provide low-cost, low-carbon power in off-peak hours when the supply mix is very clean);
- Differences in weather and climate (which can affect energy savings for heating/cooling equipment);
- Differences in climate change goals (and value of greenhouse gas emissions reductions); and
- Differences in product availability and cost.

**Harmonization is not always the right choice for Ontario.**

Here are two case studies of the trade-offs involved.

## Case Study 1: Residential Water Heaters

Ontario's zigzag struggle to set appropriate efficiency standards for residential storage tank water heaters illustrates some of the challenges Ontario faces in setting efficiency standards and assessing whether or not to harmonize with other jurisdictions.

Most Ontario homes have a traditional cylindrical hot water tank, often heated by natural gas. However, these water heaters only convert about 60 per cent of their energy into usable hot water, with the rest being lost, to the outside air in the heating process, or through the walls of the tank when hot water is not being used (standby losses). Water heating is the second largest energy use in Canadian homes (trailing only space heating), so higher-efficiency water heaters represent one of the largest potential energy savings opportunities in the residential sector.[8] Yet minimum efficiency standards in Ontario, particularly for gas-fired storage water heaters, remain low.

Much more efficient water heating technologies exist, including:

- tankless water heaters that avoid standby losses;
- condensing water heaters that capture and make use of the energy in the hot exhaust air (similar to the high-efficiency condensing furnaces that are now the minimum standard in Ontario); and
- electric heat pump water heaters that act like a refrigerator in reverse, moving heat from the surrounding air space to heat the water.

These technologies still have a small share of the marketplace, likely because they come with a higher initial cost. Some, but not all, consumers may recover this cost premium through operating energy savings, depending on how much hot water they use.

In the United States, new DOE standards that took effect in 2015 essentially eliminate large-volume low-efficiency water heaters.[9] Households requiring an abundant supply of hot water will be required to purchase one of the three higher-efficiency technologies described above. However, large-volume heaters have only a small share of the water heater market.[10] The DOE had considered mandating these higher efficiency technologies for smaller water heaters as well, but were dissuaded by concerns about the higher initial cost of high-efficiency products and about the ability of manufacturers to revamp their production lines. For larger-volume heaters, greater operating savings (due to higher volume of hot water use) make the initial cost premium less of a concern.

The DOE standards were passed in a 2010 rulemaking, giving manufacturers a five-year lead time to adapt to the new requirements. The new standards for large-volume tanks will help make high-efficiency technologies more common and perhaps drive down the price premium.

Ontario has struggled to decide whether to follow the DOE lead for large-volume water heaters. In June 2013, the Ministry of Energy proposed (Environmental Registry #011-9337) to match the DOE efficiency standard, for both gas and electric water heaters. However, the Ministry later abandoned this proposal (O. Reg. 337/13).

## Case Study 1: Continued

After several additional regulatory proposals and amendments,[11] the end result to date (shown below in Figure 5.3) is an Ontario efficiency standard for smaller gas-fired water heaters that is 1 per cent higher than the DOE (a 3 per cent increase in efficiency over Ontario's old standard), and a standard for larger water heaters that lags far behind the DOE.

The story for electric water heaters is similar – the Ministry of Energy initially proposed to harmonize with the DOE standard that would require high-efficiency heat pump technology for larger water heaters, but did not follow through.[12]

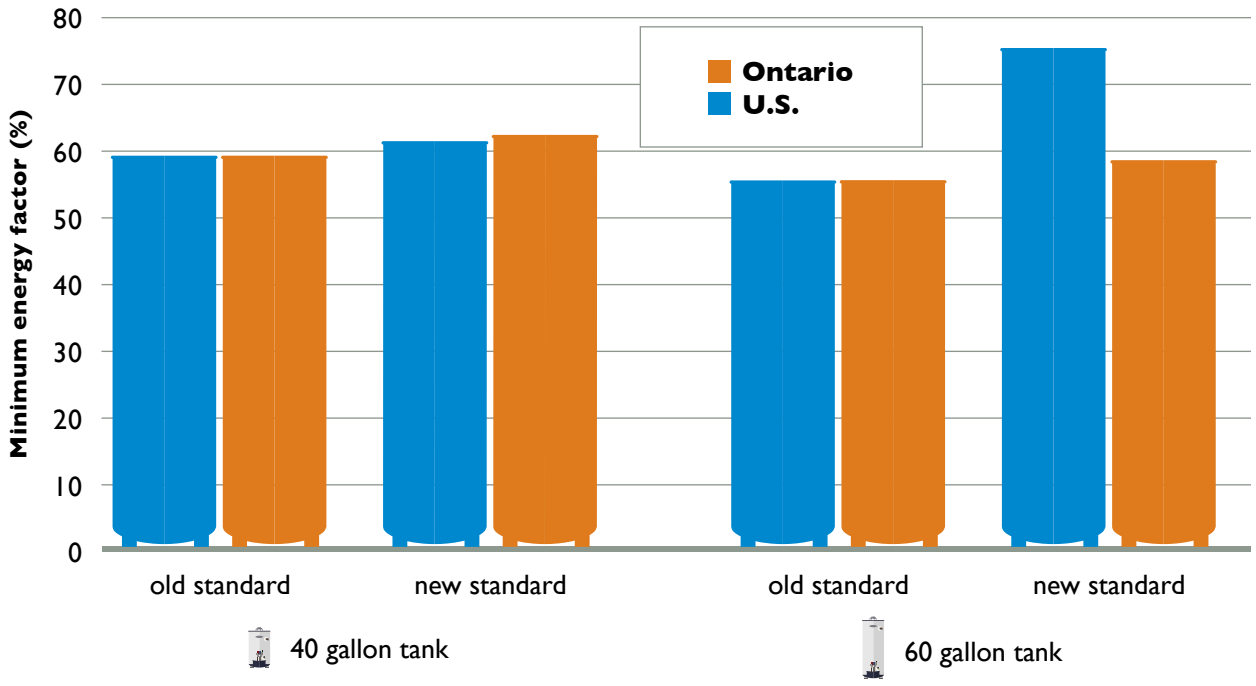


**Figure 5.3: Gas water heater minimum efficiency levels**

Note: The "new" standard became effective in April 16, 2015 in the United States, and April 1, 2016 in Ontario.

Source: Ministry of Energy, U.S. Department of Energy

The reasons why the Ministry of Energy did not harmonize with the DOE requirements for large-volume water heaters illustrate some of its challenges in setting Ontario-specific standards, and in choosing whether and when to harmonize.

*(continued)*

## Case Study 1: Continued

For electric water heaters, the issue is that our climate is colder than most of the U.S.[13] Heat pump water heaters achieve their higher efficiency by moving heat from the surrounding room or the outside air to heat up the water in the tank. Depending on where the tank is located, the building heating system may need to work harder in the winter to compensate for this heat loss, although this could be partially offset by a reduction in air conditioning energy used in the summer. In most cases, a heat pump water heater will still save energy, but it may not be as much as predicted. Energy savings will be highest in warmer regions where heating energy use is not as important. In other words, what works for the U.S. (on average) may not work as well for Ontario. Hydro One has recently begun a pilot program (funded through the Independent Electricity System Operator's (IESO's) Conservation Fund), that will measure the savings from heat pump water heaters for Ontario customers.

For gas-fired water heaters, the concern was more about timing and impacts on manufacturers and distributors in the Canadian marketplace. In 2011, the Canadian federal government had proposed (but not adopted) a staged increase in water heater energy efficiency requirements that would require condensing technology by 2020.[14] Manufacturers designing products for the Canadian marketplace had assumed that Ontario would harmonize its efficiency requirements with this Canadian proposal, and had prepared accordingly. They argued that it was unfair and impractical for Ontario to propose higher efficiency requirements in 2013 that would come into force less than two years later, giving them little lead time to adjust product lines. Ontario accepted these arguments and did not follow through with its regulatory proposals. As of the current date, the original Canadian federal plan to move towards condensing water heaters by 2020 has still not been put into law. The path towards higher-efficiency water heaters north of the border is unclear.

## Case Study 2: The Phase-Out of Inefficient Lighting – Round Two



For most products, minimum energy performance standards (MEPS) are an obscure subject known only to industry insiders. This has not been the case for general service incandescent lighting (regular light bulbs), where the introduction of MEPS attracted extensive media coverage in recent years. These standards began to take effect in Ontario and Canada in 2014, two years later than originally planned.[15]

Ontario is currently in a leadership position on light bulb standards, one which it did not originally anticipate. Ontario and Canada originally passed into law identical MEPS that were slightly higher than the levels set in the United States. While the difference in efficiency levels was not great, a certain lighting technology (halogen incandescent light bulbs) could meet the U.S. standard, but not the Canadian and Ontario standards. Canada chose to lower its MEPS to match the United States.[16]

## Case Study 2: Continued

Ontario, however, granted only a temporary exemption (until the end of 2014, through O. Reg. 93/14) to products that met the lower U.S./Canada MEPS. The end result is that general service light bulbs sold in Ontario and manufactured in 2015 or later need to meet a slightly higher efficiency standard than light bulbs sold in the rest of Canada and the United States.

The higher standards can be met by using an infrared coating on halogen bulbs, or by using more energy-efficient alternatives such as light-emitting diodes (LEDs) or compact fluorescent light bulbs (CFLs). The Ministry of Energy believes that maintaining this higher standard is important to Ontario's conservation goals, and has estimated that approximately half of the energy savings expected from a light bulb MEPS would be lost if Ontario harmonized with the lower U.S./Canadian standard.[17]

Ontario's current efficiency standard is still far below the efficiency levels that CFLs and LEDs can deliver. However, a second phase of lighting efficiency standards is on the way. Ontario Regulation 412/15 has now harmonized its MEPS for general service incandescent lamps with a California requirement that, as of 2018, all general service lamps must meet a minimum efficiency level of 45 lumens per watt, which is roughly double the efficiency level of the current MEPS.[18] This is a level of performance that can easily be met by LEDs or CFLs, but cannot be met by any type of incandescent light bulbs. This change will likely keep Ontario ahead of Canadian and U.S. standards.[19]

### 5.4.3 When Should Ontario Lead?

When harmonizing with other jurisdictions is not the right answer. Ontario can develop its own original efficiency standards, or adopt voluntary leading-edge standards as mandatory Ontario standards. These options entail more work and carry a higher risk of non-compliance (or higher compliance costs). Ontario-specific standards also impose costs on industry, who must restrict their product offerings to products that comply with Ontario standards, and undertake third-party testing to demonstrate compliance.[20] However, unique standards can enable Ontario to capture cost-effective energy savings that would otherwise be lost.

The passage of the *Green Energy Act, 2009*, suggested that Ontario would make Ontario-specific MEPS a priority. However, as the ECO has previously reported, the Ontario government did not follow through on its promise to make Ontario-specific MEPS higher than federal standards for appliances.[21] Since 2009, most of Ontario's energy efficiency performance standards have been harmonizations with standards developed elsewhere.

It was therefore a welcome surprise when, for the first time, the Ministry of Energy actively looked for opportunities where stricter Ontario-specific MEPS might be feasible and beneficial. In 2014, the Ministry commissioned two studies to assess the potential for Ontario-specific MEPS for gas- and oil-fired appliances (e.g., furnaces, boilers, water heaters) and air conditioners/heat pumps.[22] The studies estimated the costs and benefits associated with higher standards for 24 different products, using Ontario-specific information where possible. It recommended Ontario-specific MEPS where there was a significant net benefit without obvious technical or market supply issues.

The Ministry of Energy used these studies to propose Ontario-specific MEPS for eight products.[23] The proposed MEPS were generally modest increases in efficiency (5-10 per cent) over existing Canadian and U.S. MEPS, and would be cost-effective for customers. The total amount of energy saved would have been "approximately 500 GWh/year of electricity savings in 2032 (equivalent to the electricity consumed by more than 50,000 homes) and 30 PJ/year of gas savings in 2032 (equivalent to the energy consumed by more than 200,000 homes), resulting in consumers' energy savings valued at $300M/year by 2032."[24] Unfortunately, this promising initiative mostly petered out.

The Ministry consulted on these Ontario-specific MEPS proposals, first through a pre-Registry consultation with key stakeholders in February/March 2015, and then in May 2015 through the Environmental Registry (#012-4146), prior to finalizing its standards updates through O. Reg. 412/15. The proposed MEPS for many of the products were reduced between the pre-Registry consultation and the Registry posting, and again in the final regulation, in response to stakeholder feedback.[25]

**Ontario has become a North American leader in efficiency standards for general service lighting (common light bulbs), and commercial boilers, which account for most natural gas use in large buildings.**

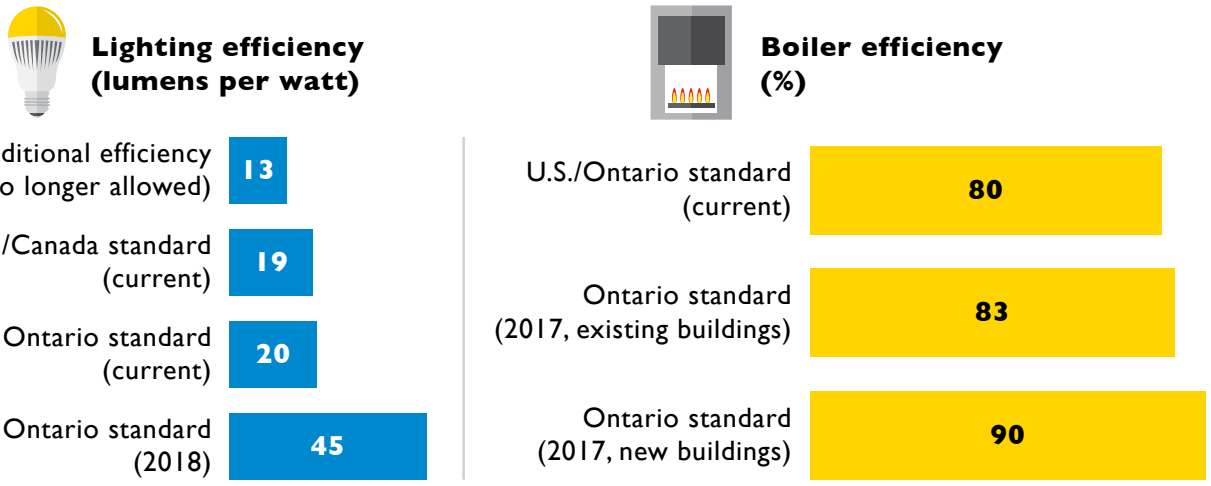


**Figure 5.4: Ontario's leading efficiency standards for general service lighting and commercial boilers**

Notes: Lighting standards assume a "60 watt" equivalent bulb that delivers 800 lumens of light output. Boiler standards shown are for commercial hot water boilers with a heat output between 88 kilowatts and 732 kilowatts.

Sources: Ministry of Energy, Natural Resources Canada, U.S. Environmental Protection Agency

Predictably, some industry stakeholders expressed concerns that some of the proposed Ontario-specific MEPS could reduce consumer selection and increase costs. For some products (small central air conditioning/heat pump, geothermal heat pump, commercial boiler), stakeholders indicated that the proposed MEPS could result in an increase in product size and/or installation cost, which could be of particular concern for retrofit applications.[26] The initial proposal to raise MEPS for hot water boilers to 90 per cent efficiency, which would require condensing technology, attracted the most comments. While several boiler manufacturers expressed support for the higher proposed MEPS, others expressed concern that condensing boilers were not always appropriate in retrofit applications, and that the expected energy savings may not occur due to high water supply temperatures in the building.

In the end, the Ministry implemented Ontario-specific MEPS for four of the original eight products, although these Ontario-specific MEPS were not as stringent as the Ministry's original proposals. Standards for the other four products were aligned with Canadian or U.S. standards, or abandoned altogether. Most significantly, Ontario passed into law new Ontario-specific MEPS for both small and large commercial boilers, which provide heating for many larger buildings. For "new building applications" only, hot water boilers will be required to achieve 90 per cent efficiency (the highest mandatory MEPS in North America). Replacement hot water boilers in existing buildings and steam boilers need not achieve this level of efficiency, but are still required to meet Ontario-specific MEPS that are higher than U.S. or Canadian levels. The other two Ontario-specific MEPS implemented were for water chillers and geothermal heat pumps, and were aligned with the voluntary ASHRAE 90.1-2013 standard.

**These standards do not regulate the total energy or environmental impact of an appliance.**

## 5.5 How Good are our Standards?

### 5.5.1 What Environmental Impacts do Efficiency Standards Cover?

The *Green Energy Act, 2009*, prohibits the sale of products in Ontario that do not meet prescribed efficiency standards. The list of covered products and the specific MEPS are set in regulation (O. Reg. 404/12). These standards do not regulate the total energy or environmental impact of an appliance or other products. They only regulate the product's operating energy efficiency, and do not cover, for example:

1. Its energy use on a life-cycle basis (including production and end-of-life processing);[27]
2. Its durability (how long it will last before it must be replaced);
3. Greenhouse gas emissions are not directly referenced in the MEPS – however, the benefit from avoided emissions can be one of the factors taken into account when the government decides what minimum efficiency level is appropriate[28];
4. Water efficiency (discussed further in section 5.6); and
5. Toxics or other environmentally harmful impacts such as ozone-depleting substances.

### 5.5.2 How Much Energy do our Standards Save?

The overall amount of energy and carbon savings from product standards is large, but quantifying the impact of Ontario's own regulations is difficult. The Ministry of Energy and the IESO have recently funded a study which will more accurately assess the contribution of product standards to Ontario's electricity conservation targets.[29]

The Ministry of Energy claims that all of its recent standards updates (made over the past four years) will result in 16.5 TWh of electricity savings and 27.0 PJ of oil and natural gas savings (primarily natural gas) per year.[30] This is likely an overestimate. The Ministry's methodology is consistent with that used by Natural Resources Canada and the U.S. Department of Energy.[31] However, this methodology does not account for natural market transformation and efficiency improvements brought on by technological advances and consumer preference, which may or may not be significant. Instead, the methodology assumes that all changes in product market share (more efficient products gaining a larger share of the market) are caused by efficiency standards.

In addition, in cases where Ontario is harmonizing with a Canadian or U.S. standard, the methodology attributes some savings to Ontario's action that would more accurately be attributed to the impact of the national standard, because the national standard would remove many less-efficient products from the Ontario market, even in the absence of Ontario regulation.[32]

While the Ministry's estimate of energy savings is of limited value when assessing the impact of harmonization with Canada/U.S. standards, it is relevant in assessing proposals for Ontario-specific MEPS. In such cases, the energy savings can more accurately be credited to the Ministry of Energy's actions.

As shown in Table 5.3, most of the potential savings from the Ontario-specific MEPS for gas- and oil-fired appliances and air conditioners/heat pumps that were proposed during pre-Registry consultation were lost when the Ministry retreated from its original proposals. Some savings will remain, particularly from the Ontario-specific boiler standards.

## 5.6 Recommendations

The ECO is generally supportive of Ontario's recent actions on product standards. It makes sense for Ontario to automatically harmonize with most U.S. DOE standards, without waiting several years for Canadian and Ontario regulations to be amended.

On the other hand, in the ECO's opinion, Ontario has enough unique circumstances that the Ministry of Energy should continue to research opportunities for Ontario-specific MEPS. This can include adopting standards from other states and provinces, or leading voluntary standards, that are higher than federal standards. The Ministry of Energy's study of gas- and oil-fired appliances and air conditioning was an honest attempt to assess the potential for Ontario-specific standards, but the final results in terms of new legal standards were limited. The study failed to give adequate weight to Ontario's aggressive greenhouse gas emissions reductions targets, and our electricity supply mix with low-cost (and low-carbon) baseload generation in off-peak hours.[33] Future attempts might be also more successful with longer lead times and better early industry consultation.

Aggressive Ontario-specific product efficiency standards may be more feasible if the Ministry works with the IESO, local distribution companies, and gas utilities to tighten the links between voluntary conservation programs and aggressive mandatory standards. For example, the Ministry

**Table 5.3: Energy Savings from Ontario-Specific Energy Performance Standards for Fuel-Burning Appliances and Air Conditioning Equipment**

| Product | Expected Energy Savings (Preliminary Estimates Based on Original Pre-Registry Proposals) | Expected Energy Savings (Final Regulation) |
|---|---|---|
| Liquid-air geothermal heat pump | ~30 GWh electricity | 30.5 GWh |
| Water chiller | ~140 GWh electricity | 32.4 GWh |
| Small ducted AC/heat pump | ~200 GWh electricity | 0 GWh |
| Room air conditioner | ~40 GWh electricity | 0 GWh |
| Portable air conditioner | ~10 GWh electricity | 0 GWh (product not regulated) |
| Computer room air conditioner | ~70 GWh electricity | 0.9 GWh |
| Commercial gas-fired boiler, small | ~20 PJ natural gas | 7.1 PJ |
| Commercial gas-fired boiler, large | ~10 PJ natural gas | 2.6 PJ |
| **Totals** | **~500 GWh electricity and ~30 PJ natural gas** | **63.8 GWh electricity and 9.7 PJ natural gas** |

Source: Ministry of Energy

could set an aggressive product standard with a long lead time (e.g., five years or even longer). In the period before the standard is to take effect, customized utility programs could help to transform the market, increasing the volume of products sold and driving down costs for the higher-efficiency option that would become the new standard. This approach is used for the Ontario Building Code, and could potentially be pursued with specific products such as condensing gas-fired water heaters, where a voluntary program could help address concerns around cost, performance, and manufacturer impact. Another option is for utility programs to help address some of the operational concerns that may arise when new standards require installing higher-efficiency equipment in retrofit situations. The Toronto Atmospheric Fund suggested taking this approach for boiler efficiency standards – requiring condensing levels of efficiency, but rewarding the gas utilities if they delivered programs to ensure that high-efficiency boilers were sized, installed, and set up appropriately. Both British Columbia and California credit utilities for the role that their conservation programs play in leading towards mandatory standards.[34]

No product efficiency standards currently limit water use. Higher water consumption can also increase energy use, both in the home (if more water needs to be heated) and upstream/downstream, as municipalities use more energy to treat and pump water to consumers, and then to treat the resulting wastewater. Water and wastewater are many municipalities' largest energy use.

## Water fixtures with excessively high flow rates waste both energy and water.

However, legal authority for water efficiency and energy efficiency standards has been splintered in Ontario, and the result has been a lack of action. The *Water Opportunities and Water Conservation Act, 2010* moved the legal authority for setting water efficiency standards from the Ministry of Energy to the Ministry of the Environment and Climate Change (MOECC). Five years later, MOECC has not regulated a single product under this authority.[35] The Ministry of Energy has proposed an amendment to the *Green Energy Act, 2009* that, if passed, would restore its authority to regulate water efficiency for products such as dishwashers that use both energy and water.[36] However, this is not a comprehensive solution. One product category that needs attention and is not addressed by this amendment is water fixtures (e.g. showerheads, faucets). Water fixtures with excessively high flow rates waste both energy and water. As a recent example of what could be accomplished, California recently passed state-specific standards for water fixtures (faucets, toilets, and urinals). The state expects that these standards will reduce water consumption by these products by about one-quarter, and save consumers money on both their energy and water bills.[37] The ECO encourages the Ministry of Energy and the Ministry of the Environment and Climate Change to take an integrated approach to assess opportunities for Ontario-specific standards for water fixtures and other water-using products, considering the impacts of both water and energy use.

**The Minister of Environment and Climate Change and the Minister of Energy should establish product standards for the efficient use of water in fixtures.**

Finally, standards are only effective when they are complied with. High levels of compliance generally require a realistic risk that noncompliance will be both detected and punished. Ontario is ineffective in both areas.

## Standards are only effective when they are complied with.

Unlike at the federal level, distributors do not need to submit information to the Ontario government to demonstrate a product's compliance with Ontario laws.[38] Rather, the law requires them to mark products that meet Ontario efficiency requirements with the label of the certification body that conducted the energy performance testing. In practice, this generic certification mark cannot be used to effectively check for compliance with Ontario law, as the certification body may have only tested the product and verified that it met a (lower) U.S. or Canadian performance level. The existing Ontario law allows for customized labeling requirements, and Ontario may wish to use this approach for products with an Ontario-specific performance standard, to make it easier to identify non-compliant products.[39] Non-compliant products could also be detected by Ontario staff by making use of the product energy efficiency information collected by the federal government, and there may be additional opportunities to collaborate with the federal government.[40]

Unfortunately, even if Ontario detects non-compliance, its ability to act is limited, because the *Green Energy Act, 2009*, removed the Ministry's authority to inspect businesses for violation of Ontario product efficiency standards and assess penalties. California has gone the opposite direction in recent years, placing a greater emphasis on compliance and adding the legal authority to impose penalties for non-compliance with its state-specific standards.[41] The Legislature should restore such powers in Ontario. Even without the power to impose fines, the Ministry could devote more effort to: ensuring that product manufacturers, distributors, and resellers are fully aware of Ontario-specific standards, monitoring for non-compliance, and publishing information on businesses that do not comply with the law.

In the ECO's view, a stronger approach to compliance and enforcement is needed if Ontario is serious about setting its own standards that are higher than U.S. or Canadian standards. For such products, Ontario cannot free-ride on compliance activities undertaken by these jurisdictions. Ontario's efficiency standards for light bulbs may be a particular compliance concern. This is a ubiquitous product sold through many channels where Ontario currently has higher standards than anywhere else in North America, and where additional lighting technologies will become non-compliant with Ontario law in 2018. The Ministry of Energy has indicated that it will monitor the phase out of non-compliant lighting products.[42]

Compliance is another area where collaboration between the Ministry of Energy and the Ministry of the Environment and Climate Change may be beneficial. MOECC may be better positioned than the Ministry of Energy to handle this responsibility, as it has built up substantial compliance and enforcement capacity due to its responsibility for enforcing other Ontario environmental laws.

**The Ministry of the Environment and Climate Change should obtain authority to inspect and enforce compliance with product efficiency standards.**

## Endnotes

1. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, website, *Appliance and Equipment Standards Program*, accessed April 2016. energy.gov/eere/buildings/appliance-and-equipment-standards-program. However, there are some differences in the scope of products regulated by Ontario standards and U.S. federal standards.

2. 10.2 TWh out of a total 30.2 TWh. Ontario Power Authority, presentation, *Conservation Targets and How They Reduce the Demand Forecast, 2013 LTEP: Module 2*, p. 10, January 2014.

3. California commenced a multi-year process in 2012 to establish energy efficiency standards for a wide range of products not covered at the federal level, including computers and other consumer electronics, lighting products, and water-using products.

4. Environmental Commissioner of Ontario, report, *Annual Energy Conservation Progress Report - 2012 (Volume Two)*, section 4.1, 2013.

5. Ontario also proposed (Environmental Registry proposal # 011-9337) to harmonize with California's MEPS for battery chargers, another product that is not federally regulated. However, Ontario eventually decided not to adopt the California standard, and to wait until the U.S. finalized a federal standard, which has not yet occurred.

6. Natural Resources Canada, website, *Regulatory Update*, December 2015. www.nrcan.gc.ca/energy/regulations-codes-standards/17959

   Natural Resources Canada, website, *Forward Regulatory Plan 2016-2018*, accessed April 2016. www.nrcan.gc.ca/energy/regulations-codes-standards/18318

7. Natural Resources Canada/U.S. Department of Energy, presentation, *Canada-United States Regulatory Cooperation Council Webinar: Proposed Approach for Energy Efficiency Standards*, January 12, 2015. energy.gov/sites/prod/files/2015/02/f20/RCC_Webinar_Presentation.pdf

8. Natural Resources Canada, report, *Energy Efficiency Trends in Canada 1990-2009*, p.12, 2013.

9. U.S. Department of Energy, Final Rulemaking, *Energy Conservation Program: Energy Conservation Standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters; Final Rule*, April 16, 2010.

10. The shipments market shares for large volume products were 4 percent for gas fired storage water heaters and 9 percent for electric storage water heaters in 2010 (*ibid*).

11. For gas-fired water heaters, O. Reg. 337/13 introduced Ontario efficiency levels that were independent of water heater size. The efficiency levels were lower than DOE for large water heaters, but higher than DOE for smaller water heaters. These requirements would have come into force on April 1, 2016, and were aligned with a standard NRCan had proposed in November 2011, but did not implement. In 2014, the Ministry proposed (Environmental Registry # 012-2479) for a second time to comply with the DOE efficiency requirements for gas-fired water heaters, but with a two year delay (compliance date of September 1, 2017). This proposal was not implemented. Finally, in 2015, the Ministry (through O. Reg. 412/15) reduced the Ontario-specific efficiency requirements that it had brought in through O. Reg. 337/13. This final efficiency level was at a MEPS that British Columbia had already made effective as far back as 2010.

12. After not acting on the proposal to match DOE levels, the Ministry of Energy first introduced new (lower than DOE) efficiency levels and maximum standby losses (in O. Reg. 337/13), then removed the minimum efficiency levels (in O. Reg. 298/14). This last change likely had little practical impact on energy use, as essentially all lost energy in electric resistance heating is due to standby losses.

13. Several comments in response to Environmental Registry posting 011-9337 questioned the use of heat pump water heaters in Canadian climates. However, research by the Pacific Northwest National Laboratory concludes that "the experimental data indicate that the penalty of installing a HPWH {heat pump water heater} in conditioned space may not be as large as modeling studies suggest, due to the buffering of interior walls resulting in localized cooling in the water heater closet, with very little

**Table 5-1: Proposals for Ontario-Specific Energy Performance Standards for Fuel-Burning Appliances and Air Conditioning Equipment**

Table 5-1: Proposals for Ontario-Specific Energy Performance Standards for Fuel-Burning Appliances and Air Conditioning Equipment


**25.** [illegible] Protocols for Ontario-Specific Energy Only appliances and Air Conditioning Equipment

space conditioning load was made up by the HVAC system in the heating season, and 37.2 ± 4.7% cooling season."

Pacific Northwest National Laboratory, report, *Impact of Ducting on Heat Pump Water Heater Space Conditioning Energy Use and Comfort*, p.iv, July 2014.

**14.** Natural Resources Canada, website, *Regulatory Update - November 2011*, accessed April 2016. www.nrcan.gc.ca/energy/regulations-codes-standards/bulletins/7145#Water_Heaters. This was an amendment to an earlier June 2010 NRCan bulletin which had proposed a more aggressive timeline for higher-efficiency water heaters (condensing levels by 2016).

**15.** The standards took effect on January 1, 2014 for 100W and 75 W equivalents, and December 31, 2014 for 60W and 40W equivalents.

**16.** Natural Resources Canada's Regulatory Impact Analysis Statement discusses how harmonization with the U.S. will reduce the expected energy savings from the lighting standard. British Columbia also chose to lower its lighting standard to harmonize with the U.S.

Government of Canada, periodical (Canada Gazette 148:2), *Regulations Amending the Energy Efficiency Regulations*, January 2014.

**17.** Ministry of Energy, information provided to the ECO in response to ECO inquiry, September 2015; April 2016. The Ministry notes that the current Ontario standard has led most consumers to choose higher-efficiency LED or CFL lighting, instead of the lowest-efficiency technology (infrared halogen lamps) that complies with the current Ontario standard.

**18.** California Energy Commission, report, *2015 Appliance Efficiency Regulations*, p.192, July 2015.

**19.** The United States has a provision in its law that requires a 45 lumens/watt MEPS for general service lighting (or a new lighting standard delivering equivalent energy savings) by 2020.

**20.** Standards do not currently require manufacturers or distributors to file product energy efficiency reports that demonstrate compliance with Ontario standards. However, the law as written still requires third-party testing to prove compliance. The administrative burden of this step can be reduced if the Ontario standard specifies the same test method as a Canadian or U.S. standard. This can allow a product to only require one round of third-party testing, even if the Ontario minimum energy performance standard is different. Ontario Regulation 404/12 (s 2.3) allows for some flexibility in product testing to avoid the need for multiple tests to comply with different jurisdictional standards.

**21.** Environmental Commissioner of Ontario, report, *Annual Energy Conservation Progress Report - 2011 (Volume One)*, section 2, 2012.

The government's promise was to set "North American leading energy efficiency standards (Energy Star) for household appliances, including efficient use of water".

**22.** Caneta Research, report (unpublished), *Fuel Burning Equipment Study*, July 2014;

Caneta Research, report (unpublished), *Air Conditioner and Heat Pump Study*, July 2014.

**23.** Liquid-air geothermal heat pumps, water chillers, small ducted air conditioners/heat pumps, room air conditioners, portable air conditioners, computer room air conditioners, large commercial gas-fired boilers, and small commercial gas-fired boilers.

**24.** Ministry of Energy, presentation, *Product Efficiency Standards: Pre-Environmental Registry Stakeholder Consultation*, p. 10, February 2015. The proposed standards were expected to deliver at least a 7% internal rate of return to customers, when accounting for both the increase in initial capital cost and the reduction in operating energy cost that would come from the higher efficiency levels.

| Product | Original Proposal (Pre-Registry) | Registry Proposal | Final Regulation |
|---|---|---|---|
| Liquid-air geothermal heat pump | New Ontario-specific MEPS in all 4 categories | MEPS lower than in pre-Registry proposal, but still Ontario-specific in all 4 categories (higher than Canadian MEPS, and aligned with ASHRAE 90.1-2013 in 3 of 4 categories). | **Ontario-specific MEPS** in 3 of 4 categories, aligned with ASHRAE 90.1-2013 levels (higher than Canadian MEPS). New MEPS in 4th category (open-loop cooling) not implemented. |
| Water chiller | New Ontario-specific MEPS (vapour compression chillers only) | MEPS lower than in pre-Registry proposal, but still Ontario-specific. | **Ontario-specific MEPS** – full alignment with ASHRAE 90.1-2013 |
| Small ducted AC/ heat pump | Mix of Ontario-specific MEPS and alignment with DOE MEPS | Full alignment with DOE MEPS (Ontario-specific MEPS removed), with the exception that Ontario-specific climate zone (V) is used to test heating season performance for heat pumps | Same as Registry proposal – full alignment with DOE MEPS, with the exception that Ontario-specific climate zone (V) is used to test heating season performance for heat pumps |
| Room air conditioner | Mix of Ontario-specific MEPS and alignment with DOE MEPS | Same as pre-Registry proposal | Full alignment with DOE MEPS (Ontario-specific MEPS removed) |
| Portable air conditioner | Regulate product for the first time, with Ontario-specific MEPS (product is not regulated by U.S. or Canada) | Product removed from proposal – will not be regulated at this time | Not Applicable |
| Computer room air conditioner | Mix of Ontario-specific MEPS and alignment with DOE MEPS | Ontario –specific MEPS removed, full alignment with DOE | Same as Registry proposal - Ontario – specific MEPS removed, full alignment with DOE |
| Commercial gas-fired boiler, small | Ontario-specific MEPS for hot water and steam boilers, requiring condensing technology (90% efficiency) for hot water boilers | MEPS for hot water boilers lowered to 85% (non-condensing), but MEPS for both hot water and steam boilers still higher than Canadian/U.S. MEPS | **Ontario-specific MEPS** in all 4 categories:<br>• Hot water boilers in existing construction: 83%;<br>• Hot water boilers in new construction: 90%;<br>• Steam boilers (natural draft): 78%;<br>• Steam boilers (not natural draft): 80% |
| Commercial gas-fired boiler, large | Ontario-specific MEPS for hot water and steam boilers, requiring condensing technology (90% efficiency) for hot water boilers | MEPS for hot water boilers lowered to 85% (non-condensing), but MEPS for both hot water and steam boilers still higher than Canadian/U.S. MEPS | **Ontario-specific MEPS** in all 4 categories:<br>• Hot water boilers in existing construction: 83%;<br>• Hot water boilers in new construction: 90%;<br>• Steam boilers (natural draft): 80%;<br>• Steam boilers (not natural draft) 81% |

Note: The Registry proposal also contained an additional Ontario-specific MEPS for a new product that arose from the initial consultant research – MEPS for fryers used in commercial kitchens (a product that was not previously regulated) would be set at ENERGY STAR® levels. This proposal was not implemented in the final regulation.

Source: Ministry of Energy

**26.** Ministry of Energy, information provided to the ECO in response to ECO inquiry, June 2015.

**27.** The relative importance of energy use and greenhouse gas emissions at different stages of a product's life cycle differs substantially between product categories. For major appliances, energy use during the production phase is usually 10 per cent or less of the total energy use over the product's life cycle, while for consumer electronics, this figure can be 50 per cent or higher. Unfortunately, at this stage, "accurate product-model level LCA {life cycle analysis} comparison is near impossible", making it difficult to incorporate into product efficiency standards. Amanda Gonzalez, Alex Chase, Noah Horowitz, report, *What We Know and Don't Know about Embodied Energy and Greenhouse Gases for Electronics, Appliances, and Light Bulbs*, pp.9-148, 2012.

**28.** Avoided greenhouse gas emissions are especially tricky to calculate for electricity consumption, since it depends on the emissions profile of the electricity used.

**29.** It is encouraging to see this work being undertaken, as the ECO has previously recommended that the IESO devote expanded effort to measuring and reporting the energy savings from codes and standards. Environmental Commissioner of Ontario, report, *Annual Energy Conservation Progress Report - 2014*, section 2.3, 2015.

**30.** **Table: Estimated Energy Savings in 2032 from Recent Product Standards Updates**

| Source Regulation | Date | Electricity Savings (TWh) | Oil and Natural Gas Savings (PJ) |
|---|---|---|---|
| 13/12 | February 2012 | 5.9 | 0 |
| 404/12 | December 2012 | 2.4 | 16.6 |
| 337/13 | December 2013 | 4.9 | 0.2 |
| 93/14 | March 2014 | 0[30] | 0 |
| 298/14 | December 2014 | 1.1 | 0.5 |
| 412/15 | December 2015 | 2.2 | 9.7 |
| **Totals** | | **16.5** | **27.0** |

Note: The greenhouse gas emissions reductions from the oil and natural gas savings alone are about 1.4 megatonnes CO2eq, which is about 2.5% of the emissions gap between Ontario's current emissions and its 2030 greenhouse gas emissions reduction target.

While the reported electricity savings equate to roughly 55% of Ontario's 2032 electricity conservation target (30 TWh), these two numbers should not be directly compared, due to methodological differences.

Source: Ministry of Energy

**31.** Briefly, the Ministry's methodology applies the following steps to estimate the annual energy savings that can be expected from a new standard (MENG response to ECO information request, September 9, 2015, q11 and attachment 5.):

**1.** Create a "baseline case", which forecasts the number of new products that would be purchased each year, and assumes the market share of products at each efficiency level remains constant.

**2.** Create a "standards case" where the number of new products sold remains the same as the baseline case, but the distribution of products sold at each efficiency level is altered, such that products with an efficiency level below the new standard are raised to the new MEPS (existing stock remains at its existing efficiency level until end-of-life).

**3.** Calculate the difference between the "standards case" stock and the "baseline case" stock for each year.

**4.** Considering stock lifetime and the unit energy consumption for each efficiency level, calculate the associated energy savings in each year.

Ministry of Energy, information provided to the ECO in response to ECO inquiry, September 2015.

**32.** For example, in a case where Ontario is harmonizing with a U.S./Canadian standard, only the portion of products produced by Ontario manufacturers would truly be impacted by Ontario's action, and only if they are producing a separate line of products for the Ontario market. Suppliers from outside the province would already be forced to move to the higher efficiency levels imposed by the U.S./ Canadian standard, regardless of whether or not Ontario harmonized with this standard.

**33.** No avoided cost of carbon was included in the analysis. The avoided cost of electricity was modeled as an average energy unit cost (residential products) or an average energy cost plus a demand cost (commercial products).

**34.** B.C. Reg. 326/2008 – Demand-Side Measures, section 4(1.4), under the *Utilities Commission Act* allows part of the energy savings from a regulatory standard to be credited to utilities, depending on their actions. Institute for Electric Efficiency, report, *Integrating Codes and Standards into Electric Utility Energy Efficiency Portfolios*, 2011), contains more information on how California and several other U.S. utilities integrate codes & standards with utility programs.

**35.** The Ontario Building Code does set minimum water efficiency standards for fixtures (section 7.6.4), but these apply only to new buildings. *Ontario Water Resources Act*, section 34.12, provides MOECC's authority for water efficiency standards.

**36.** Bill 135, *Energy Statute Law Amendment Act, 2015*. Because the Ministry of Energy does not yet have the authority to regulate water efficiency, Ontario efficiency standards for residential clotheswashers and dishwashers are harmonized with the energy efficiency requirements of the U.S. DOE standards, but not with the water efficiency requirements of these standards.

**37.** California Energy Commission, factsheet, *Frequently Asked Questions: Energy Efficiency Standards for Water Appliances*, undated. www.energy.ca.gov/appliances/2015-AAER-1/rulemaking/Water_Appliance_Fact_Sheet.pdf

Savings from the California standards update are estimated at $1.6 billion in water bill savings and $2.1 billion in energy bill savings, over a ten year period, although this includes some savings from products other than water fixtures.

California Energy Commission, report, *Staff Report: Revised Standardized Regulatory Impact Assessment of 2014 Proposed Appliance Efficiency Regulations : Regulations for Regulations for Toilets, Urinals, Faucets, Dimming Ballasts, Air Filters, and Heat-Pump Water-Chilling Packages*, p.4, February 2015.

**38.** At the federal level, dealers are required to file an energy efficiency report describing the energy efficiency of the product, and the name of the certification authority that conducted the product energy performance verification testing. Natural Resources Canada also conducts occasional post-market compliance testing where products are re-tested to confirm that they meet reported efficiency levels. A recent European report has identified that product energy efficiency claims submitted by manufacturers may be inaccurate, and understate actual energy use. MarketWatch, report, *Report on Laboratory Testing Activities*, March 2016.

**39.** Ontario Regulation 404/12 – Energy Efficiency – Appliances and Products, section 4.1.

**40.** Ontario may wish to investigate whether it could piggyback on the federal government's compliance actions (perhaps through a cost-sharing arrangement) to identify non-compliance with Ontario law, as the federal government already conducts marketplace audits and post-market compliance testing to ensure compliance with federal standards. Natural Resources Canada, information provided to the ECO in response to ECO inquiry, April 2016.

**41.** California Energy Commission/California Public Utilities Commission, report, *Codes and Standards Action Plan 2012-2015*, undated. www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5308

**42.** Ministry of Energy, information provided to the ECO in response to ECO inquiry, September 2015.

# 6 Measuring the Value of Energy Conservation

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# 6.0 Measuring the Value of Energy Conservation

## 6.1 Summary

In 2016, Ontario appears to be awash in energy. The fracking revolution is providing low-cost natural gas from the United States, and oil prices have plunged. Due to investments in new electricity generation, drops in industrial demand, and past conservation activities, Ontario also has an abundant supply of electricity. Does it make sense for Ontario to continue to invest in energy conservation?

In this article, we describe, through a set of questions and answers, how Ontario measures the value of energy conservation and determines which conservation actions are worth pursuing. We then examine, in more detail, two specific aspects of electricity conservation cost-benefit analysis:

1. how the economic value of electricity savings is estimated, and
2. whether third-party conservation program evaluations are accurately measuring electricity savings and being used to improve program performance.

The ECO concludes that Ontario has a rigorous method of valuing conservation delivered by electric and natural gas utilities and comparing it with energy supply. On the whole, Ontario ratepayers' investments in electricity and natural gas conservation have been reasonable. However, there are special challenges in electricity conservation; because it is so difficult to store electricity, it must be generated when it is needed. In Ontario's current electrical system, base load is provided by low-emission nuclear, hydro and renewable energy, much of which must be paid for whether we use it or not. Gas supplied nine per cent of Ontario's electricity in 2014, but operated at the margin (and could be displaced by conservation) roughly one third of the time. Therefore, in the short term, lowering total electricity consumption has financial, air quality and climate benefits primarily in those hours when conservation displaces gas-fired generation.

**In the short term, lowering total electricity consumption has financial, air quality and climate benefits primarily in those hours when conservation displaces gas-fired generation.**

In the longer term, conservation also minimizes capital costs and the other impacts of building new infrastructure, and makes space on the grid for population growth and new uses of electricity such as electrification of transportation. The percentage of gas-fired generation is expected to increase in coming years, when nuclear plants are being refurbished or have been closed. A culture of conservation, and the necessary technology and expertise to implement conservation programs, must be built over time and cannot be easily turned on or off. To have enough conservation when we need it, a consistent pro-conservation policy is appropriate. However, Ontario should adjust electricity conservation incentives to focus them on times when conservation displaces gas-fired generation. Ontario should also reconsider why we spend so much less on conserving fossil fuels than on electricity conservation.

**Ontario should also reconsider why we spend so much less on conserving fossil fuels than on electricity conservation.**

The ECO makes some suggestions for improvements later in this chapter, to ensure that future evaluations of the costs and benefits of conservation are as accurate and transparent as possible, and continue to drive improvements in the cost-effectiveness of conservation programs.

## 6.2 Current Situation

### 6.2.1 Why Conserve?

Why do individual households and businesses, energy utilities, or governments pursue energy conservation? In the simplest terms, each of these groups may choose to conserve when they believe the benefits of conservation are greater than the costs (assuming they have all relevant information and access to capital), although they may not actually assign a value to these costs and benefits in their decision-making process.

Individuals, energy utilities, and society will all have different viewpoints on the costs and benefits of conservation. Households and businesses may be most interested in reducing their energy bills, while energy utilities will care about the cost impact for all of their customers, operational challenges and shareholder return. Governments may have additional environmental or social priorities.

### 6.2.2 Why is Government Action Needed?

If all of the benefits of conservation went to participating households and businesses, there might be little need for government action (beyond informational initiatives, such as energy labeling). However, this is not the case. For example,

- Improved air quality and reduced greenhouse gas emissions are public goods that benefit all of us. In addition, Ontario has made formal commitments to other jurisdictions to do our part to reduce greenhouse gas emissions.

- Split responsibilities for energy costs between builders and homebuyers or landlords and tenants can make it less appealing to invest in higher-efficiency products, a problem that product efficiency standards and Building Code requirements can address.
- The capital savings from not needing to build a new electric generating station are passed on to all existing and future Ontario electricity customers, not just those customers whose conservation actions made the station unnecessary. Utility conservation programs can transfer some of those savings to conservation participants, and thereby encourage more conservation.

Without the efforts of governments and energy utilities, our society would underinvest in energy conservation.

### 6.2.3 What Conservation Initiatives Deserve Government Support?

Ontario's stated policy in both electricity and natural gas conservation is to pursue as much cost-effective conservation as possible (subject to certain budget limits).[1] In fact, Ontario is spending more than four times as much on electricity conservation as on natural gas conservation between 2015 and 2020, although natural gas provides nearly twice as much of Ontario's energy. In 2014, the imbalance was even greater, with electricity conservation spending at six times the level of natural gas conservation spending. Ontario has no specific budget for conservation of transportation or other fuels.

**Ontario is spending more than four times as much on electricity conservation as on natural gas conservation between 2015 and 2020, although natural gas provides nearly twice as much of Ontario's energy.**

Natural gas and electricity conservation programs in Ontario have been funded primarily from electricity or natural gas rates (i.e., by utility customers), not by the Ontario government.[2] Most utility programs must pass a screening for cost-effectiveness (from multiple perspectives), before they can be offered to customers.[3] If this analysis shows that a program is not likely to be cost-effective, it will not be approved.[4] Programs are reviewed again, more thoroughly, for cost-effectiveness after they have been delivered, based on actual results, as part of a formal evaluation process.

There is no legal requirement for conservation initiatives delivered directly by government to be cost-effective. In practice, the government does undertake cost-benefit analyses for key initiatives such as energy efficiency standards and the Building Code amendments, although these are not always made public.

### 6.2.4 How do We Define and Measure Cost-Effectiveness?

Measuring the cost-effectiveness of conservation is simple in theory but complex in practice.[5] The costs and benefits of a program are added up and compared, and programs with a benefit:cost ratio greater than one are considered cost-effective.

Multiple cost-benefit tests can be used to determine whether a program is cost-effective, from the perspectives of different stakeholders, as shown in Table 6.1.

**Table 6.1: Costs and Benefits of Energy Conservation from Multiple Perspectives**

| Group | Benefits of Conservation include: | Costs of Conservation include: | Cost-Benefit Test |
|---|---|---|---|
| Individual Households/ Businesses | Lower energy bills;<br>*"Non-energy" benefits such as improved comfort;*<br>*Satisfaction/reputational benefit from reducing environmental footprint; higher resale value* | Incremental costs for high-efficiency products and services (net of incentive payments) | Participant Cost Test |
| Energy Utilities (representing the interests of all utility customers) | Lower aggregate cost to provide energy services to customers, e.g. through reduced capital, operating, or fuel costs to produce and distribute energy; improved reliability (security of energy supply); reduced need for new infrastructure, for which approvals can be challenging to obtain | Administrative costs to deliver conservation programs;<br>Incentive payments to participants in conservation programs | Program Administrator Cost Test |
| Government (representing the interests of all residents) | Lower aggregate cost of energy services;<br>*Reduced greenhouse gas emissions;*<br>*Improved air quality;*<br>*Social/environmental benefits from avoiding new energy infrastructure (e.g. pipelines, generating stations, transmission lines) and associated conflict* | Administrative costs to deliver conservation programs;<br>Incremental costs for high-efficiency products and services | Total Resource Cost Test |

Note: Italics indicate benefits that are more difficult to quantify and may not be accurately accounted for in cost-benefit analysis.

These tests do not mean that a conservation project will necessarily make everyone better off. Many conservation programs pay some percentage of the cost of a conservation project (from taxpayers or ratepayer funds), with participants paying for the rest. This is a financial transfer from non-participants to participants, which can be justified as some of the benefits, including the environmental benefits, are shared by non-participants. To ensure fairness, electric and gas utilities offer conservation programs to all types of customers and attempt to achieve a high participation rate. They may also have budget limits imposed on their conservation spending to minimize the financial cost for non-participants.[6]

### 6.2.5 Are We Measuring the Right Things?

In theory, cost-benefit analysis includes all of the costs and benefits of conservation. In reality, some costs and benefits are easier to quantify than others. Cost-benefit analyses of conservation programs devote most of their effort to measuring the energy savings (and the financial benefit of these savings) (see textbox *How do We Measure and Value Energy Savings*) and the hard costs of conservation programs. Other benefits of conservation that cannot easily be given a dollar value may be ignored, making it more difficult for programs to pass cost-effectiveness testing.

## Some costs and benefits are easier to quantify than others.

A major step forward was taken in 2014 when the Minister of Energy required the Independent Electricity System Operator (IESO) to use a 15 per cent adder (an increase in the benefits proportional to the calculated benefits from energy savings) in its cost-effectiveness tests for electricity conservation programs, to capture additional "environmental, economic, and social benefits" of conservation.[7] The Ontario Energy Board has recently adopted the same 15 per cent adder for natural gas conservation cost-benefit analysis.

Greenhouse gas emissions reductions are not explicitly mentioned in the Minister's directive, but may be one of the benefits the adder represents. As Ontario's carbon cap and trade system becomes a reality, gas and electric utilities will be required to purchase allowances for the emissions associated with their products. It is not yet clear whether or how the adder will be amended as a result.

## How do We Measure and Value Energy Savings?

Measuring and valuing the energy savings from conservation projects is a three-step process:

1. ***Determining how much energy was saved, and when it occurred***. This can be done through estimates based on product technical specifications, metering of energy consumption, and/or field verification studies. As a rule of thumb, the larger and more unique a project is, the greater the amount of effort that will be devoted to accurately measuring the energy savings. Savings estimates for common conservation measures are collected and published, so that field studies of these measures do not need to be repeated every year.[8]

For electricity conservation, knowing the time of day and season when energy savings occur is important, because the economic and environmental value of saving electricity is different at different times. This is known as the load shape of a conservation measure. For example, an upgrade to a more efficient air conditioner or a more efficient refrigerator might save equal amounts of electricity, but the value of this saved energy would be very different. The refrigerator would have a flat load shape, saving almost the same amount of electricity in all hours of the year. In contrast, most of the energy savings from the high-efficiency air conditioner would be concentrated at times of high system demand and higher emissions, and thus its reduction in energy use would be more valuable.

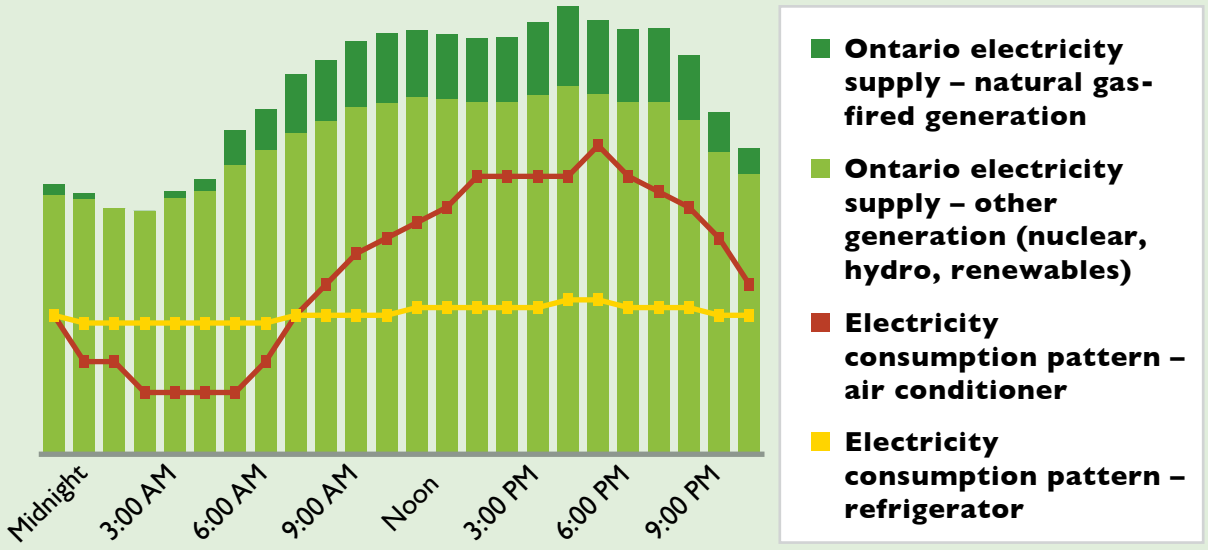



**Figure 6.1: Hourly patterns of Ontario electricity supply and energy use of selected products (hot summer day)**

Note: Product electricity consumption and Ontario electricity supply curves are conceptual. The Ontario electricity supply curve assumes that contracts for older natural gas-fired generation (non-utility generation), which run around the clock, are not renewed.

2. ***Converting gross energy savings to net energy savings***. The payment of a conservation incentive does not correspond exactly to the conservation impact of the incentive. In some cases, customers may have intended to undertake an efficiency measure with or without the incentive. If so, the program did not cause the recorded energy savings. Conversely, participation in an energy efficiency program may influence customers to undertake additional conservation measures that are not directly incented by the program, in which case some portion of these additional energy savings should be attributed to the program. Both of these adjustments are captured through the use of a net-to-gross ratio that converts gross energy savings to net energy savings.
3. ***Placing an economic value on the net energy savings***. The economic value of reduced energy use (not including the environmental benefit of reduced greenhouse gas emissions, which is usually considered separately) should include any savings in fuel costs, plus any reductions in capital costs for the infrastructure needed to produce energy (e.g., generating stations) or distribute it (e.g., pipelines, transmission lines) to customers. Converting the net energy savings (from steps 1 and 2) into an economic value is not straightforward, particularly for electricity, and is discussed in section 6.3.

### 6.2.6 Which Conservation Programs are Required to be Cost-Effective?

Not all types of gas and electric conservation programs are required to pass cost-effectiveness tests (although the intent is still to deliver these programs as efficiently as possible). For good reasons, conservation programs for low-income[9] and First Nations customers, pilot programs, and educational and market transformation programs are not required to be cost-effective:

- All ratepayers subsidize conservation programs for low-income and First Nations customers. These programs can be expensive to deliver, but have important social benefits such as "reduction in arrears management costs, increased home comfort, improved safety and health of residents, avoided homelessness and dislocation, and reductions in school dropouts from low-income families" which are difficult to quantify in cost-benefit analysis.[10] Conservation in Aboriginal communities is discussed further in the text box *Aboriginal Energy Conservation*.
- Pilot programs are useful small-scale tests to assess and improve program effectiveness, but may have higher administrative and transactional costs because of their novelty and small scale.
- For educational and market transformation programs,[11] it is often impossible to directly quantify the energy savings, making them less amenable to traditional cost-benefit analysis. Other metrics (e.g., number of builders trained to build higher-efficiency homes) are used to measure market transformation programs.

### Success Story: Pursuing Energy Conservation in Finch, Ontario

The saveONenergy Home Assistance Program for low-income residents is one of many electricity conservation programs available across Ontario. The residents of Finchview Villa, a non-profit apartment complex for seniors located in Finch, Ontario, are participating in this program.[12] The building applied to the Home Assistance Program and received the following free upgrades: more than 305 compact fluorescent light bulbs; 22 water saving measures, including tap aerators and low-flow shower heads; improvements to the building envelope through attic insulation and draft proofing; and 13 new ENERGY STAR® appliances, such as refrigerators, window air conditioners, and dehumidifiers. These upgrades helped conserve electricity and reduce utility bills (total annual electricity savings are over 28,000 kWh, and annual electricity bill savings for the co-op are more than $4,000).

### Aboriginal Energy Conservation

For Ontario's First Nations, like many other residents of the province, rising electricity costs and affordability are pressing concerns. Similarly, there are common health and environmental concerns like reducing the emissions from energy used in our communities. In addressing these concerns, there are unique socio-economic and geographic barriers for many Aboriginal communities that make delivery of conservation programs even more challenging than elsewhere in Ontario.

#### Unique Barriers Faced by Aboriginal Communities

First Nations face distinctive barriers to pursuing energy conservation, such as:

- Higher proportion of low-income households with limited financial means to improve the energy efficiency of their homes;
- Higher proportion of electrically heated homes than the Ontario average, which typically means higher bills;
- More common use of diesel generators to produce electricity which means higher bills;
- Higher proportion of poor quality housing stock that includes inefficient dwellings and houses in disrepair where installing energy efficiency measures could compromise health and safety;[13]
- Colder weather and a longer heating season than southern zones of the province;
- Remote locations where providing energy efficiency technologies and services can only easily be achieved seasonally (i.e., by ice road during winter months) or by air (which is expensive); and,

- Limited energy practitioner capacity in some regions (e.g., local contractors may not be available to service the large geographic areas).

Despite these barriers, energy conservation in aboriginal communities is valuable for its energy (avoided system/infrastructure costs), financial (lower customer bills for low income customers), employment and social equity benefits. It also helps to mitigate the health and environmental impacts associated with using diesel generators and heating oil in remote First Nation communities.[14] For example, the IESO Aboriginal Conservation Program ran for three years delivering conservation to 45 Ontario First Nation communities.[15] Final results are pending but the program yielded 6.3 million kilowatt-hour (kWh) of savings in its first two years. Savings per participant were higher than similar low-income programs for non-indigenous households – about four times higher, due largely to the opportunities to implement weatherization measures in electrically heated homes – with average savings of 2,760 kWh of energy and reduced peak demand of 0.5 kW in 2014.[16]

The table below highlights how key program delivery barriers were overcome.

| Barrier | Solution |
|---|---|
| **Community buy-in:** In some cases, there was reluctance towards outside delivery agents coming into communities and homes. There was a lack of trust as many felt the proposition of a free program too good to be true. | Local capacity building - project leads appointed from within the community to champion conservation, trained to communicate program benefits and explain specific efficiency measures.[17] |
| **Geographic remoteness – transportation costs:** shipping equipment (e.g., efficient refrigerators) to remote communities is costly. | The IESO granted permission to set aside a portion of program budget to cover unforeseen costs related to community remoteness and transportation costs. |
| **Geographic remoteness – service repairs:** In the event of appliance breakdowns, access to service technicians was limited with few service warranty providers having contractors available to go to remote locations. | New protocols negotiated with warranty service providers to serve communities involved in the project. |

**Cost-effectiveness of Aboriginal Conservation Programs**

Taken together, there are good reasons why Aboriginal programs are more expensive to deliver. It is reasonable for the IESO and the Ontario Energy Board to exempt Aboriginal conservation programs from passing cost-effectiveness testing.

The 2015-2020 conservation framework governing electricity states that Aboriginal programs do not have to be cost-effective but should be administered as efficiently as possible.[18] Currently, only four electricity distributors intend to offer conservation programs specifically targeted at First Nations communities: Hydro One[19] and the Attawapiskat, Kashechewan and Fort Albany Power Corporations.

A distributor can receive approval for a conservation plan that is not cost-effective if it satisfies the IESO that it cannot develop a cost-effective plan due to its unique circumstances. Three Ontario distribution utilities that exclusively serve First Nations customers have attempted to do this, given the limited opportunities for them to develop cost-effective programs.[20] The IESO has not yet approved their plans.[21]

For natural gas utilities, the Ontario Energy Board has set a specific cost-effectiveness benchmark for low-income/Aboriginal programs. As with electricity, First Nations natural gas conservation programs do not have to be cost-effective (i.e., a benefit/cost ratio of >1.0) but, *in aggregate*, each utilities' portfolio of low-income programs (which can include Aboriginal programs) must score >0.7 to be approved. Union Gas will offer gas conservation programs among First Nations.[22]

### 6.2.7 What Do We Pay and What Do We Get?

Final cost-effectiveness data based on actual electricity and natural gas conservation program results are published each year (see online Appendices A and B of this report). Both gas and electricity conservation programs have consistently proven to be cost-effective when measured by appropriate post-implementation cost-effectiveness tests.

Electricity conservation utility program spending in 2014 was $421 million. The portfolio of electricity conservation programs delivered in 2014 had a benefit:cost ratio of 1.40 from a societal perspective, delivering a net benefit of approximately $250 million dollars, over the lifetime of the conservation measures.[23]

Natural gas conservation utility program spending in 2014 was $66 million. The portfolio of gas conservation programs delivered by Union Gas in 2014 had a benefit:cost ratio of 1.75 from a societal perspective, while Enbridge's portfolio had a benefit-cost ratio of 2.67.[24]

These cost-benefit analyses and results encompass the entire portfolio of 2014 conservation programs, with the exception of a small amount of spending (less than 10 per cent of utility budgets) for programs that are not subject to cost-effectiveness testing.[25]

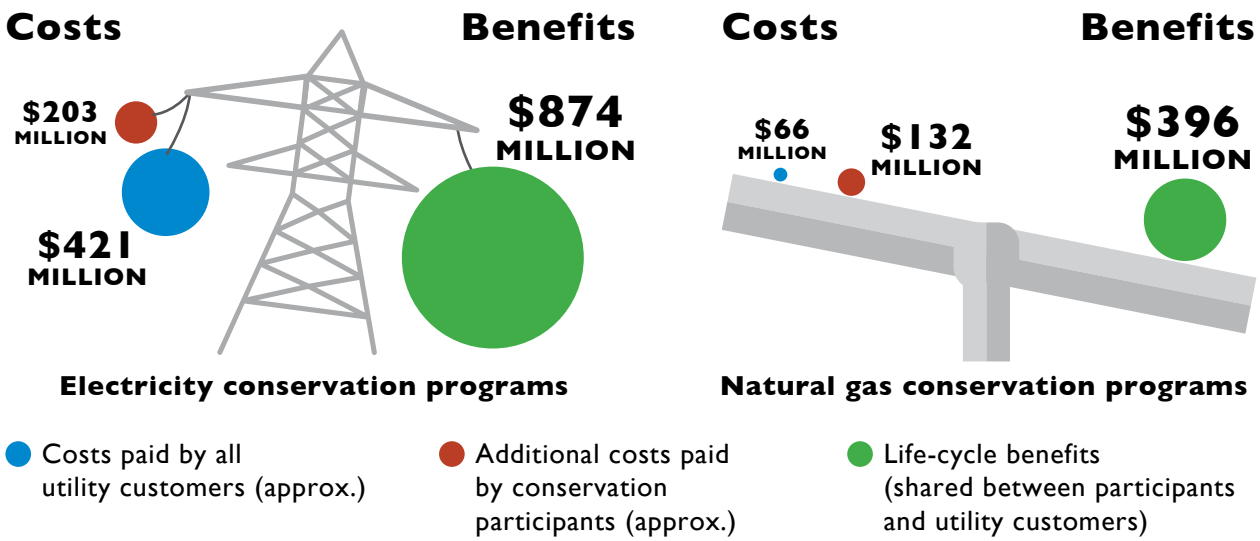



**Figure 6.2: The costs and benefits to society of 2014 energy conservation programs**

Note: Total costs and benefits are shown from a societal perspective, using the Total Resource Cost test. The primary costs are incremental costs of higher-efficiency equipment (paid for in part by program incentives), and program administration costs. Costs are largely incurred immediately, in 2014. The primary benefits are reductions in overall energy spending, which are realized over the lifetime of a conservation measure (benefits in future years are discounted, to allow for a valid economic comparison with costs). The split between participant and utility costs is approximate, using 2014 utility spending. It is not possible to estimate the split of benefits in the same way; however, the majority of benefits will go to conservation participants. The benefits of reduced greenhouse gas emissions are not included in this figure, as they were not considered in cost-effectiveness testing until 2015.

Source: Independent Electricity System Operator, Enbridge Gas Distribution, Union Gas

## Gas and electricity conservation programs have consistently proven to be cost-effective.

Not all individual conservation initiatives that were tested proved to be cost-effective. For natural gas conservation, only Union's program for low-income households, which accounted for $8.5 million in spending, was not cost-effective. For electricity, a number of individual initiatives were not cost-effective (from a societal perspective); however, these initiatives accounted for only about one-quarter of overall electricity conservation spending from 2011 to 2014.[26] Some of these initiatives were not expected to be cost-effective, such as the program for low-income households, while other programs, such as the Industrial Accelerator program for large industrial customers, were not cost-effective because some of the assumptions in the original cost-benefit analysis were not accurate (e.g., the programs have not (yet) delivered the energy savings expected). In cases like this, the IESO is expected to take steps to improve program cost-effectiveness, or discontinue the program.

Funding for electricity conservation programs is recovered through the Global Adjustment, which is also used to recover electricity costs associated with electricity supply resources that cannot be recovered through the electricity market price. As shown in Figure 6.3, conservation funding only accounted for approximately 4 per cent of the Global Adjustment in 2014.

### 6.2.8 Valuing Conservation of Different Energy Sources

Ontario has focussed heavily, and with considerable success, on conservation programs for electricity and (to a lesser extent) natural gas, which are delivered by utility monopolies and funded by ratepayers. Other energy sources, such as transportation fuels and other petroleum products, have been largely ignored and are not included in the province's Long-Term Energy Plan.

### 6.2.9 Why Conserve Electricity if We Have More Than We Need?

Few now remember our precarious supply situation in the mid-2000s, when brownouts (power reductions) were occasionally needed to keep the lights on. The situation is now reversed, with Ontario occasionally needing to curtail off-peak renewable or nuclear electricity production because sometimes we cannot use all of the power we have agreed to pay for.

However, most conservation measures will deliver savings for a decade or more. We cannot assess the value of electricity conservation by looking only at the situation today, but must look over the full life-cycle of a conservation measure. Ontario is currently in a very unusual situation with all nuclear units operating. This will change beginning later in

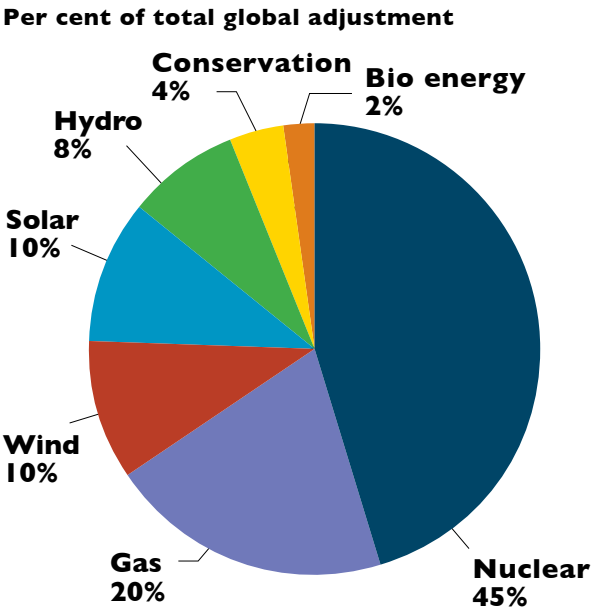



**Figure 6.3: Estimated components of the Global Adjustment based on type of electricity resource**

Note: The above figure shows the different sources of electricity supply in Ontario and how each is funded through the Global Adjustment. According to the OEB's Regulated Price Plan Report, the total Global Adjustment was forecast to be $9.1 billion from November 2013 to October 2014, and according to the IESO, $341.5 million of the 2014 Global Adjustment was spent on conservation.

Source: Ontario Energy Board, Independent Electricity System Operator[27]

2016, as first Darlington and then Bruce nuclear units are shut down for refurbishment, and the Pickering nuclear station closes permanently in the 2020s. Meanwhile, we can anticipate additional electrical demand from population growth and electrification of transportation. Both will reduce the problem of surplus electricity, but could also lead to gas-fired generation operating more frequently. This, in turn, will increase the

economic and environmental value of electricity conservation, which is higher when it displaces gas-fired generation, providing savings on fuel costs and reductions in greenhouse gas emissions. Finally, a culture of conservation, and the expertise and innovation to support it, takes a long time to build, and cannot be simply turned on and off.

## 6.3 A Detailed Analysis

The ECO undertook two studies in 2015 on technical aspects of the cost-effectiveness analysis of conservation:

- An examination of how the IESO calculates the "avoided costs" used in electricity conservation cost-effectiveness testing, to determine whether these avoided costs are accurate; and,
- A review of the program evaluations done between 2011 and 2013 of the IESO's Retrofit Program, to assess whether energy savings were estimated properly, among other factors.

### 6.3.1 Are We Correctly Measuring the Economic Value of Electricity Savings?

As noted above, in electricity, the timing of energy savings is very important. There is great environmental and financial benefit in conserving electricity in some hours of the day and year, and much less benefit at other times. This affects which electricity conservation projects are worth funding.

ECO studied the avoided costs that IESO uses in its cost-benefit analysis for electricity conservation programs, including how the avoided costs varied between on- and off-peak periods (as shown in Table 6.2).[28]

This bland table of numbers is very important. It is the IESO's best estimate as to how much each unit of energy saved through conservation is worth to electricity customers, in terms of reduced electricity system costs. It is the single most important variable the IESO uses to determine whether a conservation program is cost-effective and should be funded and delivered for the 2015-2020 period.

**Table 6.2: Avoided Energy Costs**

| Year | Avoided Cost of Energy Production 2014 $/MWh by TOU Period | | | | | | | | Avoided Capacity Costs 2014 $/kW-yr | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Winter | | | Summer | | | Shoulder | | At System Peak | | |
| | On-Peak | Mid-Peak | Off-Peak | On-Peak | Mid-Peak | Off-Peak | Mid-Peak | Off-Peak | Generation Capacity | Transmission | Distribution |
| 2015 | $46.53 | $43.38 | $37.76 | $33.65 | $38.83 | $31.87 | $47.55 | $40.77 | - | $3.83 | $4.73 |
| 2016 | $36.08 | $31.88 | $31.81 | $31.39 | $36.65 | $29.55 | $42.24 | $35.94 | - | $3.83 | $4.73 |
| 2017 | $40.97 | $34.96 | $28.72 | $27.98 | $38.38 | $30.74 | $38.39 | $33.51 | $162.15 | $3.83 | $4.73 |
| 2018 | $41.97 | $35.82 | $32.69 | $25.14 | $36.66 | $29.75 | $31.77 | $26.98 | $162.15 | $3.83 | $4.73 |
| • | | | | | | | | | | | |
| • | | | | | | | | | | | |
| • | | | | | | | | | | | |
| 2032 | $41.96 | $40.90 | $39.24 | $40.56 | $43.38 | $38.15 | $36.42 | $33.61 | $162.15 | $3.83 | $4.73 |
| 2033 | $41.96 | $40.90 | $39.24 | $40.56 | $43.38 | $38.15 | $36.42 | $33.61 | $162.15 | $3.83 | $4.73 |
| 2034 | $41.96 | $40.90 | $39.24 | $40.56 | $43.38 | $38.15 | $36.42 | $33.61 | $162.15 | $3.83 | $4.73 |

Source: Ontario Power Authority

The avoided costs are split into two components: an avoided cost of energy production, and an avoided capacity cost.

- The ***avoided cost of energy production*** is the cost savings from each unit of reduced electricity consumption, due to reduced fuel and operating costs from electricity generating stations. This avoided cost depends greatly on what type of electricity generator will be powered down due to conservation measures – known as the ***marginal generating unit***. For example, if production from a natural gas-fired generating station is reduced, less fuel is burned, and there are real cost savings that are passed on to electricity customers. However, if production from a nuclear unit or a solar or wind generator is reduced, the cost savings are much lower (fuel has low or no cost and the generator is usually under contract to be paid for the electricity regardless), and the electricity that would have been produced cannot be saved and used later (unless the generator is coupled with storage capacity).[29] The IESO estimates avoided costs of energy production for eight different time periods of the year (e.g., winter off-peak), with different values in each period, based on which type of generation is expected to be at the margin.[30]
- The ***avoided capacity cost*** places a value on the savings that conservation can provide by avoiding future capital investments in generation, transmission, or distribution infrastructure. In the table above, the value for avoided capacity costs for 2015 and 2016 is zero. This is because, by 2013, Ontario already had sufficient energy supply to meet its energy needs in 2015 and 2016. Additional reductions from conservation in these years would not deliver any capital savings. However (at the time these calculations were made), in the absence of continued conservation program activity, Ontario was expected to need new supply by 2017 to meet peak demand. Therefore, new conservation measures that can reduce peak demand in 2017 and later years have value if they can defer or eliminate the need for this new supply.[31]

Once the table of avoided costs is developed, it is used in the cost-benefit analysis of all electricity conservation programs, along with program-specific information on costs, energy savings, and load shape.[32] This approach delivers a quantitative answer – which is unique to each potential conservation program – about whether or not this program makes sense in a period of abundant electricity supply. Programs that deliver energy savings when they are needed most will have higher avoided costs and will be more likely to pass cost-effectiveness testing. Programs that deliver energy savings at times when they are worth less will need to offset that negative with other advantages (higher overall energy savings, lower cost structure, etc.) in order to pass the screening process.

### 6.3.2 How does the IESO Calculate Avoided Costs?

While these general principles on avoided costs are public, the IESO's methodology for calculating the specific numerical values is not. The ECO's discussion with the IESO was illuminating in revealing many, but not all of the details of this analysis.[33]

The IESO developed the table of avoided costs as an output of its power system planning work for the 2013 Long Term Energy Plan. The IESO estimated the avoided costs by developing two electricity supply mix portfolios, one with no ratepayer-funded conservation programs after 2014, and one with the amount of conservation needed to reach the LTEP's conservation targets. Both scenarios were modeled over all 8760 hours in the year, determining which generation

resources would run in each hour, and the costs of this generation. The difference in costs between the two scenarios, divided by the amount of conservation savings, was used to determine the avoided cost values.

The IESO's analysis showed that conservation has somewhat less value in the near-term due to Ontario's strong supply position. Conservation savings in 2015 and 2016 had an average value of about 4¢/kWh, increasing to 7¢/kWh by 2020. As most conservation measures have a lifetime of a decade or more, if installed today, these measures will still be delivering savings in the future periods when these savings are more valuable.

One of the reasons for the increased value of conservation after 2016 is its potential to defer capital investments. Another is that the type of generation that will be at the margin, and therefore can be powered down due to conservation activities, is projected to change over time. The IESO estimates that between 2014 and 2020, about 50 per cent of the electricity production avoided by conservation programs will be renewables (with the remainder being gas-fired generation). Beyond 2020, however, about 90 per cent of the energy production avoided by conservation programs will be from natural gas-fired generation. Consequently, the value of reducing total electricity consumed (in terms of both fuel cost savings and avoided greenhouse gas emissions) increases after 2020, as shown in Figure 6.4.

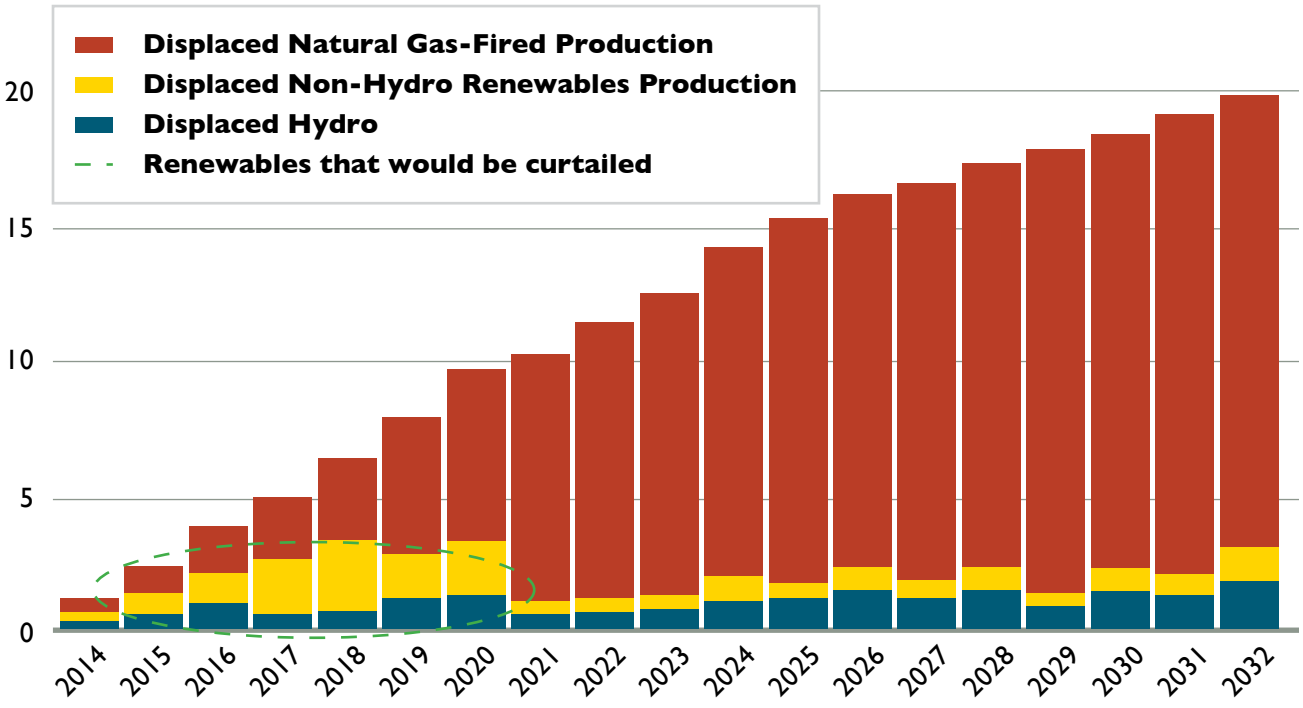



**Figure 6.4: Avoided energy production due to utility-funded energy efficiency programs, 2014 -2032 (TWh)**

Between 2014-2020, about 50% of the energy production avoided by energy efficiency programs is from renewables. Beyond 2020, about 90% of the energy production avoided by energy efficiency programs is from natural gas-fired energy production.

Bars represent energy production from available generation resources displaced by planned energy efficiency programs

Source: Independent Electricity System Operator[34]

Following this discussion with the IESO, the ECO was satisfied that the procedure for calculating avoided costs is methodologically sound in principle and should yield reasonably accurate values. Unfortunately, the IESO was not able to provide the ECO with the full details as to how the avoided costs associated with each type of generation and energy supply contract were calculated. This left the ECO unable to determine why the IESO's analysis shows so little difference in avoided costs between peak and off-peak hours in the near-term (one would expect that avoided costs in off-peak hours in the near term would be quite low, as there is limited opportunity to reduce the use of expensive gas-fired generation).

In addition, the methodology is very sensitive to Ontario supply and demand conditions. This analysis was conducted as part of the 2013 LTEP, so it told us what conservation programs were worth delivering based on the best available information at that time, not necessarily what programs are worth delivering today. Several major changes to Ontario's supply mix have been announced in subsequent years, in particular, changes to the timing of planned nuclear refurbishments and the shut-down of the Pickering nuclear station, that will affect the value of conservation programs.

It is expected that avoided costs will be updated again as part of the next LTEP, in 2016 or 2017. The ECO suggests that this updated version of avoided costs should be used going forward in conservation program cost-effectiveness testing. The ECO also encourages the IESO to publish its updated analysis of avoided costs to allow public consideration of whether any changes to the IESO's methodology should be made.

In particular, the ECO notes that one specific variable – the type of electricity generation at the margin in each hour – has a large influence on whether it is good public policy (considering both costs and greenhouse gas emissions) to attempt to reduce electricity consumption in that hour. To generalize, lowering total electricity consumption has financial, air quality and climate benefits primarily in those hours when conservation displaces gas-fired generation.

It would be valuable for energy policy discussion in general if the IESO could publish historical statistics[35] on what type of electricity generation has been at the margin in each hour (recognizing that there may be some market confidentiality issues to overcome), and projections as to what type is expected to be at the margin in the future, given different planning assumptions. This would be useful not only in assessing the costs and benefits of conservation, but also in assessing the costs and benefits of other measures that might increase or reduce electricity use by switching between electricity and another fuel (e.g., electric vehicles, behind-the meter generation and combined heat and power generation, and electric heat pumps). The ECO will expect to see this type of scenario analysis used in the next LTEP.

### 6.3.3 Are We Using Program Evaluations to Measure Energy Savings and Cost-Effectiveness Accurately, and to Improve Program Performance?

Post-implementation conservation program evaluations almost always measure energy savings and cost-effectiveness (impact evaluation), and may also look at how to improve program performance (process evaluation). The IESO has published a detailed guide of protocols for evaluation, measurement and verification (EMV), to be used for evaluating all electricity conservation programs.[36] These protocols are also used to evaluate natural gas conservation programs, where appropriate.[37] The IESO's EMV protocols draw heavily upon the International Performance Measurement & Verification Protocol, and methods used in California to evaluate conservation programs. The IESO's

protocols are consistent with industry-standard best practices.

In the electricity sector, the IESO is responsible for program evaluation (of both province-wide and custom LDC programs). Third parties are hired by the IESO to perform these evaluations (in early years, some evaluations were done internally and were not made public), and most programs are evaluated every year.[38] In the natural gas sector, the OEB has final oversight over evaluation of utility programs, with the assistance of an evaluation advisory group of utility representatives and stakeholders (the ECO sits as an observer on this group).[39]

There is some potential for conflict of interest in the electricity sector – the IESO hires and manages the program evaluators, yet it is also accountable (jointly with LDCs) for the performance of programs that are being evaluated. In the gas sector, the functions of program operation and program evaluation are separated.

With this concern in mind, the ECO contracted for a time-series review of the program evaluations done over the years of the IESO's Retrofit Program.[40] This program funds electricity conservation measures (e.g., lighting improvements) in existing buildings in the commercial and institutional sector, and is the largest electricity conservation program in terms of both dollars spent and energy savings. The purpose of the ECO review was to assess the strengths and weaknesses of these evaluation reports and to perform a reality check that the evaluation framework was functioning as intended.

The results of this review were generally positive. The ECO found that the methods used to assess energy savings were credible and in-line with best practices used in the evaluation community. No evidence was found that the evaluations made improper assumptions that led to overstated program energy savings.

However, the review identified several concerns of a procedural nature with the conservation program evaluations:

- ***The linkage between program evaluation and program operation was weak***. Many recommendations made by the evaluator to improve program results were not acted on by the IESO, and were often repeated in evaluation reports year after year. The IESO did not publicly respond to the evaluator's recommendations, nor did it indicate what action it intended to take in response to the recommendations.
- ***Little or no details of the cost-effectiveness analysis were included in the public evaluation reports***. For example, the IESO's evaluation reports included no discussion of how the additional customer costs for conservation projects were determined, or how the funds for program administration were spent. Perhaps more important, there was no analysis of how to drive down costs and improve program cost-effectiveness. The IESO's published *Conservation & Demand Management Energy Efficiency Cost Effectiveness Guide* is an excellent resource for the IESO's general methodology for cost-effectiveness testing. However, the program evaluator must rely on his or her professional judgment to apply these guidelines to actual programs. Key issues and concerns with cost-effectiveness that the evaluator identifies should be discussed in the evaluation reports.[41] Instead, the published evaluation reports are silent on cost-effectiveness, while the IESO publishes (separately) the overall cost-benefit results for its programs, with no supporting details. The review conducted for the ECO flagged this lack of transparency regarding cost-effectiveness analysis as being far outside the norm in comparison with other jurisdictions.

The ECO finds both of these concerns to be valid. While the IESO has indicated that it does review and prioritize recommendations made by the program evaluators,[42] there is value and accountability in requiring a formal response to evaluator recommendations, as is done in natural gas conservation.[43] Concerning cost-effectiveness, there is no indication in the IESO'S EMV Protocols that consideration of cost-effectiveness should be treated any differently from other aspects of program evaluation and kept out of public view. More detail as to how the IESO is measuring and seeking to improve program cost-effectiveness can only be a good thing.

In the ECO's view, these and other concerns could also be addressed by opening up the evaluation process to provide a role for other interested parties, such as representatives of different classes of electricity customers. This change would also help address the perception of conflict of interest. The IESO's original EMV protocols did include plans for an evaluation stakeholder advisory committee, but this proposal was never acted on.[44]

## 6.4 Recommendations

**Ontario should focus electricity conservation on times of higher demand, when conservation displaces natural gas-fired generation.**

**The Independent Electricity System Operator should improve public participation in conservation planning by providing greater transparency about marginal hourly generation and how it is implementing recommendations for conservation program improvements.**

## Endnotes

**1.** Ministry of Energy, directive to Ontario Power Authority, *Re: 2015-2020 Conservation First Framework*, March 31, 2014, section 3.5 (v).

For the gas sector, the Minister's direction is to "enable the achievement of all cost-effective DSM".

Minister of Energy, directive to the Ontario Energy Board, untitled, March 26, 2014. www.ontarioenergyboard.ca/oeb/_Documents/Documents/Directive_to_the_OEB_20140326_CDM.pdf

The OEB's filing guidelines further clarify that programs must pass a cost-effectiveness test, with the exceptions of market transformation programs, pilot programs, and low-income programs (which must pass a lower cost-effectiveness threshold). Ontario Energy Board, EB-2014-0134 report, *Filing Guidelines to the Demand Side Management Framework for Natural Gas Distributors (2015-2020)*, section 9, December 22, 2014. www.ontarioenergyboard.ca/oeb/_Documents/EB-2014-0134/Filing_Guidelines_to_the_DSM_Framework_20141222.pdf

**2.** This could change if the Ontario government continues to make new investments in conservation using its Green Investment Fund.

**3.** Programs must usually pass the Total Resource Cost test and the Program Administrator Cost test. The Participant Cost Test is not usually used – because of the voluntary nature of conservation programs, it can usually be implied that any participant in a conservation program has determined (implicitly or explicitly) that the benefits of participation outweigh the costs.

**4.** For example, the OEB recently rejected funding for a Home Energy Report program proposed by Union and Enbridge, on the grounds that the program did not appear likely to be cost-effective.

**5.** This is a very brief overview. For more details, see Ontario Power Authority, report, *Conservation & Demand Management Energy Efficiency Cost Effectiveness Guide*, July 2014.

**6.** For example, one of the Ontario Energy Board's criteria in determining conservation budgets for natural gas utilities was limiting the rate impact to approximately $2 per month for residential customers, to minimize the impact on customers who do not participate in conservation programs.

**7.** Ministry of Energy, direction to the Ontario Power Authority, *Re: Amending March 31, 2014 Direction Regarding 2015-2020 Conservation First Framework*, October 23, 2014.

**8.** For electricity measures, see Independent Electricity System Operator, website, *Measures and Assumptions List*, accessed April 2016. www.powerauthority.on.ca/opa-conservation/conservation-information-hub/evaluation-measurement-verification/measures-assumptions-lists;

For natural gas measures, no comprehensive single source of measures is available at this time, but a Technical Reference Manual is under development.

**9.** In natural gas conservation, programs for low-income consumers are subject to cost-benefit analysis, but must pass a lower threshold (benefit:cost ratio of 0.7 or higher, instead of 1.0)

**10.** Ontario Energy Board, EB-2008-0346 report, *Demand Side Management Guidelines for Natural Gas Utilities*, p. 16, June 30, 2011.

**11.** Market transformation programs are only offered by gas utilities and focus on facilitating fundamental changes that lead to greater market shares of energy-efficient products and services.

**12.** This project was completed with assistance from GreenSaver. GreenSaver, report, *HAP Case Study – Finchview Villa*, 2015. www.greensaver.org/wp-content/uploads/2015/06/FinchviewVilla.pdf

**13.** According to the program evaluation, common health and safety issues include considerable amounts of mould at prospective participant homes. In these cases, adding additional insulation or air sealing measures could pose serious health threats to their occupants. In other cases, homes were in such a state of disrepair that adding more insulation was an ineffective solution to a much more extensive problem. Opinion Dynamics, report, *2014 Evaluation Report for the Aboriginal Conservation Program*, October 29, 2015.

**14.** Chiefs of Ontario, report, *First Nations Electricity Report: An Energy Literacy Tool to Support Meaningful Participation*, p. 28, January 2016.

**15.** The Aboriginal Conservation Program was originally intended to be a 2-year program offered to up to approximately 20 First Nation electrically heated communities. However, over subscription led to OPA expansion of the program. The program was delivered by First Nations Engineering Services Ltd and focussed on improving home energy efficiency. Selected communities received basic conservation measures such as smart power bars and efficient shower heads, and in some cases, additional weatherization measures (e.g., draft proofing), new ENERGY STAR appliances, or programmable thermostats.

**16.** Savings per project for Aboriginal Conservation Program (ACP) participants were considerably higher compared to similar low-income programs (Home Assistance Program), and participation grew steadily between 2013 and 2015. ACP participants saved on average 2,760 kWh of energy and reduced peak demand by 0.5 kW in 2014, compared with 770 kWh and 0.10 kW in savings for Home Assistance Program customers over the same period. The success of the ACP has been attributed to a higher proportion of ACP participants who received weatherization measures (e.g., insulation and draft proofing), 22 per cent of ACP received weatherization versus 3 per cent of Home Assistance Program participants.

*Supra*, note 13.

**17.** Training was initially done remotely in each community, but over the 3 program years evolved to all champions being brought to Toronto and trained over two days. According to the IESO, having a local champion with enhanced training was directly reflected in savings results. The same type of capacity building with centralised training is expected to occur under the Hydro One First Nation program.

**18.** *Supra*, note 1.

**19.** Hydro One is the only non-First Nations LDC that has submitted a custom conservation program targeting Aboriginal customers. Hydro One serves 21,700 First Nation customers from 102 of Ontario's 133 First Nation communities and in 2013 and 2014, the utility provided conservation measures to 1,600 homes under the Aboriginal Conservation Program (ACP). Hydro One's custom First Nations Conservation Program began in January 2016 and mirrors its low-income Home Assistance program, similar to the ACP.

**20.** There is a very limited industrial and commercial customer base, and little use of air conditioning, eliminating many of the energy conservation opportunities that are most cost-effective in other regions.

**21.** The reason for revisions was given as "significant revisions to original submission to maximize cost-effectiveness – currently with LDC".

Independent Electricity System Operator, information provided to the ECO in response to ECO inquiry, October 16, 2015.

**22.** Ontario Energy Board, EB-2015-0029/EB 2015-0049 Decision and Order, *Union Gas Ltd. and Enbridge Gas Distribution: Applications for approval of 2015-2020 demand side management plans*, January 20, 2016.

**23.** Independent Electricity System Operator, information provided to the ECO in response to ECO inquiry, October 16, 2015.

**24.** Enbridge Gas Distribution, report, *2014 Demand Side Management Annual Report*, October 19, 2015.

Union Gas, report, *Final Demand Side Management 2014 Annual Report*, December 4, 2015.

**25.** For electricity conservation, capability-building initiatives and the Conservation Fund (accounting for about two per cent of 2011-2014 electricity conservation program spending) were not tested for cost-effectiveness and are not included in cost-effectiveness results. For natural gas conservation, market transformation programs are not subject to cost-effectiveness testing and accounted for 9 per cent ($5.7 million) of natural gas conservation program spending ($4.4 million for Enbridge, and $1.3 million (Optimum Home) for Union).

**26.** Independent Electricity System Operator, information provided to the ECO in response to ECO inquiry, October 16, 2015; April 18, 2016.

**27.** Ontario Energy Board, report, *Regulated Price Plan Price Report: November 1, 2013 to October 31, 2014*, pp. 18-20, October 17, 2013;

Independent Electricity System Operator, information provided to the ECO in response to ECO inquiry, October 16, 2015.

**28.** These costs are published in appendix A of the *Conservation & Demand Management Energy Efficiency Cost Effectiveness Guide* (*supra*, note 5).

**29.** Short-term reductions in nuclear power production (at Bruce Power stations only) are achieved by running the reactors at full power, but allowing some of the steam produced bypass the turbine, so there are no savings from reduced fuel (uranium) consumption.

**30.** The time periods used by the IESO for cost-effectiveness testing are similar, but not identical, to the time-of-use periods that the Ontario Energy Board uses for setting electricity TOU rates.

**31.** The value assigned for avoided capacity cost is proportional to the IESO's estimated capital cost of procuring a new gas-fired peaking (simple-cycle) generating station, as this is generally considered the least expensive supply-side resource to meet peak demand needs. For example, the IESO estimates that the capital cost of 1 MW (1000 kW) of new gas-fired generation would work out to $162,150 per year. A conservation measure that reduced system peak demand by 1 kW would save 1/1000 of this cost, so the avoided capacity cost would be valued at $162.15 per year.

**32.** The avoided energy and capacity costs for all years in the lifetime of the conservation measure are summed together (the value of savings in future years is discounted, by 4 per cent per year).

**33.** Independent Electricity System Operator, presentation (unpublished), *Overview of Electricity Conservation Program Avoided Costs: Presentation to Environmental Commissioner of Ontario (ECO)*, June 17, 2015.

**34.** *Ibid*, slide 20.

**35.** Historical data on the type of generation at the margin (setting the real-time market clearing price) is published in the OEB's biannual Market Surveillance Panel reports, but only quarterly averages are shown, not hour-by-hour data.

**36.** Ontario Power Authority, report, *Evaluation, Measurement and Verification (EM&V) Protocols and Requirements, v 2.0*, undated. www.powerauthority.on.ca/sites/default/files/conservation/Conservation-First-EMandV-Protocols-and-Requirements-2015-2020-Apr29-2015.pdf

**37.** Ontario Energy Board, EB-2014-0134 report, *Filing Guidelines to the Demand Side Management Framework for Natural Gas Distributors (2015-2020)*, section 7.1.3, December 22, 2014.

**38.** Final evaluation reports are made public by the IESO.

Independent Electricity System Operator, website, *Evaluation Reports*, accessed April 2016. www.powerauthority.on.ca/opa-conservation/conservation-information-hub/evaluation-measurement-verification/reports

**39.** The Ontario Energy Board is taking a more hands-on role in directly co-ordinating program evaluation for the 2015-2020 DSM Framework. Previously, each gas utility, in collaboration with a technical group of stakeholders, jointly oversaw an independent audit. Final results were submitted to the OEB for approval.

Ontario Energy Board, EB-2014-0134 report, *Demand Side Management Framework for Natural Gas Distributors (2015-2020)*, section 7.2, December 22, 2014.

**40.** Itron, report, *Review of 2011-2014 Ontario Power Authority Evaluation Practices* (unpublished), June 2015.

Original evaluations of the Retrofit program can be found at *Supra*, note 38.

**41.** The IESO has confirmed that the cost-effectiveness calculations are performed by the third-party evaluation firms, not by the IESO itself.

Independent Electricity System Operator, information provided to the ECO in response to ECO inquiry, October 16, 2015.

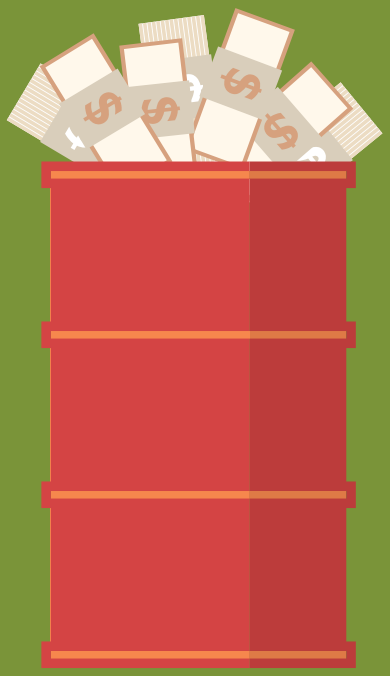
**42.** *Ibid.*

**43.** See for example, how auditor recommendations are treated in:

Enbridge Gas Distribution, EB-2015-0267 report, 2014 *Demand Side Management Audit Summary Report*, October 19, 2015.

**44.** Ontario Power Authority, report, *EM&V Protocols and Requirements 2011-2014*, supplement 1, March 2011.

# 7 Fossil Fuel Subsidies



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# 7.0 Fossil Fuel Subsidies

While Ontario has committed to improve the conservation of fossil fuels, we also have policies that conflict with that objective. One of the barriers to reduced fossil fuel consumption is that Ontario still provides substantial financial support – or subsidies – for the use of some fossil fuels. It is time to examine these subsidies and ask whether an alternative approach is warranted.

## 7.1 What is a Fossil Fuel Subsidy?

According to the World Trade Organization's Agreement on Subsidies and Countervailing Measures,[1] a subsidy consists of three basic elements: a financial contribution, by a government or public body, which confers a benefit. Tax concessions – or foregone government revenues – are specifically included in the definition along with other forms of financial contribution (e.g., grants, loans, equity infusions, loan guarantees, or the provision of goods). A fossil fuel subsidy, therefore is a financial contribution, including a tax concession, by a government that supports the extraction, refining, or use of fossil fuels.

## 7.2 Fossil Fuel Subsidies Around the World

The Organisation for Economic Co-operation and Development (OECD), in its *Inventory of Support Measures for Fossil Fuels 2015*,[2] found that tax concessions for fuel used by particular industries, groups and regions constitute the most common form of support provided. Of the 800 fossil fuel support measures identified by the OECD within 40 countries, almost two-thirds are tax concessions[3] (see text box for examples).

Using combined data from the OECD and the International Energy Agency, global financial subsidies and other support payments for fossil fuel production and consumption have been estimated at about $600 to $650 billion (U.S.) every year (about $770 – $830 billion Canadian at the date of writing).[4]

### Global Examples of Tax Concessions for Fossil Fuel Consumption

- Belgium: Fuel-Tax Rebate for Taxi Drivers and Road Freight
- Denmark: Energy-Duty Exemption for Ferries
- Finland: Reduced Energy-Tax Rate on Peat Used in Heating
- France: VAT Reduction for Petroleum Products Sold in Corsica
- Germany: Energy-Tax Refund for Diesel Used in Agriculture and Forestry
- Greece: Excise-Tax Refund for Fuels Used in Tourist Boats

The combustion of fossil fuel has many negative impacts on society – in terms of poor air quality, human health impacts, and climate change. These result in costs to society that are not included within the price paid by consumers. The International Monetary Fund (IMF) argues that the failure to include these external costs also represents a subsidy.[5] Under this expanded definition, the IMF has estimated the total worldwide support for fossil fuel use in 2015 was $5.3 trillion (U.S. ).[6] For Canada, the IMF estimates energy production and consumption subsidies at more than $28 billion (U.S. )[7] each year, most of it in unpaid climate and air pollution damage (see Table 7.1).

## 7.3 Why do Subsidies Matter?

Governments use subsidies for various public policy reasons. Ideally they should be used to encourage beneficial activities and behaviours and to discourage harmful activities and behaviours. With the clear role that fossil fuels play in contributing to climate change[8] and other environmental and human health problems,[9] it is worthwhile to re-examine the use of subsidies for fossil fuels.

There are various problems caused by fossil fuel subsidies. First, the fossil fuel subsidies provided to both producers and consumers discourage energy conservation by keeping prices artificially low.

Second, subsidizing fossil fuel production may serve to disadvantage other more sustainable energy sources. Such subsidies can create an uneven playing field that is tipped toward carbon-intensive sources. Fossil fuel subsidies dwarf the support provided to renewable energy; in 2013, Group of Twenty (G20) member countries provided fossil fuel subsidies that were almost four times the amount of subsidies that were provided globally for renewable alternatives.[10] As well, because energy investment is often long term, such subsidies help to lock societies into carbon-intensive pathways for decades to come at the expense of cleaner alternatives.

Third, fossil fuel subsidies funnel scarce public resources towards carbon-intensive activities, funds that could be better applied to support more desirable programs or activities. The International Institute for Sustainable Development's Global Subsidies Initiative suggests that shifting fossil fuel subsidies to support other activities could make a significant contribution to climate change mitigation; worldwide, a phase-out of these subsidies could reduce emissions between 6 and 13 per cent by 2050.[11] If part of the fiscal savings were invested in energy efficiency, renewable energy or other low carbon measures, the savings could be significantly higher.[12]

In sum, fossil fuel subsidies exacerbate climate change, local air pollution, and damage to human health and ecosystems by supporting fossil fuel

**Table 7.1: Canadian Energy Production and Consumption Subsidies, in Billions (2015)**

| Nominal GDP | Population, millions | Pre-tax subsidies | Global warming | Local air pollution | Foregone consumption tax revenue | Total post-tax subsidies |
|---|---|---|---|---|---|---|
| $1,873 | 35.88 | $1.4 | $17.20 | $6.05 | $3.53 | $28.18 |

Source: International Monetary Fund Fiscal Affairs Department, *How Large are Global Energy Subsidies, Country-level Subsidy Estimates* (June 2015).

Note: All dollar values are U.S. $ billions.

extraction, processing, transportation and use. Governments around the world are beginning to take notice.

**Fossil fuel subsidies exacerbate climate change, local air pollution, and damage to human health and ecosystems by supporting fossil fuel extraction, processing, transportation and use.**

## 7.4 Global Efforts to Reduce Fossil Fuel Subsidies

As awareness is growing of the harm done by fossil fuel subsidies, many countries have committed to reduce them. In September 2009, the leaders of the G20, including Canada, committed:

"To phase out and rationalize over the medium term inefficient fossil fuel subsidies while providing targeted support for the poorest. Inefficient fossil fuel subsidies encourage wasteful consumption, reduce our energy security, impede investment in clean energy sources and undermine efforts to deal with the threat of climate change."[13]

Two months later, the Asia-Pacific Economic Cooperation forum made a similar pledge.[14]

In 2010, Costa Rica, Denmark, Ethiopia, Finland, New Zealand, Norway, Sweden and Switzerland established an informal group of countries to support fossil fuel subsidy reform.[15] In 2015, the group released a *Fossil Fuel Subsidy Reform Communiqué* that calls for accelerated action. Forty countries, including Canada,[16] have endorsed the Communiqué. It states in part:

"The International Energy Agency highlights fossil fuel subsidy reform as a key component of a set of energy measures to combat climate change and estimates that even a partial phase-out of fossil fuel subsidies would generate 12% of the total abatement needed by 2020 to keep the door open to the 2°C target. Accelerating the reform of fossil fuel subsidies is therefore an urgent priority.

Fossil fuel subsidy reform has both economic and environmental benefits, thereby supporting our shared global commitment to sustainable development. The International Monetary Fund views that fossil fuel prices should reflect not only supply costs but also environmental impacts like climate change and the health costs of local air pollution…."[17]

Some progress is being made to implement these commitments.[18] The OECD reports recent subsidy reforms in a number of countries, including Mexico, India, Germany, Indonesia and France.[19] Austria and the Netherlands phased out their excise-tax reduction for use of diesel in farming and heating, citing its environmental harm and cost to monitor.[20] Sweden is phasing out its diesel tax breaks for all land-based industries.[21] Indonesia and Iran have reduced their fossil fuel consumer subsidies and have used some of the proceeds to finance health coverage and other social priorities, such as infrastructure.[22]

In 2015, more than a dozen countries included commitments to cut or redirect fossil fuel subsidies in their Intended Nationally Determined Contributions to the Paris Climate Agreement.[23] Some countries are examining payments for ecosystem services as an alternative to fossil fuel supports for agriculture and forestry.

## 7.5 Fossil Fuel Subsidies in Ontario

Ontario currently provides more than half a billion dollars in tax concessions each year to support fossil fuel use (see Table 7.2).

### 7.5.1 Aviation Fuel

The largest commodity tax concession (in terms of the total amount of foregone revenue) is the reduced rate for aviation fuel.[24] Although aviation around the world has a significant and growing energy and carbon footprint,[25] it typically benefits from very low levels of tax. Since 1944, most government members of the International Civil Aviation Organisation (ICAO) have exempted aviation fuel used for international flights from tax.[26] Ontario is one of the few jurisdictions that imposes a tax on aviation fuel used for international flights; although, the rate of taxation is lower than comparable fuels, as discussed below.[27]

It is reasonable to assume that this major tax concession has contributed to the strong growth of aviation around the world since 1951. In light of climate change, some jurisdictions (including the European Commission) have recently moved to phase out these exemptions. However, it has proven difficult for any single jurisdiction to reduce these exemptions, because airlines and air travel compete across national boundaries. For this reason, a report prepared for the National Airlines Council of Canada argues that removal of Ontario's aviation fuel tax could help to stimulate the overall provincial economy.[28]

It may be possible for countries to revisit this issue later this year. The ICAO has committed to develop a global market-based measure to address carbon pollution from international aviation, for adoption at the 38th ICAO

**Table 7.2: Ontario Commodity Tax Concessions for Fossil Fuels**

| Measure | 2015 ($ millions) |
|---|---|
| Reduced Tax Rate for Aviation Fuel | 320 |
| Fuel Tax Exemption for Coloured Fuel | 215 |
| Fuel Tax Reduction for Railway Diesel | 65 |
| Gasoline Tax Exemption for Methanol and Natural Gas | 15 |
| Gasoline Tax Reduction for Propane | 7 |
| Diesel Tax Refund for Auxiliary Equipment | 3 |
| Gasoline Tax Refund for Unlicensed Equipment | 3 |
| **Total** | **628** |

Source: Ontario Ministry of Finance, *Transparency in Taxation* (2015).

Assembly in Montreal in September 2016.[29] Work to develop this mechanism is underway through the ICAO's Global Aviation Dialogues.

Ontario is gradually increasing the tax rate on aviation fuel, despite protests by airports near the international border. The *2014 Ontario Budget* introduced an increase to the tax rate on aviation fuel by one cent per litre each year for four years. The first and second increases occurred in September 2014 and April 2015, taking the tax rate on aviation fuel to 4.7 cents per litre. The tax rate will increase by a further one cent per litre in April 2016 and 2017. Upon full implementation in April 2017, aviation fuel will be taxed at the rate of 6.7 cents per litre, in comparison to the 14.7 cents per litre charged on unleaded gasoline.[30] This tax increase will serve to reduce the annual subsidy by approximately $125 million per year starting in 2018.[31]

### 7.5.2 Coloured Fuel

The most well-known fuel-tax concession in Ontario is the coloured fuel exemption, which has been in place since at least 1981.[32] Coloured fuel, typically diesel, is exempt from the 14.3 cents per litre tax under the provincial *Fuel Tax Act*[33] and can be used for any purpose, other than to power a licenced motor vehicle, or to operate a recreational vehicle, watercraft, boat or any other recreational machine.[34] As such, coloured fuel may be used to operate unlicensed construction, forestry, mining, farm and other business equipment; to generate electricity; for heating, lighting or cooking; and to operate commercial marine vessels. First Nations individuals who are registered under the federal *Indian Act* and First Nations bands may use coloured fuel in licensed vehicles where the fuel is acquired on a reserve.[35]

According to the Ministry of Finance's 2015 *Transparency in Taxation*[36] report, the coloured fuel tax break cost the provincial treasury $215 million[37] in 2015 in foregone tax revenue. The breakdown is shown in Table 7.3.

**Table 7.3: Fuel Tax, Exemption for Coloured Fuel, Impacts by Sector (2015)**

| Sector | Breakdown | Impact ($ millions) | % of Total Impact |
|---|---|---|---|
| Residential | | 88 | 41 |
| Farming | | 28[38] | 13 |
| Business | | 92 | 43 |
| | Transportation<br>Construction<br>Mining<br>Manufacturing<br>Other | 47<br>15<br>9<br>7<br>14 | |
| Public Service Bodies | | 7 | 3 |
| **Total** | | **215** | **100%** |

Source: Ministry of Finance (2016).

### 7.5.3 Natural Gas and Propane for Vehicle Use

There is also a tax exemption for natural gas and methanol used in motor vehicles and a reduced tax rate for propane used in motor vehicles. Some life-cycle analysis studies suggest that compressed natural gas/liquefied natural gas and liquefied petroleum gas (i.e., propane) vehicles offer around 10 per cent less greenhouse gas emissions across the fuel supply/distribution/use lifecycle, as compared to gasoline powered vehicles.[39] These greenhouse gas emissions benefits are, however, strongly sensitive to the rate of leaks and other escapes of methane from the natural gas system, because of the high potency of methane as a greenhouse gas (see text box in Chapter 2 *How Clean is Natural Gas?*). It is worth noting, however, that the use of these fuels can contribute to material improvements in local air quality where the fuel is used.

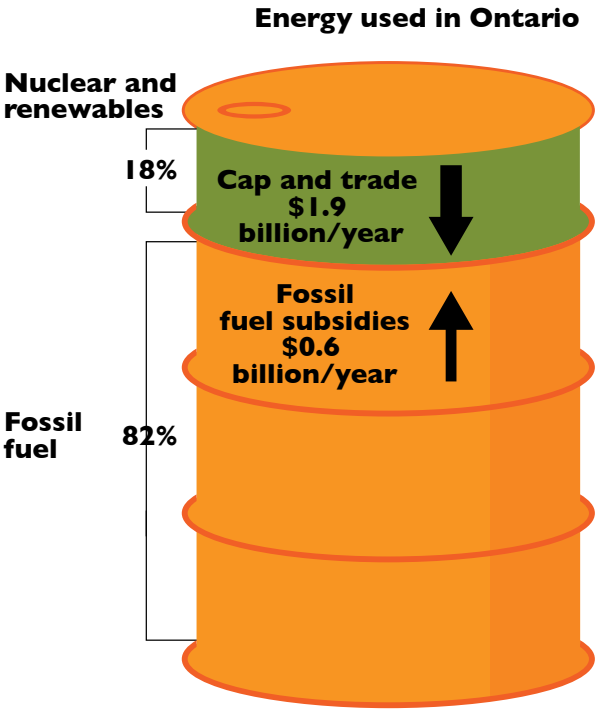


**Figure 7.1. The perversity of fossil fuel subsidies within a cap-and-trade system**

## 7.6 Options for Ontario

Ontario has committed to make major reductions in our greenhouse gas emissions. This necessarily requires steep decreases in fossil fuel consumption. To this end, Ontario has introduced a cap-and-trade program to put a price on carbon, and particularly on fossil fuel combustion; approximately $1.9 billion will be generated annually through this program starting in 2017-2018.[40] Ontario's fossil fuel use tax concessions[41] undermine the intended purposes and operation of cap and trade. One arm of government is putting a price on carbon, to decrease fossil fuel consumption and its climate damage. At the same time, tax concessions from the same government reduce the cost of those same fossil fuels and likely increase their use.

**Ontario's fossil fuel use tax concessions undermine the intended purposes and operation of cap and trade.**

Ontario is aware of this contradiction. Ontario's 2015 *Climate Change Strategy* pledges to "review and make recommendations regarding existing policies and programs that support fossil fuel use" and to "look at removing existing initiatives that support fossil fuel use...".[42] The ECO agrees that this review is overdue, and should include a review of tax concessions.

This is not to say that all fossil fuel subsidies should be simply eliminated. While fossil fuel subsidy reform is urgent for environmental and climate reasons, the impacts of reform on vulnerable segments of society must be carefully managed. While subsidies often benefit richer households disproportionately, higher energy prices have a serious effect on poorer households, for whom energy often represents a large share of total spending.[43] The impact on businesses can also be significant, depending on timing, on offsetting supports, and on their opportunities to moderate fossil fuel consumption by shifting to cleaner options. Cutting subsidies could well cause disproportionate economic damage if the cuts affect trade-exposed businesses, such as airports, unless neighbouring jurisdictions do the same.

One of the largest categories of coloured fuel use is to heat residential buildings, which accounts for $88 million in foregone revenue each year. An obvious alternative for the coloured fuel tax exemption would be to spend the same funds on an energy audit and retrofit program for oil-heated homes. This would allow homeowners to permanently reduce their energy bills and greenhouse gas emissions, thus reducing the need for an ongoing subsidy and often increasing indoor comfort. In fact, oil-heated homes will qualify for the $100 million in energy audits and retrofits announced as part of the Green Investment Fund.[44] More funds could be added to this program. Another alternative is to transfer funds from supporting coloured fuel use to supporting low-income families, perhaps through the Northern Energy Tax Credit and/or the Ontario Energy and Property Tax Credit.[45] Both of these tax credits focus available funds on families most in need, while allowing them to spend the money as they see fit.

For agriculture, forestry and construction, there may be better alternatives, including some that support the ecosystem services provided by farmers and by environmentally responsible forestry and construction practices.[46] For marine and other off-road transportation businesses, there could be opportunities to use the additional revenues gained through the removal of the tax exemption to support the acquisition of high-efficiency, low emission engines and other equipment. Knowledgeable stakeholders could likely suggest other and better alternatives that would not only support each industry, but also result in better air quality and reduced fossil fuel consumption.

## 7.7 Recommendation

It is time for policy makers to reassess the relevance of fossil fuel subsidies in today's context and to tilt the playing field toward a lower carbon future. It is perverse to put a price on carbon through cap and trade while still financially supporting the consumption of carbon-intense fossil fuels. It is possible for Ontario to adopt better tax policies than the out dated tradition of fossil fuel subsidies.

**The Minister of Finance should redirect tax breaks from supporting fossil fuel consumption to activities that contribute to the public good.**

Fuel price changes are driven primarily by fluctuations in the price of oil. It is less disruptive to phase out or repurpose fuel subsidies when oil prices are low. This means that the record 2015 drop in the price of oil — and its continued projected low until 2017[47] — gives governments an important opportunity to reform fossil fuel subsidies at the least economic and social cost.

## Endnotes

1. World Trade Organization, *Agreement on Subsidies and Countervailing Measures*, Part I: General Provisions, Article 1: Definition of a Subsidy, Section 1.1.

2. Organization for Economic Cooperation and Development, website, *OECD analysis of budgetary support and tax expenditures*. www.oecd.org/site/tadffss/data/ (These fossil-fuel support findings are based on a detailed, line-by-line analysis of the budgets of each of the 34 OECD countries, as well as six partner countries. Policies of subnational governments were also included in the analysis.)

3. OECD, *OECD Companion to the Inventory of Support Measures for Fossil Fuels*, p.45, September 21, 2015.

4. *Ibid.* (The value of all support measures was between $160-200 billion (U.S.) annually over the period 2010-2014.) In 2014 the International Energy Agency estimated that consumer subsidies for fossil fuels were $490 billion (U.S.). (International Energy Association, report, *World Energy Outlook 2015*, p.7, November 12, 2014). The OECD has indicated by email to the ECO (February 2, 2016), that while each agency shares a similar understanding of what constitutes a subsidy, they use different estimations methods. As the two sets of estimates are often complementary the combined estimate of $600 - $650 billion is reasonable. [U.S. conversion rate as of April 12, 2016].

5. International Monetary Fund, report, *Energy Subsidy Reform: Lessons and Implications*, January 28, 2013.

6. International Monetary Fund, working paper WP/15/105, *How Large Are Global Energy Subsidies?*, p.5, May 2015. (This methodology has been generally rejected by fossil-fuel industries.)

7. International Monetary Fund Fiscal Affairs Department, database, *Country-level Subsidy Estimates Database*, June 2015. (link to "country level estimates" excel spreadsheet available here: www.imf.org/external/pubs/ft/survey/so/2015/NEW070215A.htm) Our selection of these estimates excludes external costs related to congestion, accidents and road damage, which are consequences of the use of vehicles, not of fossil fuels *per se*.

8. See generally the Assessment Reports of the Intergovernmental Panel on Climate Change, at: www.ipcc.ch.

9. Fossil fuel use contributes to poor air quality due to the release of sulfur dioxide, nitrogen dioxide, ozone and fine particulate matter. Air pollution is a major environmental risk to health and can increase the risk of stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma. (World Health Organization, Fact sheet No. 313, *Ambient (outdoor) air quality and health*, March 2014.).

10. Oil Change International, report, *Empty Promises: G20 subsidies to oil, gas and coal production*, p.11, November 2015.

11. Nordic Council of Ministers, working paper, *Fossil-Fuel Subsidies and Climate Change: Options for policy-makers within their Intended Nationally Determined Contributions*, Executive Summary, 2015.

12. Nordic Council of Ministers, report, *Tackling Fossil Fuel Subsidies and Climate Change: Levelling the energy playing field*, p.11, 2015. (Modelling by the Global Subsidies Initiative of the IISD found that emissions reductions could be increased to 18.15% when 30% of the savings from subsidy reform are redirected towards renewables and energy efficiency.)

13. The Pittsburgh Summit, *Leaders' Statement*, September 24-25, 2009.

14. Asia-Pacific Economic Cooperation, 2009 Leaders' Declaration, *A New Growth Paradigm for a Connected Asia-Pacific in the 21st Century, Singapore*, November 14, 2009.

15. Friends of Fossil Fuel Subsidy Reform: fffsr.org/

16. Canada did so on November 27, 2015, as per email to the ECO from Jane McDonald, Director, Climate Change – Office of the Minister of Environment and Climate Change.

17. Fossil-Fuel Subsidy Reform Communiqué: fffsr.org/communique/

18. While there has been some international momentum towards reforming consumer subsidies, limited progress has been made with respect to production subsidies. (Oil Change International, report, *Empty Promises: G20 subsidies to oil, gas and coal production*, p.82, November 2015.)

19. OECD, *OECD Companion to the Inventory of Support Measures for Fossil Fuels*, p. 42-43, September 21, 2015.

20. *Ibid*, p.43.

**21.** As per information provided to the ECO by the OECD.

**22.** Vinay Gupta, Ranu Dhillon, and Robert Yates, periodical (The Lancet, vol: 3), *Financing universal health coverage by cutting fossil fuel subsidies*, p.1. June 2015.

**23.** IISD, paper, *Fiscal Instruments in INDCs: How countries are looking to fiscal policies to support INDC implementation*, Table 1, December 2015.

**24.** Government of Ontario, Ministry of Finance, report, *Transparency in Taxation*, Table 5 at footnote 5, 2015. (According to Table 5, the amount of the foregone revenue is estimated by comparing the tax rate on aviation fuel, which is typically jet fuel (kerosene) or aviation gasoline, to the general gasoline tax rate.)

**25.** European Commission, website, *Reducing emissions from aviation*, accessed April 2016. ec.europa.eu/clima/policies/transport/aviation/index_en.htm ("by 2020, global international aviation emissions are projected to be around 70% higher than in 2005 even if fuel efficiency improves by 2% per year. ICAO forecasts that by 2050 they could grow by a further 300-700%."); See also, ICAO, report, *2013 Environmental Report, Aviation and Climate Change, Destination Green.*

**26.** While the *Chicago Convention on International Civil Aviation* of 1944 did not deal comprehensively with tax matters, Article 24 of the Convention stated that "fuel…on board an aircraft of a Contracting State on arrival in the territory of another Contracting State and retained on board…shall be exempt from customs duty". In 1951, the ICAO Council adopted a Resolution and Recommendation on the taxation of fuel that was "designed to recognize the unique nature of civil aviation and the need to accord tax exempt status to certain aspects of the operations of international air transport. They were adopted because multiple taxation on the aircraft, fuel, technical supplies and the income of international air transport, as well as taxes on its sale and use, were considered as major obstacles to further development of international air transport". (ICAO, council resolution and commentary, *ICAO's Policies on Taxation in the Field of International Air Transport*, Third Edition – 2000, Introduction, approved by Council February 24, 1999.)

**27.** Vijay Gill, *Increasing Aviation Fuel Tax Might Not Increase Government Revenues at All*, Conference Board of Canada commentary, July 14, 2014.

**28.** See for example: Fred Lazar, *The Case for Eliminating the Government of Ontario Tax on Aviation Fuel on Transborder and International Flights*, (prepared for the National Airlines Council of Canada) March 2013.

**29.** International Civil Aviation Organization, website, *Meetings & Events: 2016 Global Aviation Dialogues (GLADs)*, accessed April 2016. www.icao.int/Meetings/GLADs-2016/Pages/default.aspx

**30.** Ontario Ministry of Finance, website, *Gasoline Tax*, accessed April 2016. /www.fin.gov.on.ca/en/tax/gt/

**31.** As per information provided to the ECO by the Ministry of Finance.

**32.** From 1925 to 1981, some off-road uses of fuel were also exempt from fuel taxes. The coloured fuel program was introduced in 1981 as an enforcement mechanism, to simplify administration and reduce abuse of the exemptions. The scope of the exemptions has been amended from time to time. Amendments have been proposed to the definition of road-building machines, and vehicles that do not fit the new definition would be required to use clear fuel. The fuel tax exemption for biodiesel was repealed effective April 1, 2014, making biodiesel taxable in the same way as clear diesel fuel. (Ministry of Finance, website, *Fuel Tax*, accessed April 2016. www.fin.gov.on.ca/en/tax/ft/index.html)

**33.** Fuel tax rates were last changed on January 1, 1992.

**34.** Ontario Ministry of Finance, website, *Fuel Tax*, accessed April 2016. www.fin.gov.on.ca/en/tax/ft/index.html

**35.** *Ibid.*

**36.** Ontario Ministry of Finance, website, *Transparency in Taxation, 2015*, accessed April 2016. www.fin.gov.on.ca/en/budget/fallstatement/2015/transparency.html

**37.** Plus enforcement costs.

**38.** As per information provided to the ECO by the Ministry of Agriculture, Food and Rural Affairs, the 2011 Census of Agriculture indicates a total of 51,950 farms in Ontario. Approximately 44,000 farm businesses are registered in Ontario under the *Farm Registration and Farm Organizations Funding Act, 1993.*

**39.** The actual impact depends heavily on the source of the gas. (U.S. Department of Energy, Energy Efficiency and Renewable Energy, website, *Alternative Fuels Data Center*, accessed April 2016. www.afdc.energy.gov)

**40.** 2016 Ontario Budget, Jobs for Today and Tomorrow. Chapter I, Building Prosperity and Creating Jobs, page 23.

**41.** It is worth noting that, contrary to popular belief, fuel taxes in Ontario are not dedicated for road construction and maintenance. They go into the consolidated revenue fund and are used to support all provincial programs. Since 2004, two cents of the 14.7 cent per litre gasoline tax has been given to municipalities for public transit. The 2014 Ontario Budget announced that 7.5 cents per litre of the existing gasoline tax would be dedicated to public transit and infrastructure through the Moving Ontario Forward plan.

**42.** *Ontario's Climate Change Strategy 2015*.

**43.** The Fossil Fuel Subsidy Reform Communiqué recognized that the "majority of fossil-fuel subsidies are also socially regressive, with benefits disproportionately skewed toward middle- and upper-middle income households" and therefore urged that "accelerated subsidy reform needs to be undertaken alongside measures that protect the poor and vulnerable groups from the impact of higher energy prices." (fffsr.org/communique/)

**44.** Government of Ontario, news release, *Ontario Investing $100 Million to Create Jobs and Help Homeowners Save Energy*, February 4, 2016. As per information provided to the ECO by the Ministry of Energy, oil-heated homes will qualify for this funding.

**45.** British Columbia's equivalent is the Low Income Climate Action Tax Credit. (Government of British Columbia, website, *Low Income Climate Action Tax Credit*, accessed April 2016. www2.gov.bc.ca/gov/content/taxes/income-taxes/personal/credits/climate-action)

**46.** See for example: Forest Trends, The Katoomba Group, and UNEP, report, *Payments for Ecosystem Services. Getting Started: A Primer*, May 2008; see also, Ecological and Economic Foundations, report, *The Economics of Ecosystems and Biodiversity*, 2010.

**47.** International Energy Association, report, *Medium-Term Oil Market Report 2016*, p.9, 2016.

# 8 Recommendations

## Key recommendations from this year's report:

1. All public bodies in Ontario should get serious about a "cleaner, leaner, greener" approach to energy, especially reducing the use of fossil fuels.

2. Ontario should adopt formal targets for reducing fossil fuel consumption.

3. Public bodies should be accountable to the public for the energy they use.

### Chapter 3: Transportation Fuel

4. The Minister of Transportation and municipal councils should reduce transportation fuel consumption by:

   a. Accommodating population growth within complete communities served by good transit and active transportation infrastructure;

   b. Making transit faster and more reliable through cost-effective transit investments and by granting transit vehicles priority on key arterials and highways; and

   c. Supporting the rapid growth of low carbon transportation vehicles and fuels, including electrification.

5. Public bodies should report the energy use of their fleets.

6. The next Ontario Building Code should require conduits in new buildings so that electric vehicle charging infrastructure can be conveniently and cost effectively added by occupants.

7. The Ontario Energy Board and utilities should encourage electric vehicle charging during off-peak hours, through enhanced time of use rates and load control technology.

## Chapter 4: Public Buildings

8. The Minister of Energy should:
   a. disclose the energy used in Ontario government buildings in a user-friendly format;
   b. set energy use intensity targets for all public buildings;
   c. implement *Green Energy Act, 2009* provisions that protect consumers by mandating home energy use disclosure prior to sale; and
   d. require large private sector buildings to disclose their energy intensity.

9. The Minister of Finance should remove barriers that prevent public bodies from borrowing to upgrade the energy efficiency of their buildings, and from using the resulting energy bill savings to repay the loan.

## Chapter 5: Codes and Standards

10. The Minister of Environment and Climate Change and the Minister of Energy should establish product standards for the efficient use of water in fixtures.

11. The Ministry of the Environment and Climate Change should obtain authority to inspect and enforce compliance with product efficiency standards.

## Chapter 6: Measuring the Value of Conservation

12. Ontario should focus electricity conservation on times of higher demand, when conservation displaces natural gas-fired generation.

13. **The Independent Electricity System Operator should improve public participation in conservation planning by providing greater transparency about marginal hourly generation and how it is implementing recommendations for conservation program improvements.**

## Chapter 7: Fossil Fuel Subsidies

14. **The Minister of Finance should redirect tax breaks from supporting fossil fuel consumption to activities that contribute to the public good.**

## Key outstanding recommendations from past reports:

### Ensure stable, predictable rules for the energy sector.

**The ECO recommends that the Ministry of Energy and Infrastructure commit to a period of policy stability to allow for implementation and evaluation of the Green Energy and *Green Economy Act, 2009*. (2009 report, volume one).**

Since this recommendation was made seven years ago, there has been continuing change to the regulatory frameworks for electricity and natural gas conservation, and the procurement of renewable generation. Most were accomplished by use of ministerial direction with little public involvement. The recommendation remains relevant to limit the often dramatic changes made in regulatory frameworks, targets, governance procedures without explanation or consultation which hinder assessment of conservation's effectiveness.

### Create a long-term energy plan encompassing all fuels.

**The ECO recommends that the Secretary of Cabinet direct the development of a comprehensive energy conservation strategy encompassing all major energy sources used in Ontario. The strategy should be developed with public input. (2009 report, volume one)**

**The ECO recommends that the Ministry of Energy build upon the work completed in the Long-Term Energy Plan and produce a comprehensive multi-fuel energy plan. (2010 report, volume one)**

Since these recommendations were made 6-7 years ago, no multi-fuel plan has been produced. The recommendation remains relevant since it was directed at the need for a plan for Ontario's use of hydrocarbons. With a renewed emphasis on climate change planning, the need to incorporate conservation of fossil fuels in energy planning is even more pressing.

## Establish mandatory energy reporting and labelling for all buildings.

**The ECO recommends that the government proclaim and implement the provision for mandatory home energy efficiency disclosure in the *Green Energy Act, 2009*. (2011 report, volume one)**

**The ECO recommends that the Ministry of Energy and Infrastructure establish reportable benchmarking by sector. This would assist the government in deciding whether to establish targets to conserve natural gas, oil, propane and transportation fuels, and would make the targets meaningful. (2009 report, volume one)**

**The ECO recommends that the Minister of Infrastructure issue a directive requiring annual, public reports of energy consumption for all government ministries and an energy conservation plan for the Ontario government by the end of 2012. (2011 report, volume one)**

Since these recommendations were made 5-7 years ago, there has been no labeling or reporting for homes or Ontario government-owned buildings. There is annual reporting of broader public sector buildings' energy use and GHGs. Reporting and benchmarking of energy and water use in large private sector buildings was proposed in 2015 but is not yet implemented. The seeming abandonment of home energy ratings remains a particular concern as residential buildings are significant consumers of fossil fuels.

## Make fuel and emissions data available.

**The ECO recommends that the Independent Electricity System Operator make publicly available the estimated greenhouse gas emissions factors for Ontario's electricity consumption on an hourly basis. (2011 report, volume one)**

**The ECO recommends that the Ministry of Energy expand the annual energy reporting requirements for the Broader Public Sector to include fleets and other key energy-consuming operations. (2011 report, volume one)**

**The ECO recommends that the Minister of Infrastructure issue a directive requiring annual, public reports of energy consumption for all government ministries and an energy conservation plan for the Ontario government by the end of 2012. (2011 report, volume one)**

**The ECO recommends that the Minister of Education ensure that the Ontario public has unrestricted access to the utility consumption database by July 1, 2013. (2011 report, volume two)**

Since these recommendations were made 5 years ago, one notable dataset has become available – annual energy use in broader public sector (municipalities, schools, universities, colleges and hospitals) facilities. However, hourly greenhouse gas emissions from electrical generation have not been published, broader public sector fleet data is not reported, (although OPS fleet data is reported), and energy use in Ontario government buildings is not made publicly available. There is no public access to the Ministry of Education's energy database, although data on schools' energy use is available under reporting requirements for the broader public sector (noted above).

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# A

# Natural Gas

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# Appendix A. Natural Gas

## A.1 2014 Natural Gas Conservation Program Results

### Introduction

This appendix reviews the 2014 conservation savings program results for Ontario's two large natural gas utilities, Enbridge Gas Distribution and Union Gas, which provide natural gas service to the majority of Ontario gas customers.[1] Enbridge and Union have delivered conservation programs to their customers since the 1990s. Gas utility conservation programs contribute to three goals: assisting gas consumers in reducing their gas consumption and managing their energy bills; creating a culture of conservation; and, avoiding costs related to future natural gas infrastructure investment.[2] Results are not yet available for 2015 due to the need for results to be verified and audited before being filed with the Ontario Energy Board (OEB).[3] Conservation programs from 2015 to 2020 will be delivered under a new conservation framework, discussed briefly in section A.2.

Enbridge and Union had mixed results in 2014 for their natural gas conservation programs. Positives included the continued cost-effectiveness of conservation programs, higher participation in the utilities' home retrofit programs, and Enbridge's extension of its programs for low-income customers into private sector multi-residential buildings. However, there was an overall decline in natural gas savings, due to fewer large-scale conservation projects undertaken by commercial and industrial customers.

### Overall Natural Gas Savings

The projected lifetime natural gas savings[4] (divided by sector) that each utility achieved through its 2012, 2013, and 2014 conservation programs is shown below in Figure A.1. Lifetime

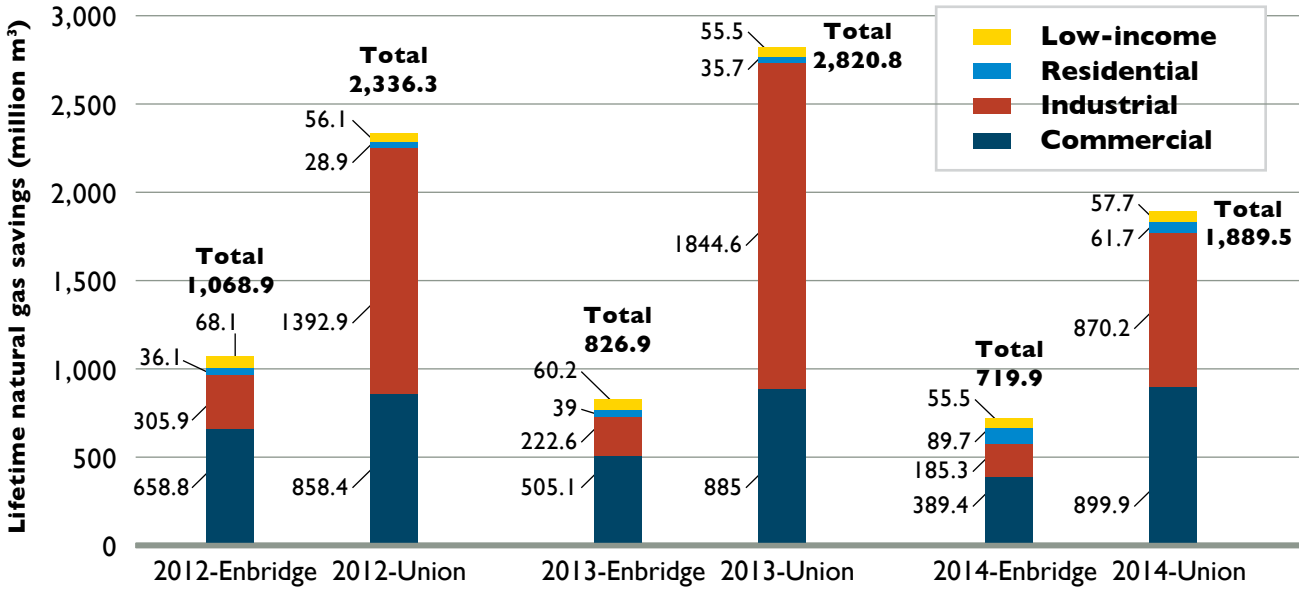


**Figure A.1: Lifetime natural gas savings from 2012-2014 gas utility conservation programs by sector**

Note: Only savings from large-volume industrial customers (rate classes T1, T2, and 100) are included in the "industrial" category for Union Gas. Savings for smaller industrial customers are included in the "commercial" category.

Source: Enbridge Gas Distribution, 2012, 2013, and 2014 Annual DSM Reports; Union Gas, 2012, 2013, and 2014 Annual DSM Reports

natural gas savings is the primary metric the OEB uses to measure the success of most natural gas conservation programs, because it incents utilities to capture as much conservation as possible within a given budget, and gives greater value to long-lived conservation projects that will deliver savings for many years (e.g. building envelope improvements).[5] Union has traditionally had higher overall savings because it serves more large industrial gas consumers, who are often able to undertake larger conservation projects with very high energy savings.

## Program Spending and Cost-Effectiveness

Enbridge and Union spent approximately $66 million on gas conservation programs in 2014 ($32.5 million by Enbridge, and $33.7 million by Union Gas), about 10 per cent higher than in 2013. The conservation initiatives funded by Enbridge and Union continued to offer good value for society. Each dollar spent on energy efficiency yielded approximately $2.67 in benefits (largely through savings on gas costs) for Enbridge's conservation programs, and $1.75 for Union's programs, as measured using the Total Resource Cost test, which compares the costs and benefits of a program from a societal perspective. These results differ from previous years, in which the programs offered by Union Gas were typically more cost-effective than those offered by Enbridge. This reflects the reduction in energy savings in 2014 of Union's programs for large-volume industrial customers, which are typically the most cost-effective conservation projects of all customer classes.

## 2014 Highlights by Sector

### Commercial and Industrial Programs Produced Lower Savings

Conservation projects undertaken by large industrial and commercial (including institutional and multi-residential) customers have traditionally accounted for the lion's share of overall energy savings from natural gas conservation programs, with utilities offering financial incentives and technical assistance. However, savings from these larger projects declined in 2014, and this appears to be a trend, at least for Enbridge, whose overall savings peaked in 2011 and have declined in each of the three following years. Enbridge identified low natural gas prices as one contributing factor that inhibited customer interest in conservation projects. Gas conservation may become more attractive to all natural gas customers if Ontario's future carbon cap-and-trade system increases customer gas costs.

To offset the decline in natural gas savings, the utilities are increasing their efforts to market to smaller customers that have not been as active in conservation programs to date. While efficiency projects for larger customers are often customized, programs for smaller customers are more likely to focus on standardized efficiency measures (e.g., space heating, water heating, and commercial kitchen technologies). While there is great untapped potential for energy savings among these smaller customers, the savings per project will be lower and administrative costs will likely be higher.

### Savings from Residential Programs Trending Upward

Both utilities were able to significantly increase participation and energy savings from their home retrofit programs in the residential sector. The programs offered by Enbridge and Union are similar, with both programs attempting to deliver deep retrofits that decrease a home's overall natural gas use by 25 per cent or more, by providing incentives for measures such as insulation and more efficient space and water heating equipment. Enbridge more than tripled participation in its program, delivering retrofits to more than 5,000 homes. There is clearly further scope for program expansion, as Enbridge had

not fully rolled out this program throughout its service territory – 99 per cent of 2014 program participants came from the Greater Toronto Area. In 2014, Enbridge was able to meet the higher than anticipated demand for its residential retrofit program by shifting some of its budget from other program areas. However, in 2015, it was not able to do this, and unfortunately had to temporarily freeze this program once its budget limit was reached. This was an unfortunate consequence of the delay in approving utilities' 2015-2020 conservation plans. This obstacle has now been overcome, and residential retrofit programs will be a key component of both utilities' 2015-2020 plans.

### Mixed and Modest Savings from Low-Income Programs (Single-Family and Multi-Unit Dwellings)

Enbridge and Union deliver programs for low-income households, in both single-family homes (free efficiency upgrades) and multi-residential buildings (higher incentives for building owners for efficiency upgrades). Results for single-family homes were similar to 2013, with Enbridge and Union retrofitting about 2,700 homes in total. For multi-residential buildings, Union delivered approximately 40 per cent higher savings, while Enbridge experienced disappointing results for the second year in a row, due in part to a continuing freeze by Toronto Community Housing in implementing energy efficiency projects, an issue that has now been resolved. In 2014, Enbridge expanded eligibility for its low-income multi-residential program beyond the social housing sector, to include privately owned buildings with a high proportion of low-income occupants. This may increase savings in future years.

### Market Transformation Programs – Steady Progress with Homebuilders and Realtors

Market transformation programs are intended to facilitate a change in the marketplace towards more energy efficient products. Performance is measured by metrics other than the acquisition of overall gas savings. The metrics are specific to the program and the type of change it is trying to achieve, and are shown in Table A.1 and Table A.2. In this category, both Union and Enbridge offer programs to develop the capacity of homebuilders to build new homes to higher energy performance levels than required by the Ontario Building Code. These programs led to 1,424 high-performance homes being built by participating builders in 2014. Enbridge also offers a similar program for larger buildings (which saw the participation of many new condominium projects in 2014) and a program to encourage home energy ratings at time of sale, with the end goal of transforming the resale market so that a home's energy performance rating becomes a standard condition of sale. This program delivered better results in 2014 (662 ratings, versus 138 ratings in 2013), although this is still a very small portion of the resale market.

## Performance Against Targets

Utility performance on conservation is measured by the OEB against a complicated "scorecard" of targets. The targets were previously proposed by utilities, and adjusted and approved by the OEB as part of the Board's review of the utilities' 2012-2014 conservation plans. Each utility is eligible for performance incentives scaled to their performance against targets, paid for by ratepayers through natural gas rates. The most important targets for utilities are the lifetime natural gas savings achieved from their combined suite of resource acquisition[6] programs in the industrial, commercial and residential sectors. However, the scorecards also include additional targets for progress on more specific conservation program goals.

Based on the 2014 results, the utilities will be eligible for $16.5 million in incentives ($7.6 million for Enbridge Gas Distribution and $9.0 million for Union Gas). Enbridge is eligible for about

70 per cent of its maximum incentive payment, and Union just over 80 per cent.[7] The OEB has not yet approved these incentive payments.[8] The Board has the option of adjusting the incentive payments if it believes there have been inaccuracies by the utilities in measuring their progress against targets, including their methodology for measuring energy savings. The Board approved the incentive payments for Enbridge and Union's 2013 conservation results with no changes (in contrast to previous years), despite some concerns raised by Board staff.[9]

The 2014 conservation results for Enbridge Gas Distribution and Union Gas are shown in Table A.1 and Table A.2, respectively.[10] For each utility, actual 2014 program results are shown in comparison with the targets that were established in their three-year plans.[11]

**Table A.1: Summary of 2014 Performance Against Conservation Targets – Enbridge Gas**

| Program Type | Target Description | Progress on Target | Target Weight[12] |
|---|---|---|---|
| **Resource Acquisition (58 per cent of total budget)** | 992.06 million $m^3$ of lifetime natural gas savings, due to 2014 conservation programs (excluding low-income programs and market transformation programs) | 664.37 million $m^3$ of lifetime natural gas savings (67 per cent of target) | 92 per cent |
| | Residential deep savings - 747 houses completing deep retrofits with at least two major conservation measures, and achieving natural gas savings of 25 per cent or more (on average) | 5,213 houses completed deep retrofits (698 per cent of target) | 8 per cent |
| | | | |
| **Low-Income (23 per cent of total budget)** | 23.6 million $m^3$ of lifetime natural gas savings in single family homes, due to 2014 low-income conservation programs | 25.67 million $m^3$ of lifetime natural gas savings (109 per cent of target) | 50 per cent |
| | 64.2 million $m^3$ of lifetime natural gas savings in multi-residential buildings, due to 2014 low-income conservation programs. | 29.8 million $m^3$ of lifetime natural gas savings (46 per cent of target) | 45 per cent |

*(continued)*

**Table A.1: Continued**

| Program Type | Target Description | Progress on Target | Target Weight[12] |
|---|---|---|---|
| | 40 per cent of multi-residential buildings that participate in low-income conservation programs also participate in Building Performance Management program | 74 per cent of multi-residential buildings that participated in low-income conservation programs also participated in Building Performance Management program (185 per cent of target) | 5 per cent |
| | | | |
| **Market Transformation (19 per cent of total budget)** | Commercial Savings by Design program - 12 new developments enrolled in program for higher-performance design of new commercial/industrial/ multi-residential buildings | 19 new developments enrolled (158 per cent of target) | 20 per cent |
| | Residential Savings By Design program – 16 new residential homebuilders enrolled in program for higher-performance design of new low-rise residential buildings | 23 new builders enrolled (144 per cent of target) | 31 per cent |
| | Residential Savings By Design program – 1,000 new homes built to energy efficiency levels 25 per cent higher than Building Code | 1,059 new homes built to energy efficiency levels 25 per cent higher than Building Code through program (106 per cent of target) | 20 per cent |
| | Home Labelling program - commitment from realtors collectively responsible for at least 5,000 listings to include data field for energy rating information on home sale listings | Realtors collectively responsible for 40,040 listings committed to including data field for energy rating information (801 per cent of target) | 20 per cent |
| | Home Labelling program – 1,500 home energy ratings performed | 662 ratings performed (44 per cent of target) | 9 per cent |

Results < 75 per cent of target; Results between 75 and 125 per cent of target; Results > 125 per cent of target

Source: Enbridge Gas Distribution, report, *2014 Demand Side Management Annual Report*, October 19, 2015.

**Table A.2: Summary of 2014 Performance Against Conservation Targets – Union Gas**

| Program Type | Target Description | Progress on Target | Target Weight[12] |
|---|---|---|---|
| **Resource Acquisition Programs (52 per cent of total budget)** | 788.1 million $m^3$ of lifetime natural gas savings, due to 2014 conservation programs (excluding low-income programs, market transformation programs, and programs for large-volume customers) | 961.6 million $m^3$ of lifetime natural gas savings (122 per cent of target) | 90 per cent |
| | Residential deep savings - 254 houses completing deep retrofits with at least two major conservation measures, and achieving natural gas savings of 25 per cent or more (on average) | 996 houses completed deep retrofits (392 per cent of target) | 5 per cent |
| | Commercial/industrial deep savings – 9.97 per cent reduction in customer gas consumption (on average) due to commercial/ industrial custom conservation projects, compared with customer baseline | 7.88 per cent reduction in gas consumption for participants (79 per cent of target) | 5 per cent |
| | | | |
| **Low-Income Programs (25 per cent of total budget)** | 26 million $m^3$ of lifetime natural gas savings in single family homes, due to 2014 low-income conservation programs | 36.1 million $m^3$ of lifetime natural gas savings (139 per cent of target) | 60 per cent |
| | 17.6 million $m^3$ of lifetime natural gas savings in multi-residential buildings, due to 2014 low-income conservation programs | 21.6 million $m^3$ of lifetime natural gas savings (123 per cent of target) | 40 per cent |

*(continued)*

**Table A.2: Continued**

| Program Type | Target Description | Progress on Target | Target Weight[12] |
|---|---|---|---|
| **Market Transformation Programs (5 per cent of total budget)** | 4 residential homebuilders newly enrolled in Optimum Home program for higher-performance design of new low-rise residential buildings | 3 new builders enrolled (75 per cent of target) | 40 per cent |
| | 60 per cent of builders participating in Optimum Home program have built at least one prototype home to high efficiency levels (>20 per cent above Ontario Building Code) | 86.4 per cent of participating builders have built at least one prototype home to high efficiency levels (>20 per cent above Ontario Building Code) (144 per cent of target) | 40 per cent |
| | 6 per cent of new homes built in 2014 by participating builders are built to high efficiency levels (>20 per cent above Ontario Building Code) | 14.7 per cent of new homes built in 2014 by participating builders are built to high efficiency levels (>20 per cent above Ontario Building Code) (365 high-efficiency homes built, 246 per cent of target) | 20 per cent |
| | | | |
| **Large Volume Customer Programs (17 per cent of total budget)** | 208.7 million $m^3$ of lifetime natural gas savings from rate T1 customers, due to 2014 conservation programs | 81.6 million $m^3$ of lifetime natural gas savings (39 per cent of target) | 60 per cent |
| | 1,060.1 million $m^3$ of lifetime natural gas savings from rate T2/100 customers, due to 2014 conservation programs | 788.6 million $m^3$ of lifetime natural gas savings (74 per cent of target) | 40 per cent |

Results < 75 per cent of target; Results between 75 and 125 per cent of target; Results > 125 per cent of target

Source: Union Gas, report, *Final Demand Side Management 2014 Annual Report*, December 4, 2015.

## A.2 Natural Gas Policy in 2015

Natural gas policy development in 2015 exceeded the level of activity typical of past years, as several initiatives were launched to support the new regulatory framework for distributors' demand-side management activities. The OEB also received direction from the Minister of Energy to incorporate carbon emissions into its work and regulatory procedures for demand-side management (DSM). Enbridge and Union Gas submitted their 2015-2020 DSM plans for approval by the Board in accordance with the framework. The Board began a technical study to examine future amounts of conservation savings. Among supply policy developments, both utilities were invited by the Board to apply to provide service to regions of the province currently unserved by natural gas.

### Transition to the 2015-2020 Regulatory Framework for Demand-Side Management

The OEB established the regulatory framework for natural gas demand-side management for the period 2015-2020 in late 2014, just days prior to the start date of the regulatory scheme. This policy was launched as a result of a 2014 directive from the Minister of Energy. Among new rules and procedures, the framework stipulated that 15 per cent be added to the calculation of the monetary benefits of conservation when the Board approves the cost-effectiveness of conservation programs. In effect, this additional amount is meant to monetize some of the environmental benefits provided from gas conservation's reduction of carbon dioxide emissions, as well as other non-energy benefits like employment.

The same 2014 ministerial directive required the OEB to study the achievable potential for natural gas efficiency every three years – with the first study to be completed by June 2016. The study will estimate the amount of savings that can feasibly be acquired assuming certain technical, budgetary and other influencing factors. (A similar study is being conducted for electricity). The first study is now underway.

In February 2015, the minister further instructed the OEB on carbon emissions. In the achievable potential study, the Board is to consider how the benefits of carbon reduction should be used when screening programs for cost-effectiveness approval, and when setting utility budgets for DSM programs.

### DSM Budgets Increase to Begin Design of New Programs Under the New Framework

2014 was intended to be the last year of natural gas conservation program delivery under the old 2012-2014 framework rules.[13] Since the new regulatory framework for 2015-2020 (aligned with the time period of the new electricity framework) was not finalized until late December 2014, the two gas distributors were late in developing and submitting new DSM plans for approval. The 2015-2020 DSM plans did not receive Board approval until early 2016, following an extensive hearing.[14] Given this delay, the utilities were ordered by the Board to roll over their programs, budgets and targets from 2014 into 2015. The Board allowed them to increase overall spending by up to 15 per cent to begin developing new initiatives to address some key priorities in the new DSM framework (e.g., pursue long-term savings and comprehensive solutions, maximize participation, and minimize lost opportunities).

Conservation budgets for 2015-2020 will increase to approximately $60 million per year for each utility, in order to meet the Ministry of Energy's objective of achieving all cost-effective conservation.[15] Union and Enbridge's 2016 natural gas savings targets for resource acquisition programs are roughly 25 per cent higher than their average results from 2012 to 2014.[16] The distributors proposed programs that respond to some of the trends seen in 2014 program results. For example, funding for the residential retrofit programs will be scaled up to meet a clear market demand. The Ontario government will provide $100 million in additional funding from its Green Investment Fund to enable these programs to reach an additional 37,000 households.[17] To address the problem of attracting hard-to-reach small business customers, direct install[18] programs will provide a turnkey service for some common efficiency technologies, such as commercial kitchen ventilation. This program structure makes participation cheap and simple for customers, and has been used successfully in electricity conservation programs to install efficient lighting. Programs under the new framework will begin to roll out in 2016.

## Expansion of Natural Gas Distribution

The government signaled in the 2013 Long-Term Energy Plan that it would pursue options to expand natural gas infrastructure to service more communities in rural and northern Ontario. In February 2015, the OEB invited parties interested in distributing natural gas to currently unserved areas to apply to provide service. Shortly after, the government announced a $200 million Natural Gas Access Loan and a $30 million Natural Gas Economic Development Grant for the purposes of economic development and energy diversification in these communities.

The Board provided initial guidance on how the utilities should identify and address issues of economic prudence, and recover the costs of the service expansion. The OEB also commissioned cross-jurisdictional research on how others had addressed system expansion (e.g., performing economic tests, prioritizing industrial or institutional consumers). In November 2015, the Board issued guidelines on how to: secure a municipal franchise agreement to serve an area of the province; undertake an environmental assessment and reporting; gain Board permission for leave to construct facilities; and, acquire Board approval of distribution rates to charge customers for regulated service. Union Gas applied for approval to connect up to 30 rural and First Nation communities to the gas grid.

## Endnotes

**1.** Enbridge provides service to much of the Greater Golden Horseshoe, greater Ottawa, and the Niagara region, while Union services much of the rest of the province. Kitchener Utilities, Utilities Kingston, and Natural Resource Gas Limited are other Ontario natural gas providers with small service territories, but do not offer conservation programs.

**2.** Ontario Energy Board, EB-2014-0134 report, *Demand Side Management Framework for Natural Gas Distributors (2015-2020)*, section 1.4, December 22, 2014. www.ontarioenergyboard.ca/oeb/_Documents/EB-2014-0134/Report_Demand_Side_Management_Framework_20141222.pdf

**3.** Typically, results are provided to the Board by utilities in fall of the calendar year following the year in which the results were achieved (e.g., 2014 results were filed with the Board in October to December 2015). The OEB then consults utilities and interested parties, conducts a hearing to scrutinize the results, and approves the incentive payments to utilities, typically 4-6 months after the initial filing. As of May 2016, the OEB had not yet approved the 2014 results discussed here.

**4.** "Lifetime natural gas savings" is as the amount of natural gas that is reasonably expected to be saved due to the energy conservation measures taken in a given year (through utility conservation programs), over the lifetime of these conservation measures. For example, a high-efficiency water heater might deliver 200 $m^3$ of gas savings for a lifetime of 20 years, a lifetime savings of 4000 $m^3$, compared to a less efficient water heater.

**5.** Savings can also be reported as "first year savings" – the reduction in gas consumption in the first year that a conservation measure is in place. Enbridge's 2014 programs delivered 43.5 million cubic metres of first year gas savings, about 0.4 per cent of the total gas consumed by Enbridge customers in 2014. Union's first year savings in 2014 were 133 million cubic metres, about 0.9 per cent of the total gas consumed by Union customers.

**6.** Resource acquisition programs are programs that seek to achieve, direct measurable energy savings. The primary metric used to evaluate the success of these programs is the lifetime amount of natural gas savings the programs deliver.

**7.** Incentives are capped at $10.9 million for Enbridge, and $10.8 million for Union Gas. Utilities must do more than reach the 100 per cent level on their targets in order to be eligible for their maximum incentive, as incentives continue to accumulate up to 150 per cent of the target level.

**8.** The Board's review of 2014 natural gas conservation results is through cases EB-2015-0267 (Enbridge) and EB-2015-0276 (Union).

**9.** Cases EB-2014-0277 (Enbridge), EB-2014-0273 (Union). Board staff concerns were regarding the utility's treatment of free-ridership rates, baselines, and measure lifetimes, for large custom projects. Board staff suggested reducing the claimed gas savings for these projects by 20-25 per cent. The Board did not agree and approved utility incentive payments with no reduction in claimed savings.

**10.** A full description of the natural gas conservation programs offered and 2014 results can be found in Enbridge and Union's 2014 demand side management annual reports, which are filed with the Ontario Energy Board (cases EB-2015-0267, EB-2015-0276):

Enbridge Gas Distribution, report, *2014 Demand Side Management Annual Report*, October 19, 2015. www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/502999/view/Ex%20B-1-1_EGDI_DSM2014%20accounts_20151030.PDF

Union Gas, report, *Final Demand Side Management 2014 Annual Report*, December 4, 2015. http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/509017/view/UNION_APPL_2014_DSM%20Deferrals_20151209.PDF

**11.** The types of targets and the formulae for setting these targets are set out in the utilities' three-year plans. The exact numerical target for a given year may be dependent in part on the previous year's results.

**12.** A proxy for the importance of each target is the maximum incentive that utilities can achieve by reaching the target. This maximum incentive is proportional to the budget for that category of programs, multiplied by the target weight.

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**13.** Plans developed for the 2012-2014 framework by Enbridge and Union describe the suite of conservation programs offered, the allowable budgets for each program, and the utility performance targets and incentives. These plans were developed by the utilities using the policy guidance of the Ontario Energy Board (Ontario Energy Board, EB-2008-0346 report, *Demand Side Management Guidelines for Natural Gas Utilities*, June 30, 2011. www.ontarioenergyboard.ca/oeb/_Documents/Regulatory/DSM_Guidelines_for_Natural_Gas_Utilities.pdf) and were subsequently approved by the Board (cases EB-2011-0327, EB-2012-0337 (Union); EB-2011-0295, EB-2012-0394 (Enbridge)).

**14.** New policy framework: *supra*, note 2.

Board decision approving Union and Enbridge's 2015-2020 Plans: Ontario Energy Board, EB-2015-0029/EB-2015-0049 Decision and Order, *Applications for approval of 2015-2020 demand side management plans*. January 20, 2016. www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/513656/view/Decision_and_Order_Enbridge_Union%20_DSM_20160120.PDF

**15.** Minister of Energy, directive to the Ontario Energy Board, untitled, March 26, 2014. www.ontarioenergyboard.ca/oeb/_Documents/Documents/Directive_to_the_OEB_20140326_CDM.pdf

**16.** The Ontario Energy Board set these targets by increasing the targets originally proposed by Union and Enbridge by 10 per cent, believing that the targets originally proposed were not aggressive enough. Targets for later years (2017-2020) will depend in part on 2016 results.

Ontario Energy Board, EB-2015-0029/EB-2015-0049 Decision and Order, *Applications for approval of 2015-2020 demand side management plans*, p. 66, January 20, 2016. www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/513656/view/Decision_and_Order_Enbridge_Union%20_DSM_20160120.PDF

**17.** Ministry of Energy, news release, *Ontario Investing $100 Million to Create Jobs and Help Homeowners Save Energy*, February 4, 2016. It is not yet clear how this funding will affect utility targets, or whether it can be used to support retrofits for households outside of Enbridge and Union service territories.

**18.** Direct install programs typically involve proactive utility installation of standardized high-efficiency technologies (usually at low or no cost to customers), as opposed to custom solutions.

# B
# Electricity

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# Appendix B. Electricity

## B.1 2014 Electricity Conservation Program Results and Final Results Against 2011-2014 Targets

### Introduction

2014 marked the end of a four-year electricity conservation framework. On the direction of the Minister of Energy, this framework assigned legal responsibility for conservation performance targets to each of Ontario's local distribution companies (LDCs) as a condition of their operating licences, while assigning joint responsibility for conservation program delivery to LDCs and Ontario's Independent Electricity System Operator (IESO).[1] This framework has been replaced by a new and different, six year conservation framework ("Conservation First"), to run from 2015 to 2020.[2]

These conservation programs were expected to reduce Ontario's electricity consumption, save money for customers, improve reliability, avoid new generation, and reduce greenhouse gas emissions. The final program results can be used to assess how successful we were in achieving these objectives.[3]

In total, Ontario LDCs exceeded their overall energy savings target, but only reached 70 per cent of the more important peak demand target. Performance on both targets varied widely between individual LDCs, many of whom failed to satisfy their licence conditions. As of May 2016, no LDC had been sanctioned for these failures.

### Energy and Peak Demand Savings: Final Results Against 2011-2014 LDC Conservation Targets

#### Understanding the Targets

Each Ontario LDC was assigned two energy conservation targets for the 2011-2014 period by the Ontario Energy Board, following direction from the Ministry of Energy:

1. An **energy savings target** for reducing the overall amount of electricity consumption in all hours of the year, measured in gigawatt-hours (GWh). The aggregate 2011-2014 province-wide energy savings target for all LDCs was a cumulative energy savings of 6,000 GWh over the four-year period (about one per cent of total Ontario electricity consumption in these years). Somewhat confusingly, this choice of target meant that the performance of conservation programs in earlier years of the framework was weighted more heavily towards final results – a project completed in 2011 would deliver four years of savings towards the target, whereas a project completed in 2014 would only deliver one year of attributable savings.
2. A **peak demand target** for reducing the amount of electricity consumption during the peak hours of the year when Ontario electricity consumption is highest (usually hot summer afternoons, although in the cold winter of 2014, Ontario experienced its first winter peak in a decade), measured in megawatts (MW). The aggregate 2011-2014 province-wide peak demand target for all LDCs was a reduction in provincial peak demand of 1,330 MW (approximately five per cent of Ontario's system peak in 2014).

The two targets are complementary and both play important roles. Together, energy savings and peak demand reduction are good metrics of Ontario's conservation program efforts, and surrogates for the financial and environmental benefits that energy conservation produces, both for customers and for Ontario as a whole.

**In the medium and longer term, the more important of the two targets is the peak demand target**. Peak demand is the largest single long-term cost driver in Ontario's electricity system, which must be sized to deliver reliable power every moment of the year. Peak demand savings contribute to the reliability of the electricity system, free up capacity for other uses (e.g., space heating with heat pumps, electric vehicles) and help avoid spending on new generation, transmission and distribution. The 2013 Long-Term Energy Plan predicts that the IESO will need to buy 2800 MW of additional resources by 2025 to meet summer peak demand, on top of planned conservation improvements and increased renewable capacity.[4] The most likely option to fill this gap, although not the only one, is gas-fired generation.

Peak demand reductions also reduce operating energy costs and greenhouse gas emissions, because they reduce the use of high-cost, high-emissions gas-fired plants that only run when demand warrants. However, the size of these benefits depend on whether energy use is reduced only for a very small number of hours around peak (which has been the effect of some "demand response" programs[5]) or for a larger number of hours when gas-fired plants are operating. Reducing energy use in that larger block of hours is an important public priority which does not yet receive sufficient attention.

In Ontario's current electrical system, base load is provided by emissions-free nuclear, hydro and renewable energy. The fuel costs, air quality impacts and greenhouse gas emissions of the electricity system are much higher during the upper third of the daily demand curve, when gas-fired generation is used. The gas-fired generation used to meet the highest peak demand are simple cycle gas turbines, with generally higher fuel consumption and higher emissions than the combined cycle plants that are called on first.

The **energy savings target** (reducing total electricity consumption) can reduce operating costs, air quality impacts and greenhouse gas emissions of the electricity system, depending on the time of day that the savings occur. Total savings have air quality and greenhouse gas benefits, to the extent that they displace gas-fired generation, which only supplied nine per cent of Ontario's electricity in 2014, but operated at the margin (and could be displaced by conservation) in roughly 33 per cent of hours.[6] The IESO expects this percentage to increase in coming years, as Ontario's dependence on gas-fired generation increases.[7] It should also be noted that current conditions include the effects of conservation programs from previous years – had conservation not taken place, the amount of gas-fired generation operating in 2014 would have been higher.

Total energy savings will usually reduce customer bills. For the system as a whole, total energy savings reduce operating costs, except if they occur at times that Ontario is already legally obliged to pay for more power than we are using. In 2011-2014, this often occurred between midnight and 5 a.m., largely because:

- All nuclear plants are currently operating;
- Ontario has suffered a large loss of industrial operations since 2008, reducing electricity demand in the overnight hours;
- Some older gas-fired generators and renewable generators have contracts that reward them for electricity production in all hours, even when this energy is not needed.

The current oversupply of contracted electricity is unusual and is expected to be over by the early 2020s. In addition to population and load growth, many of the current contracts for older gas plants (often referred to as "non-utility generators" or NUGs) have "take or pay" requirements that expire between now and 2020; the Ministry of Energy has indicated that they will not be recontracted on the same terms. Of the nuclear plants, Pickering is to be shut down in 2020 or 2024, and Bruce and Darlington units will be shut down progressively for refurbishment, beginning in 2016 for Darlington and 2020 for Bruce. After that time, conservation is expected to displace gas-fired generation in up to 90 per cent of hours.[8] This will increase the cost-effectiveness and environmental advantages of total energy savings.

In the new 2015-2020 conservation framework (discussed later in this appendix), LDCs have been assigned an energy savings target but not a peak demand target. The Long-Term Energy Plan contains a 2025 target for peak demand reduction through demand response programs that is the responsibility of the IESO. This creates a potentially troublesome gap, since LDCs receive little incentive to focus their energy savings on times when conservation would displace natural gas-fired generation or reduce the need for new generation.[9]

Most conservation programs will deliver both energy and peak demand savings, but some programs may contribute more to one target than the other, as shown in Table B.1.

**Table B.1: Matching Conservation Program Measures to Conservation Targets**

| Conservation Program Measure (Example) | Pattern of Energy Savings | Contributes (Primarily) to Which Conservation Target? |
|---|---|---|
| High-efficiency refrigerator | Relatively constant over all hours of the year. | Energy savings |
| High-efficiency commercial air conditioning | Savings over several months of the year, with greater savings during hotter weather (usually correlating with system peak demand and higher greenhouse gas emissions). | Energy savings and peak demand |
| Demand response program* | Concentrated in very few hours at time of system peak demand. Energy savings may be zero if the program is not activated. | Peak demand |

Note: * Demand response programs enable program operators to temporarily reduce the electricity consumption of program participants, at times when the electricity system is under stress.

### Targets vs. Results

We compare the final 2011-2014 conservation program results with the two targets, both on a province-wide basis, and for individual LDCs. Savings from all conservation programs offered by an LDC to its customers are counted towards the LDC's targets, as are savings from time-of-use pricing. Results of specific conservation programs are discussed later in the article.

Final results against the 2011-2014 targets at the provincial level are shown in Figure B.1 and Figure B.2.[10]

In aggregate, Ontario LDCs achieved their overall energy savings target, but only reached 70 per cent of their peak demand target.

Figure B.1 shows how energy savings from each year of conservation program activity accumulate and make a meaningful dent in Ontario's overall electricity consumption.

Annual electricity consumption in 2014 was reduced by about 2800 GWh (about two per cent of Ontario's total electricity use in this year), due to the combined effects of conservation programs in all four years. In other words, each year of new conservation projects reduced Ontario's 2014 electricity use by about 0.5 per cent. This cannot continue forever – eventually a conservation measure reaches the end of its useful life and no longer delivers energy savings. Because most conservation projects have a useful lifetime of 10 to 20 years, a continuation of conservation programs at the same rate of activity as the 2011-2014 period would eventually reduce Ontario's electricity consumption by 5 to 10 per cent (0.5 per cent new savings each year).

### Individual LDC Results

The results of individual LDCs against their 2014 targets are shown in Figure B.3. Full numerical results for each LDC are presented in Table B.6.

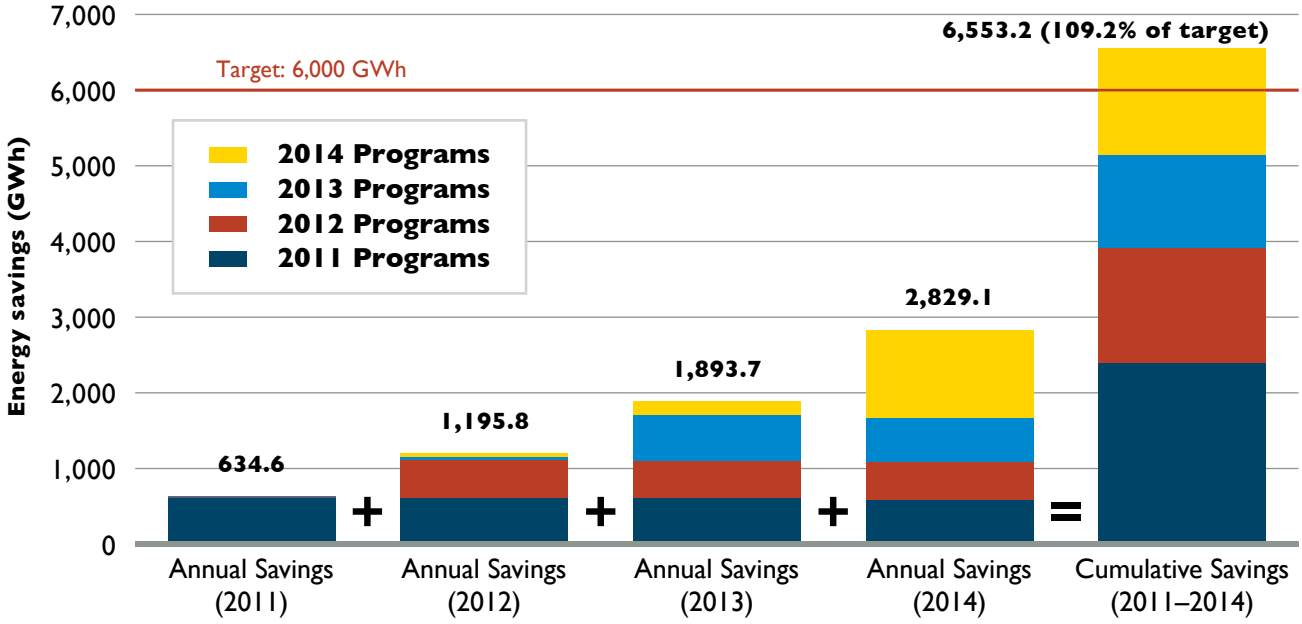


**Figure B.1: Province-wide conservation results against 2011-2014 energy savings target**

Notes: Results for 2012, 2013 and 2014 conservation programs include adjustments to previous years' verified results, due to late reporting of completed projects. These adjustments show up as small amounts of annual savings in earlier years.

Source: Independent Electricity System Operator

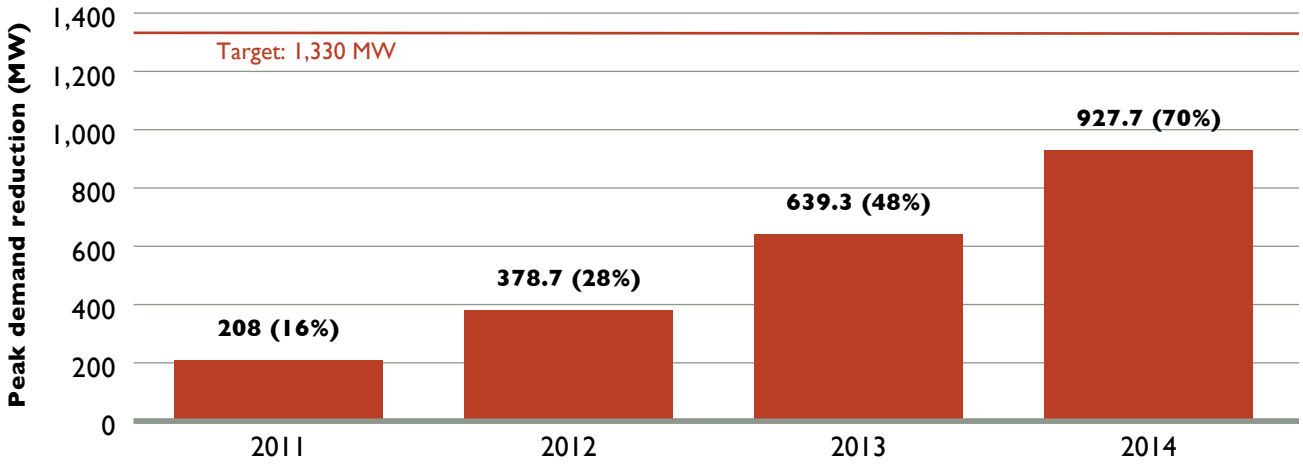


**Figure B.2: Province-wide conservation results against 2014 peak demand target, achieved by year-end**

Notes: Values for peak demand reduction show savings achieved by reporting year-end, that persisted until 2014 (assuming persistence of demand response savings through 2014). This is a different method of reporting year-to-year progress than found in the IESO and OEB reports on 2011-2014 conservation results, although the final 2014 peak demand reduction (and the final result against the 2014 target) is the same.

Source: Independent Electricity System Operator

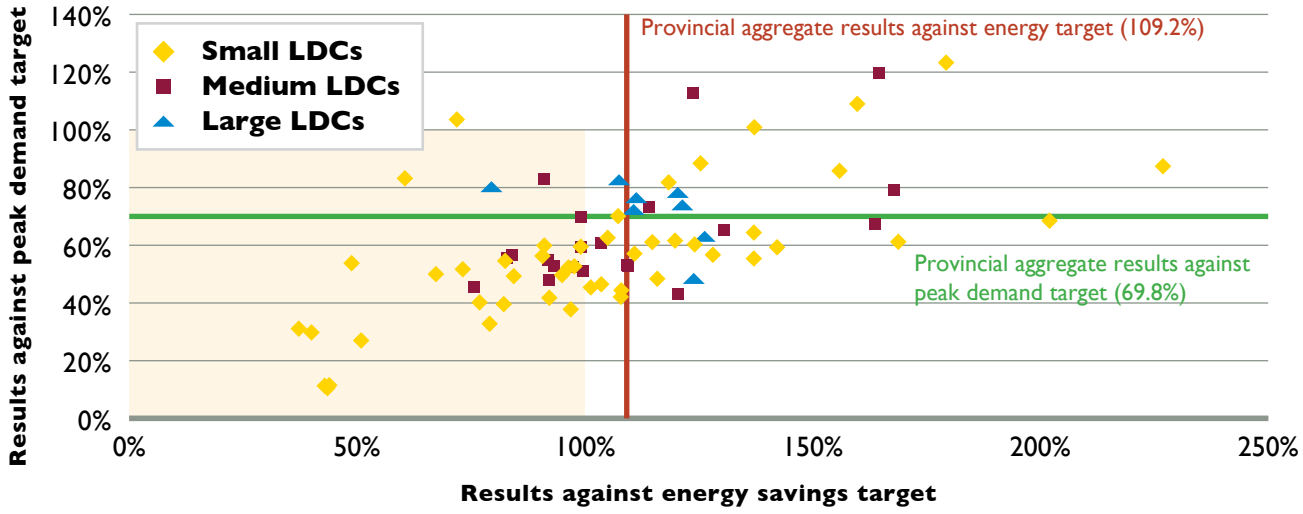


**Figure B.3: Final LDC results against 2014 conservation targets**

Note: "Small LDCs" have an energy target accounting for less than 0.5 per cent of the aggregate 2014 LDC energy target; "medium LDCs" have an energy target accounting for between 0.5 per cent and 2 per cent of the aggregate target, and "large LDCs" have an energy target accounting for more than 2 per cent of the aggregate target.

Sources: Independent Electricity System Operator, PowerStream

There was a wide variation in performance across LDCs. The LDC at the 75th percentile with regards to the energy savings target achieved roughly double the relative energy savings of the LDC at the 25th percentile (140 per cent of target versus 70 per cent). Variations in performance across LDCs reflect both the degree of effort which the utility put towards promoting conservation programs to its customers, and the fit between an LDC's customer base and the conservation programs offered. In particular, an LDC's results against the peak demand target will be affected based on whether the LDC has suitable large commercial and industrial customers who were able to participate in the Demand Response 3 program.

Forty-three of 76 LDCs met their energy target, but only five LDCs met both their energy and peak demand targets. Twelve LDCs met at least 80 per cent of their energy and peak demand targets, as shown in Table B.2. These twelve LDCs are eligible for performance incentives from the OEB.

**Table B.2: Electric Utilities Reaching 80 per cent of Both Conservation Targets**

| Utility | Per Cent of Peak Demand Target Achieved | Per Cent of Energy Savings Target Achieved | Eligible Incentive ($) |
|---|---|---|---|
| Brantford Power | 79.7 | 168.6 | 293,520 |
| Centre Wellington Hydro Ltd. | 110.9 | 137.2 | 34,557* |
| Chapleau Public Utilities Corporation | 123.3 | 179.3 | 8,921* |
| Festival Hydro Inc. | 85.8 | 155.9 | 179,766 |
| Fort Frances Power Corporation | 81.8 | 118.4 | 6,265* |
| Guelph Hydro Electric Systems Inc. | 119.8 | 164.6 | 611,350 |
| Horizon Utilities Corporation | 80.8 | 107.5 | 270,624 |
| Hydro 2000 Inc. | 109.0 | 159.8 | 6,260* |
| Kingston Hydro Corporation | 112.9 | 123.7 | 118,977 |
| Midland Power Utility Corporation | 88.4 | 125.4 | 28,319 |
| Orillia Power Distribution Corporation | 87.4 | 226.9 | 93,386 |
| Peterborough Distribution Incorporated | 83.0 | 91.0 | 16,243 |

Note: Performance incentives based on utility applications to the Ontario Energy Board, with the exception of those marked with an asterisk, which were estimated by the ECO using the Ontario Energy Board's performance incentive calculator.

Because the conservation targets were a license condition, the Ontario Energy Board (OEB) has the option of taking compliance action against LDCs that did not meet one or both of their targets, such as imposing financial penalties or suspending an LDC's electricity distribution license. To date, there have been no consequences for LDCs for failing to meet their conservation targets.

The OEB has stated that it will not take any action against LDCs for missing their peak demand target.[11] The performance of several key peak demand reduction initiatives (demand response programs and time-of-use pricing) was affected by the decisions of the Ministry and the OEB, making it difficult to hold LDCs fully accountable for missing their peak demand targets.[12] The Board is reviewing the annual reports for the thirteen LDCs that did not reach at least 80 per cent of their energy savings target, to assess whether these LDCs made best efforts to reach their target, and may take some compliance action with regards to these LDCs.[13] With the exception of Oshawa PUC Networks, these thirteen LDCs are all small, each serving 12,000 or fewer customers.

For the 2015-2020 Framework, achievement of conservation targets will no longer be an LDC condition of license. An LDC's license requirement will be simply to make conservation programs available to each customer segment, "as far as is appropriate and reasonable".[14] The new framework will rely primarily on financial incentives for high performance to motivate LDCs, although it does provide some tools for the IESO to address gross underperformance (for LDCs on pace to achieve less than 50 per cent of their target).

### Overall Electricity System Impact

What was the overall impact of the four years of conservation programs on Ontario's electricity system, and the consequences of the deviation between conservation targets and final results?

As noted earlier, Ontario's annual electricity consumption in 2014 was about two per cent lower than it would have otherwise been, due to the combined results of all of the projects completed through LDC conservation programs over the 2011-2014 period. The greenhouse gas impact of this reduction is difficult to calculate, because the IESO does not publish hourly data as to which type of generation is "at the margin" and was displaced by conservation. However, a rough estimate is that 2011-2014 LDC conservation efforts displaced natural gas consumption about one-third of the time in 2014. This would have reduced the electricity sector's 2014 greenhouse gas emissions by roughly seven per cent, or 0.4 megatonnes of $CO_2$ equivalent.[15]

What about the peak demand target, where Ontario fell roughly 400 MW short of the target?

Missing the peak demand target had no impact on reliability in 2011 to 2014, because Ontario had ample electrical capacity to meet peak demand in the short term. In fact, the Ministry of Energy and the IESO took several actions in the 2011-2014 period that reduced spending on a primary peak demand reduction initiative, the Demand Response 3 program.[16]

The Ministry of Energy's directions to the IESO in recent years have not launched major new generation procurements, and in fact, have slowed down previously planned procurements, in particular, the re-contracting of non-utility generators. The IESO has also concluded that the strong supply position will continue in the medium term, and that existing and planned Ontario resources will be sufficient to meet Ontario demand over the period from 2015 to 2019.[17] If so, the failure to reach the peak demand target did not harm the reliability of Ontario's electricity system from 2011 to about 2019.

Will this hold true over the longer term? Ontario's supply position will be much weaker by the early 2020s, when Ontario's Pickering nuclear station is closed and refurbishments of the Bruce and Darlington nuclear stations are underway. The IESO currently has 400 MW less conservation on hand than it expected to help make up for the loss of these nuclear units. Whether this matters will depend on how successful the IESO is in its demand response initiatives in the next five years. More will likely be revealed in Ontario's next Long-Term Energy Plan update, scheduled to be initiated in 2016. If the Plan calls for any new gas-fired generation to meet peak demand, this would be an important sign of failure of the government's approach to peak demand reduction.

Only about 100 MW of the 400 MW shortfall between actual peak demand reduction and the 2014 peak demand target was due to lower than projected savings from the demand response programs that the Minister deferred.[18] The remaining 300 MW had been expected to come from other energy conservation programs and time-of-use pricing. The fact that Ontario met its energy savings target and missed its peak demand target means that less energy was saved from these programs in on-peak periods than expected, and more energy was saved in off-peak periods, which produce much fewer benefits. Therefore, Ontario's use of fossil-fueled generation and its greenhouse gas emissions between 2011 and 2014 were higher than they would have been had the peak demand target been achieved.

## Specific Program Results

Conservation programs are offered to two different categories of electricity customers:

- **Programs for Distribution-Connected Customers** are offered by Ontario LDCs to customers connected to the electricity distribution system (the low-voltage part of the grid that provides final service to most customers) within their service territories. These programs (with one exception) are "province-wide programs" where the IESO and the LDC each play a role in program design and administration (the exact role that each party plays varies depending on the program). Programs are offered to different customer segments – consumers, businesses, and industry, in addition to specialized programs for low-income customers and Aboriginal peoples. An LDC may choose not to offer some of the province-wide programs, if it does not believe there will be sufficient interest from the LDC's customers. For a full description of all of the province-wide conservation programs and initiatives offered in 2011-2014, see the conservation annual reports filed by individual LDCs.[19] LDCs were also eligible to apply to the OEB to develop custom conservation programs for their customers, however, only one such program was implemented, by PowerStream. This program is discussed further below.
- **Programs for Transmission-Connected Customers** are offered to large customers (primarily industrial facilities) connected directly to the electricity transmission system (the high-voltage part of the grid that delivers electricity from large centralized generating stations), instead of to an LDC's distribution network. These programs are delivered by the IESO with no involvement from LDCs.

Results of specific programs for both transmission- and distribution-connected customers are discussed below. Only the results from programs for distribution-connected customers are counted towards the LDC targets discussed in the previous section.[20]

## 2014 Results: Conservation Programs for Distribution-Connected Customers

Looking at the results of programs for distribution-connected customers, 2014 was the strongest year

of conservation performance over the four-year period. This is shown in Figure B.4.

As 2014 was the final year of the old framework, there were only incremental changes to the suite of province-wide conservation programs for distribution-connected customers.

There was a large increase in 2014 in energy savings from LED lighting (incented through coupons and in-store retailer events), which accounted for 55 per cent of the energy savings in the residential sector. LEDs may expand the reach of lighting conservation to more households, by appealing to customers who did not find fluorescent bulbs to be a suitable replacement for traditional incandescent lighting.

Participation in the *peaksaver* program continued to rise in 2014. The energy use of nearly 300,000 devices (primarily air conditioners) in Ontario can now be temporarily controlled remotely through this program, to reduce electricity use at times of high system demand. This program is intended to be activated only when Ontario's electricity system is under serious stress, to avoid inconveniencing participating customers. This control was not activated at all in 2014, due to the province's strong supply situation, and a cooler than average summer with reduced electricity demand.

For the first time, demand savings from time-of-use (TOU) pricing were quantified and counted towards LDC conservation targets, due to the LDC role in installing smart meters and raising awareness of TOU pricing. Unfortunately, the measured results are somewhat disappointing. The IESO's evaluation found only a 0.7 per cent reduction in peak demand among residential customers, which equates to a province-wide demand reduction of 55 MW. At the time the 2011-2014 targets were set, the projected demand savings anticipated from time-of-use pricing were almost six times greater (308 MW). As the ECO has previously noted, peak demand reduction from TOU pricing would likely be greater if there was more of a difference between peak and off-peak electricity prices.[21] However, individual LDCs cannot adjust TOU prices, as they are set by the OEB.

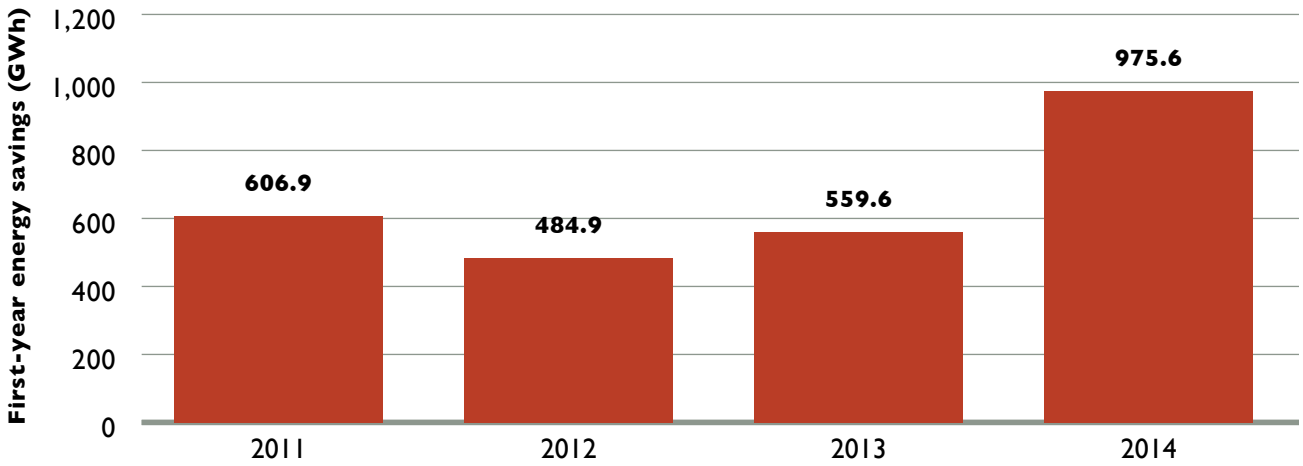


**Figure B.4: First-year energy savings from new conservation program activity: programs for distribution-connected customers**

Notes: Excludes results from previous years that were reported late.

Source: Independent Electricity System Operator

Business conservation programs continued to deliver the lion's share of conservation results. LED lighting projects were popular in this sector as well (through the Retrofit program and the Direct Install Lighting program). The Retrofit program was again the primary program utilized by businesses, although 2014 also saw an increase in energy savings from new construction projects. The Energy Audit program appeared to be successful in serving as a first step to encourage companies to undertake conservation projects. Toronto Hydro estimated that 60 per cent of audits led eventually to a project application.

Ten large industrial conservation projects were completed through the Process & Systems Upgrade initiative in 2014, doubling 2013 participation levels. However, four of these ten projects were behind-the-meter generation. While the impact of behind-the-meter generation is similar to conservation from the viewpoint of a power system planner (because it reduces the amount of electricity that needs to be supplied from the provincial grid), it does not always deliver the same environmental and climate benefits.

Peak demand savings from business and industrial customers were impacted by a directive in March 2014 from the Minister of Energy to the IESO, which essentially prevented new customers from enrolling in the Demand Response 3 (DR3) program.[22] For example, PowerStream reported that it had 27 customers who had agreed to participate in the DR 3 program, but had not yet finalized their program enrolment prior to the direction, costing PowerStream about 5 MW of savings. As with *peaksaver*, the DR3 program did not need to be activated in 2014 due to the province's strong supply situation and low electricity demand, as the cost of activating the program (in the form of additional payments to program participants) would have outweighed the system benefit of doing so.

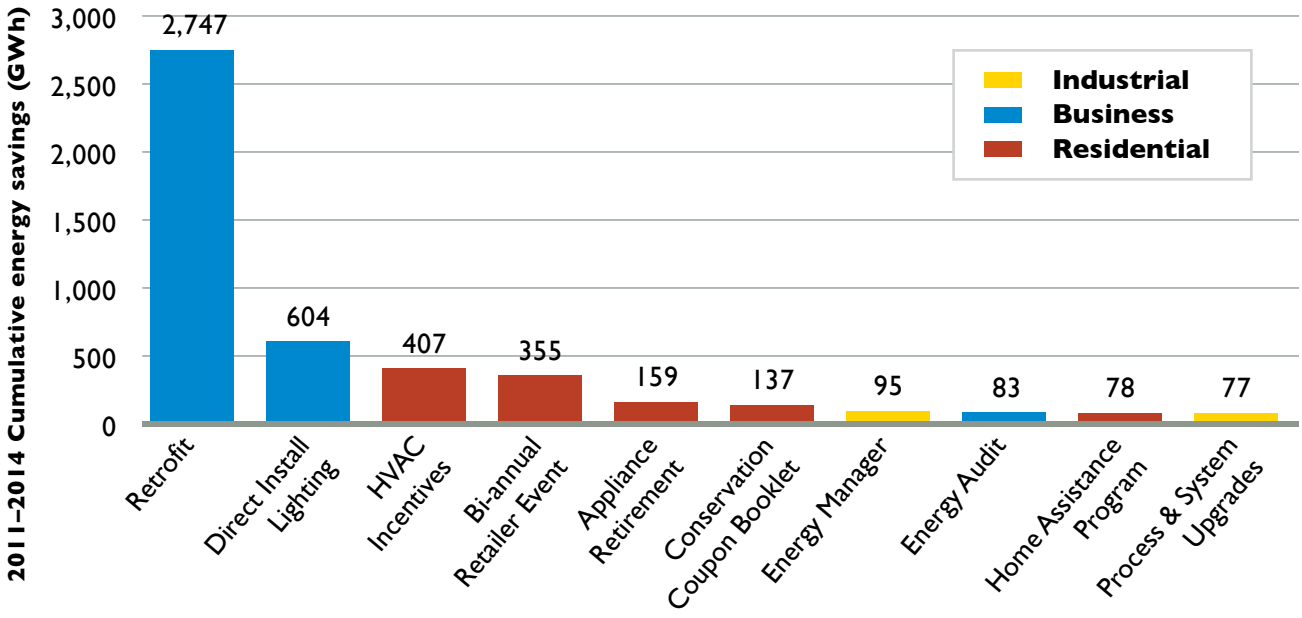


**Figure B.5: 2011-2014 cumulative energy savings from leading conservation initiatives**

Notes: Excludes results from pre-2011 programs completed in 2011-2014. Results for Retrofit initiative include commercial and industrial customers.

Source: Independent Electricity System Operator

The cumulative energy savings of the most successful conservation initiatives for distribution-connected customers are shown in Figure B.5. The importance of the Retrofit initiative for business customers is apparent. Final results for all initiatives are shown in Table B.3, including 2014 activity and incremental energy savings, cumulative energy savings over four years, and peak demand reduction.

**Table B.3: 2014 Conservation Results by Program for Distribution-Connected Customers**

| Initiative | 2014 Participation (New Projects) | 2014 Incremental Energy Savings (2014 savings from new activity in 2014) (GWh) | 2011-2014 Cumulative Energy Savings (GWh) | 2014 Peak Demand Reduction (MW) (from program activity in all four years) |
|---|---|---|---|---|
| **Consumer Program** | | | | |
| Appliance Retirement | 22,563 appliances | 9.5 | 159.1 | 8.2 |
| Appliance Exchange | 5,685 appliances | 2.1 | 10.6 | 3.0 |
| HVAC Incentives | 113,002 installations | 42.9 | 447.0 | 93.8 |
| Conservation Instant Coupon Booklet | 1,208,108 products | 32.8 | 137.3 | 4.5 |
| Bi-Annual Retailer Event | 4,824,751 products | 122.9 | 355.2 | 12.4 |
| Retailer Co-op | 0 | 0 | 0.01 | 0 |
| Residential Demand Response (*peaksaver*PLUS) | 241,381 devices | 0.01 | 0.8 | 117.5 |
| Residential Demand Response In-Home Display | 188,577 devices | 0 | 0 | 0 |
| Residential New Construction | 2,367 homes | 2.3 | 2.7 | 0.4 |
| **Consumer Program Total** | | **212.5** | **1112.6** | **239.7** |

*(continued)*

**Table B.3: Continued**

| Initiative | 2014 Participation (New Projects) | 2014 Incremental Energy Savings (2014 savings from new activity in 2014) (GWh) | 2011-2014 Cumulative Energy Savings (GWh) | 2014 Peak Demand Reduction (MW) (from program activity in all four years) |
|---|---|---|---|---|
| **Business Program** | | | | |
| Retrofit | 10,925 projects | 462.9 | 2631.4 | 213.5 |
| Direct Install Lighting | 23,784 projects | 84.5 | 604.2 | 73.3 |
| Building Commissioning | 5 buildings | 1.5 | 1.5 | 1.0 |
| New Construction | 226 projects | 20.4 | 37.4 | 8.9 |
| Energy Audit | 473 audits | 30.9 | 82.9 | 10.6 |
| Small Commercial Demand Response (*peaksaver*PLUS) | 3,652 devices | 0 | 0.002 | 2.1 |
| Small Commercial Demand Response IHD | 820 devices | 0 | 0 | 0 |
| Demand Response 3 | 180 facilities | 0 | 1.3 | 23.4 |
| **Business Program Total** | | **600.2** | **3358.7** | **332.8** |
| **Industrial Program** | | | | |
| Process & System Upgrades | 10 projects | 72.1 | 77.3 | 10.0 |
| Monitoring & Targeting | 5 projects | 0.5 | 0.5 | 0.1 |
| Energy Manager | 379 projects | 40.4 | 95.3 | 8.4 |

*(continued)*

**Table B.3: Continued**

| Initiative | 2014 Participation (New Projects) | 2014 Incremental Energy Savings (2014 savings from new activity in 2014) (GWh) | 2011-2014 Cumulative Energy Savings (GWh) | 2014 Peak Demand Reduction (MW) (from program activity in all four years) |
|---|---|---|---|---|
| Retrofit | 0 projects | 0 | 115.5 | 4.6 |
| Demand Response 3 | 336 facilities | 0 | 9.2 | 166.1 |
| **Industrial Program Total** | | **113.0** | **297.7** | **189.2** |
| **Home Assistance Program** | | | | |
| **Home Assistance Program** | **25,424 homes** | **19.6** | **77.5** | **5.4** |
| **Aboriginal Program** | | | | |
| **Aboriginal Program** | **1,125 homes** | **3.1** | **6.3** | **0.8** |
| **Pre 2011 Programs Completed in 2011 2014** | | | | |
| Electricity Retrofit Incentive Program | 0 projects | 0 | 484.6 | 21.7 |
| High Performance New Construction | 3 projects | 0.7 | 148.2 | 9.3 |
| Toronto Comprehensive | 5 projects | 2.5 | 350.3 | 16.1 |
| Multifamily Energy Efficiency Rebates | 0 projects | 0 | 30.4 | 2.0 |
| LDC Custom Programs | 0 projects | 0 | 5.5 | 0.4 |
| **Pre-2011 Programs Total** | | **3.2** | **1018.9** | **49.4** |

*(continued)*

**Table B.3: Continued**

| Initiative | 2014 Participation (New Projects) | 2014 Incremental Energy Savings (2014 savings from new activity in 2014) (GWh) | 2011-2014 Cumulative Energy Savings (GWh) | 2014 Peak Demand Reduction (MW) (from program activity in all four years) |
|---|---|---|---|---|
| **Other Programs** | | | | |
| Program-Enabled Savings | 43 projects | 19.0 | 30.8 | 11.5 |
| Time-of-Use Savings | | 0 | 0 | 54.8 |
| LDC Pilots | 1,174 projects | 5.1 | 5.1 | 1.2 |
| **Other Programs Total** | | **24.1** | **35.8** | **67.4** |
| **Adjustments to Previous Years' Results** | | **195.2** | **645.4** | **43.0** |
| **Overall Totals** | | **1,170.8** | **6553.0** | **927.7** |

Source: Independent Electricity System Operator

## Custom Local Conservation Programs and Pilots

Only one custom conservation program, PowerStream's Business Refrigeration Incentives (BRI) program, was developed by an LDC and approved by the OEB, under the 2011-2014 framework (in addition, Greater Sudbury Hydro operated custom conservation programs throughout the 2011-2014 period that had been approved prior to 2011). PowerStream's BRI program launched in late 2013. It was evaluated at the end of 2014 and the evaluation tells a positive story of a program successfully delivering conservation to a customer segment that was missed by the larger province-wide programs.[23]

The BRI offers energy audits and free upgrades of energy-efficient commercial refrigeration technologies to targeted customers (primarily grocery stores, restaurants, and other food service establishments). More than one thousand businesses participated in the program, and the evaluation found the program to be cost-effective. The evaluation also provided strong evidence that most of these conservation projects would not have taken place without

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a dedicated program in place. Only 5 per cent of program participants had previously intended to upgrade their refrigeration equipment immediately, and 72 per cent had no upgrade plans at all. In addition, some of the energy-efficient technologies (e.g., motor upgrades) were uncommon in the marketplace, and it would have been difficult for customers to identify and purchase these upgrades on their own. The BRI program was instrumental in overcoming barriers to conservation in these businesses. PowerStream will continue the BRI program under the new 2015-2020 framework, as will a second LDC (Collus PowerStream).

Several LDCs also delivered pilot programs in 2014. Pilot programs are smaller-scale conservation initiatives delivered by an LDC and funded through the IESO's Conservation Fund, to test the viability of a program concept, and assess whether it can be scaled up into a full program that may also be applicable for other LDCs. For the first time, the IESO attributed a small amount of energy and demand savings to pilot projects in 2014. Only those pilots that were in market in 2014 are listed below, however, many additional pilots were approved late in 2014 or in 2015, and some will hopefully evolve into full programs in the coming years. Particularly exciting is Hydro One's "Heat Pump Advantage" pilot, which will promote and test cold-climate air source heat pumps, an improved technology that has the potential to cut heating energy use in half in electrically-heated homes, without the high installation cost of geothermal heat pumps.

**Table B.4: LDC Conservation Pilots in Market in 2014**

| Local Distribution Company | 2014 Conservation Fund Initiatives |
|---|---|
| Cambridge & North Dumfries Hydro | "Rush Hour Rewards" – Rebate for smart thermostat (Nest learning thermostat) in return for participation in residential demand response program |
| EnWin | Integration of water conservation measures into the Home Assistance Program<br>Retrocommissioning in commercial buildings |
| Horizon Utilities | Energy mapping |
| Horizon Utilities, Hydro One, Milton Hydro | Social benchmarking program for residential customers that compares household energy usage to peer groups and provides energy-saving advice |
| Hydro One | Thermal storage |

*(continued)*

**Table B.4: Continued**

| Local Distribution Company | 2014 Conservation Fund Initiatives |
|---|---|
| Hydro Ottawa | Rebate for smart wi-fi thermostat (Honeywell) in return for participation in residential demand response program<br>Conservation voltage reduction |
| Kitchener-Wilmot Hydro | Direct install of demand control ventilation in commercial kitchens |
| Niagara Peninsula Energy | Time-shifting of charging of non-road electric vehicles |
| Niagara-on-the-Lake Hydro | Energy efficiency in wineries and other facilities |
| Toronto Hydro | "Grid Saver" – Demand response by small commercial and institutional customers using roof-top units for space heating and cooling.<br>"Suite Saver" – Demand response in multi-unit residential buildings, through control of the central building chiller. |
| Toronto Hydro/PowerStream | Strategic energy management for large commercial and industrial consumers |

Source: Independent Electricity System Operator, Ontario Energy Board

## 2014 Results: Conservation Programs for Transmission-Connected Customers

Results for programs for transmission-connected customers in 2014 are shown in Table B.5. These programs delivered very little in the way of energy savings (only one per cent of the incremental energy savings in 2014 that the programs for distribution-connected customers delivered). The freeze on new DR3 contracts as of March 2014 also reduced peak demand savings from this group of customers. The Industrial Accelerator program for large industrial customers continued to disappoint. The Ministry of Energy set a target for 300 MW of peak demand savings from Industrial Accelerator, but demand savings at the end of 2015 (from all years of this program's operation) stood at only eight MW. Onerous contract requirements and delays in processing applications were identified as key barriers. Many additional studies for industrial projects have been undertaken and will hopefully lead to energy savings in future years as projects are completed.

## 2011-2014 Conservation Program Spending

Conservation program spending by the IESO and individual LDCs totalled $421.3 million in 2014, and $1,277.9 million over the 2011-2014 period. Spending on conservation programs is recovered from all electricity ratepayers through a small portion (about four per cent in 2014) of

the Global Adjustment charge on electricity bills. Conservation spending accounts for about 2 per cent of the overall electricity bill.[24]

Spending by program is shown in Figure B.6. The bulk of the spending went to the Business and Consumer programs.

**Table B.5: 2014 Conservation Results by Program for Transmission-Connected Customers**

| Initiative | 2014 Participation | 2014 Incremental Energy Savings (from new activity in 2014) (GWh) | 2014 Peak Demand Savings (from new activity in 2014) (MW) |
|---|---|---|---|
| Industrial Accelerator | 8 projects | 13.5 | 1.5 |
| Demand Response 2 | 2 facilities | 0 | 64.6 |
| Demand Response 3 | 56 facilities | 0 | 126.6 |
| Residential Demand Response (*peaksaver*)* | 67,347 devices | 0.01 | 33.1 |
| **All Programs for Transmission-Connected Customers** | | **13.5** | **225.8** |

Notes: * Savings from customers who enrolled in the *peaksaver* initiative prior to 2011 that have not converted to the *peaksaver*PLUS initiative offered by LDCs are counted in this category. This initiative was for distribution-connected customers, but is placed here because it has no LDC involvement and does not contribute to LDC conservation targets.

Source: Independent Electricity System Operator

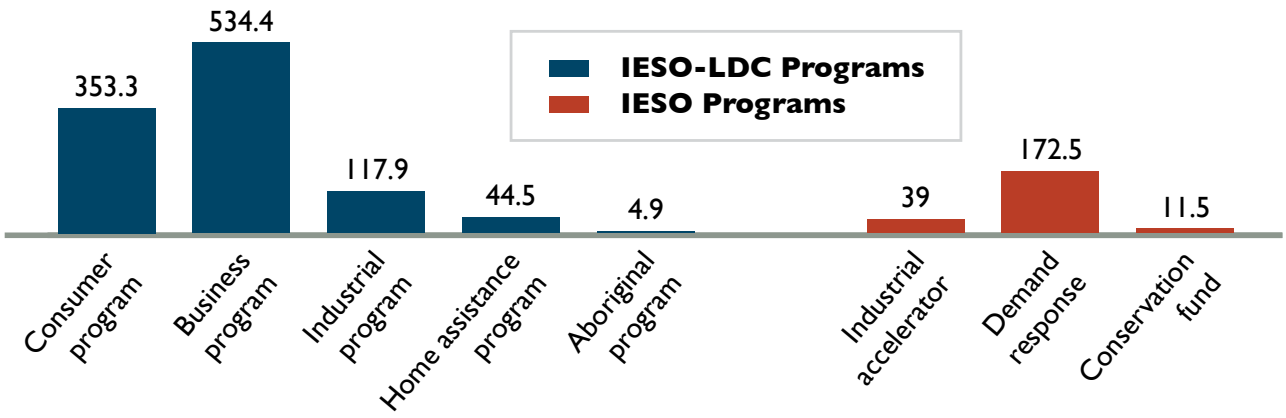


**Figure B.6: Conservation spending by program ($M), 2011-2014**

Source: Independent Electricity System Operator

Spending by type of expense is shown in Figure B.7. Approximately three-quarters of conservation spending flowed to participants in conservation programs as benefits or financial incentives, while the other one-quarter was spent on program administration by the IESO and LDCs. The IESO has responsibility for functions such as program evaluation, tracking of results, and province-wide marketing, while LDCs are responsible for local marketing. Either the IESO or the LDCs may be responsible for technical assistance, customer support, and other program delivery functions (this varies depending on the specific conservation program), and both groups have a role in program design.

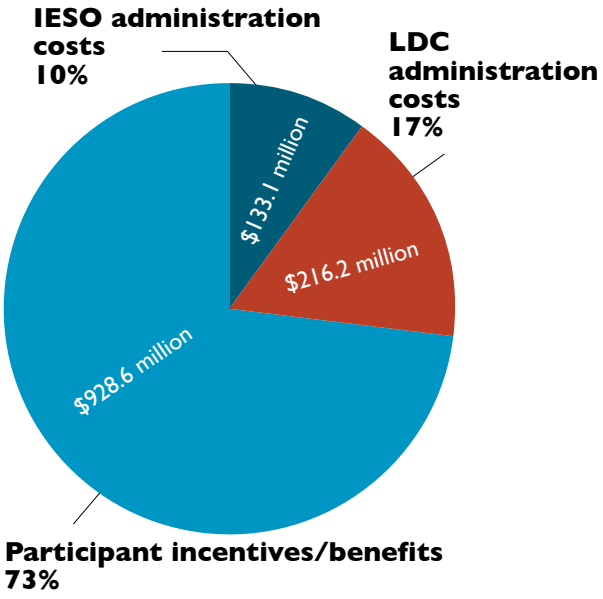


**Figure B.7: Conservation spending by expense type ($M), 2011-2014**

Source: Independent Electricity System Operator

## Additional Expenses

The costs shown above for conservation programs do not include two additional categories of expenses:

- **Smart meters**: Although time-of-use pricing is considered a conservation initiative, the cost of smart meters (which are needed for time-of-use pricing, but serve additional functions) are not included here and are included in distribution rates, not in the Global Adjustment.
- **Performance Incentives for LDCs**: Based on their conservation spending and results, some LDCs were eligible for one or two financial incentives for their role in conservation program delivery. These two incentives are not included in the spending figures in the previous section.
  - *A performance incentive for achieving at least 80 per cent of both the energy and peak demand targets.* Twelve utilities reached this level and are eligible for performance incentives (if approved by the OEB), as shown in Table B.2. The sum of performance incentives for the twelve utilities (assuming Board approval) is only approximately $1.7 million.
  - *A cost-efficiency incentive for underspending the allocated conservation administration budget.* Utilities spending between 80 per cent and 100 per cent of their budget were eligible to keep a portion of the unspent funds advanced to them by the IESO. This incentive is not tied to performance, so long as the LDC made commercially reasonable efforts to reach its conservation targets. In aggregate, utilities underspent their four-year conservation administration budget by $41.2 million, and were eligible to retain

$26.7 million of these funds. Most, but not all, utilities were eligible for at least a small cost-efficiency incentive. The ECO had previously expressed concern that this incentive might work at cross purposes to the performance incentive, and cause some LDCs to limit their efforts. There is no evidence to suggest that this occurred, but the fact that the final cost-efficiency incentives paid out to utilities were much higher than performance incentives does suggest that these incentives were not optimally designed to encourage utilities to seek the highest amount of possible savings. In the 2015-2020 framework, the incentive structure has been changed – utilities will only be eligible for a cost-efficiency incentive if they meet or exceed their conservation target.

## Program Cost-Effectiveness

The cost effectiveness of province-wide conservation programs from 2011 to 2014 is shown in Table B.6. Two cost-effectiveness tests are used. Both tests compare the lifetime program benefits (primarily from cost savings due to reduced electricity consumption) and costs, but from different perspectives. The Total Resource Cost test considers the impact on all parties, including electricity ratepayers and conservation program participants. The Program Administrator Cost test considers the costs and benefits from the perspective of the program administrator (the IESO).[25] For both tests, a ratio of greater than one indicates that the conservation program benefits exceed the costs.

The overall portfolio of conservation programs has been cost-effective using either test, which is a requirement of the conservation framework. Most conservation programs (where a "program" is defined as all of the initiatives available to a given sector) have also been cost-effective, with the exception of the Industrial and Low Income programs. However, the cost-effectiveness of individual initiatives within programs (not shown) varies widely. Many individual initiatives were not cost-effective (from a Total Resource Cost perspective); however, these initiatives accounted for only about one-quarter of overall conservation spending from 2011 to 2014.[26] In some cases, the initiatives that are not cost-effective serve as "loss leaders" – e.g., the Energy Audit initiative funds building energy audits and may not be cost-effective on their own, but hopefully lead participants to undertake cost-effective conservation projects through the Retrofit initiative. In other cases, an initiative can fail cost-effectiveness testing if it has incurred upfront administrative costs, but has not (at least yet) delivered the energy savings that were expected (e.g., Industrial Accelerator).

While overall cost-effectiveness of the conservation portfolio did not change greatly in 2014, several initiatives showed improved cost-effectiveness. Both the Direct Install Lighting initiative and the Bi-Annual Retailer Event benefited due to the increased interest in LED lighting, and the industrial conservation program for smaller distribution-connected customers (Process & Systems) showed improved results, as more projects were completed.

These cost-benefit analyses do not include a value for the non-energy benefits of conservation (e.g., environmental benefits due to reduced greenhouse gas emissions). Cost-effectiveness analysis of conservation programs in the new 2015-2020 framework will include a value for non-energy benefits, per direction from the Minister of Energy[27], which will improve the benefit:cost ratios.

The "levelized" delivery cost of conservation is also shown in Table B.6. For energy efficiency programs, this is the cost (from the program administrator's perspective) of saving a unit of electricity through conservation programs, which allows comparison with the cost of generating the same unit of power. For demand response programs, the levelized cost is the cost of reducing a unit of peak demand, which can be compared with the cost of building a new generating plant to meet peak demand. The levelized cost of energy efficiency programs from 2011 to 2014 was 3.7 cents per kilowatt-hour, which is much lower than any new form of electricity generation.

### Transition to the Conservation First 2015-2020 Framework

A new six-year conservation framework spans the years 2015 to 2020. 2015 was a year of transition between the two frameworks. The change was

**Table B.6: Cost-Effectiveness of 2011-2014 Conservation Programs**

| Program | Total Resource Cost Test Benefit: Cost Ratio | Program Administrator Cost Test Benefit: Cost Ratio | Levelized Delivery Cost | |
|---|---|---|---|---|
| | | | Energy Efficiency (¢/kWh) | Demand Response ($/MW-month) |
| Consumer | 1.3 | 1.6 | 4.8 | 13,857 (*peaksaver* PLUS) |
| Business | 1.3 | 2.8 | 3.1 | Not applicable |
| Industrial | 0.9 | 1.3 | 4.0 | 11,162 (Demand Response 3) |
| Low Income | 0.6 | 0.6 | 11.4 | Not applicable |
| Aboriginal | 1.1 | 1.1 | 7.7 | Not applicable |
| **Total - All Distribution-Connected Programs** | **1.2** | **2.2** | **3.6** | **13,334** |
| IESO-Only Demand Response | 1.6 | 1.1 | Not applicable | 8,418 |
| IESO-Only Industrial Accelerator | 0.6 | 0.5 | 11.2 | Not applicable |
| **All Transmission-Connected and Distribution-Connected Programs** | **1.2** | **2.1** | **3.7** | **12,062** |

Notes: Consumer program results also include commercial participants in Residential Demand Response initiative; Business program results also include industrial participants in Retrofit initiative; Industrial program includes commercial participants in Demand Response 3 initiative. Levelized delivery cost is calculated from the program administrator's perspective, and excludes incremental customer costs of conservation measures.

Source: Independent Electricity System Operator

largely invisible from the perspective of customers. Throughout the year and into 2016, LDC-IESO working groups reviewed and updated the suite of province-wide conservation programs. Programs from the old framework were rolled over into 2015, to bridge the period until new program rules were available. Most programs from the 2011-2014 framework will continue, with a few exceptions, such as the Appliance Retirement Initiative (Fridge and Freezer Pick-up), which was not extended on a province-wide basis due to its poor cost-effectiveness results and a market approaching saturation. It may be revisited as a local program, where market need still exists. The IESO-delivered Aboriginal Conservation Program ended on December 31, 2015, but a First Nations Conservation Program will be offered by Hydro One (beginning in mid-2016), which serves the majority of Ontario's First Nation communities. Other continuing programs will be updated with a view towards improving efficiency and cost-effectiveness. New local, regional and pilot programs will also begin rolling out in 2016. Conservation savings achieved by LDCs in 2015, whether from old or new programs, will count towards their 2015-2020 targets.

Each LDC was required to submit a conservation plan to the IESO for review by May 1, 2015. Each LDC's plan outlines how it proposes to achieve its target, including the mix of conservation programs it intends to offer, and proposed budgets. The IESO reviewed the submitted conservation plans for reasonableness and cost-effectiveness. At the time of writing, plans had been approved for all LDCs except for the three Five Nations LDCs (Attawapikstat Power, Fort Albany Power, and Kashechewan Power). Once an LDC's conservation plan is approved, the LDC can access the funds it requires to deliver programs under the new framework (with the exception of custom programs, which still require individual review and approval by the IESO).[28]

One major change in the new framework was the decision to transition demand response programs away from LDCs to the IESO, who will be responsible for meeting a 2025 demand response target. This transition was essentially complete by the end of 2015.[29] Demand response resources are unique among conservation measures because their electricity use can be controlled in real time. They can therefore be treated similar to electricity generators, and can participate in the real-time IESO electricity market and be considered as a supply resource by the IESO for power system planning purposes, making the IESO a natural host for demand response.

The transition was a two-step process. Participants in the Demand Response 3 program were transferred to the IESO's Capacity-Based Demand Response Program, which honoured existing contracts, but integrated demand response providers into the real-time market. In particular, participants were required to reduce their electricity consumption when the wholesale electricity price was expected to exceed a certain threshold. This threshold was not exceeded in 2015, so demand response resources were not activated.

As existing demand response contracts expire, they will not be renewed under the previous terms. Instead, the IESO will procure demand response with the price set through a competitive auction, held annually. The first Demand Response auction was completed in December 2015, securing approximately 400 MW of demand response capability from seven participants. By 2018, all Demand Response 3 contracts will have expired. The amount of demand response that the IESO procures through future auctions will depend on the needs of the electricity system, and the cost of acquiring additional demand response capacity in comparison with alternative resources, such as gas-fired generation.

# B.2 Final 2011-2014 Electricity Conservation Results for Each Local Distribution Company

Utilities achieving more than 80 per cent of both their peak demand and energy targets, eligible for performance incentives from the OEB.

Utilities achieving more than 80 per cent of their energy target, but less than 80 per cent of their peak demand target.

Utilities achieving less than 80 per cent of their energy target, at risk of compliance action from OEB.

## Table B.7: 2014 Electricity Conservation Results for Each Local Distribution Company

| | Target 1: Energy Savings | | | | Target 2: Peak Demand Reduction | | | |
|---|---|---|---|---|---|---|---|---|
| | Target | | Achieved | | Target | | Achieved | |
| LDC | 2011-2014 Cumulative Energy Savings Target (GWh) | LDC's Share of Aggregate Provincial Energy Target (per cent) | 2011-2014 Cumulative Energy Savings (GWh) | Amount of 2011-2014 Energy Target Achieved (per cent) | 2014 Peak Demand Reduction Target (MW) | LDC's Share of Aggregate Provincial Peak Demand Target (per cent) | 2014 Peak Demand Reduction (MW) | Amount of 2014 Demand Target Achieved (per cent) |
| Algoma Power Inc. | 7.37 | 0.12% | 4.5 | 60.5% | 1.28 | 0.10% | 1.1 | 83.2% |
| Atikokan Hydro Inc. | 1.16 | 0.02% | 0.9 | 79.1% | 0.20 | 0.02% | 0.1 | 32.8% |
| Attawapiskat Power Corporation | 0.29 | 0.00% | 0.1 | 43.5% | 0.07 | 0.01% | 0.0 | 10.5% |
| Bluewater Power Distribution Corporation | 53.73 | 0.90% | 45.2 | 84.1% | 10.65 | 0.80% | 6.0 | 56.6% |
| Brant County Power Inc. | 9.85 | 0.16% | 9.4 | 95.0% | 3.30 | 0.25% | 1.6 | 49.7% |
| Brantford Power Inc.* | 48.92 | 0.82% | 82.5 | 168.6% | 11.38 | 0.86% | 9.1 | 79.7% |
| Burlington Hydro Inc. | 82.37 | 1.37% | 85.3 | 103.5% | 21.95 | 1.65% | 13.4 | 60.9% |
| Cambridge and North Dumfries Hydro Inc. | 73.66 | 1.23% | 120.5 | 163.6% | 17.68 | 1.33% | 11.9 | 67.4% |
| Canadian Niagara Power Inc. | 25.08 | 0.42% | 20.7 | 82.5% | 6.40 | 0.48% | 3.5 | 54.6% |
| Centre Wellington Hydro Ltd. | 7.81 | 0.13% | 10.7 | 137.2% | 1.64 | 0.12% | 1.7 | 100.9% |
| Chapleau Public Utilities Corporation | 1.21 | 0.02% | 2.2 | 179.3% | 0.17 | 0.01% | 0.2 | 123.3% |
| COLLUS Power Corporation | 14.97 | 0.25% | 13.6 | 90.7% | 3.14 | 0.24% | 1.8 | 56.3% |

*(continued)*

## Table B.7: Continued

| LDC | Target 1: Energy Savings | | | | Target 2: Peak Demand Reduction | | | |
|---|---|---|---|---|---|---|---|---|
| | Target | | Achieved | | Target | | Achieved | |
| | 2011-2014 Cumulative Energy Savings Target (GWh) | LDC's Share of Aggregate Provincial Energy Target (per cent) | 2011-2014 Cumulative Energy Savings (GWh) | Amount of 2011-2014 Energy Target Achieved (per cent) | 2014 Peak Demand Reduction Target (MW) | LDC's Share of Aggregate Provincial Peak Demand Target (per cent) | 2014 Peak Demand Reduction (MW) | Amount of 2014 Demand Target Achieved (per cent) |
| Cooperative Hydro Embrun Inc. | 1.12 | 0.02% | 1.5 | 137.1% | 0.34 | 0.03% | 0.2 | 64.4% |
| E.L.K. Energy Inc. | 8.25 | 0.14% | 8.0 | 96.9% | 2.69 | 0.20% | 1.0 | 37.8% |
| Enersource Hydro Mississauga Inc. | 417.22 | 6.95% | 464.3 | 111.3% | 92.98 | 6.99% | 69.4 | 74.6% |
| ENTEGRUS* | 46.53 | 0.78% | 50.9 | 109.4% | 12.12 | 0.91% | 6.4 | 53.2% |
| ENWIN Utilities Ltd. | 117.89 | 1.96% | 153.9 | 130.5% | 26.81 | 2.02% | 17.5 | 65.4% |
| Erie Thames Powerlines Corporation | 22.97 | 0.38% | 38.8 | 168.8% | 5.22 | 0.39% | 3.2 | 61.2% |
| Espanola Regional Hydro Distribution Corporation | 2.76 | 0.05% | 3.4 | 124.1% | 0.52 | 0.04% | 0.3 | 60.3% |
| Essex Powerlines Corporation | 21.54 | 0.36% | 23.3 | 108.0% | 7.19 | 0.54% | 3.2 | 44.4% |
| Festival Hydro Inc. | 29.25 | 0.49% | 45.6 | 155.9% | 6.23 | 0.47% | 5.3 | 85.8% |
| Fort Albany Power Corporation | 0.24 | 0.00% | 0.1 | 43.9% | 0.05 | 0.00% | 0.0 | 11.5% |
| Fort Frances Power Corporation | 3.64 | 0.06% | 4.3 | 118.4% | 0.61 | 0.05% | 0.5 | 81.8% |
| Greater Sudbury Hydro Inc.** | 43.71 | 0.73% | 42.6 | 97.5% | 8.22 | 0.62% | 4.3 | 52.6% |
| Grimsby Power Inc. | 7.76 | 0.13% | 10.6 | 137.1% | 2.06 | 0.15% | 1.1 | 55.4% |
| Guelph Hydro Electric Systems Inc. | 79.53 | 1.33% | 130.9 | 164.6% | 16.71 | 1.26% | 20.0 | 119.8% |
| Haldimand County Hydro Inc. | 13.30 | 0.22% | 15.3 | 114.8% | 2.85 | 0.21% | 1.7 | 61.1% |
| Halton Hills Hydro Inc. | 22.48 | 0.37% | 23.3 | 103.6% | 6.15 | 0.46% | 2.9 | 46.5% |

*(continued)*

**Table B.7: Continued**

| LDC | Target 1: Energy Savings | | | | Target 2: Peak Demand Reduction | | | |
|---|---|---|---|---|---|---|---|---|
| | Target | | Achieved | | Target | | Achieved | |
| | 2011-2014 Cumulative Energy Savings Target (GWh) | LDC's Share of Aggregate Provincial Energy Target (per cent) | 2011-2014 Cumulative Energy Savings (GWh) | Amount of 2011-2014 Energy Target Achieved (per cent) | 2014 Peak Demand Reduction Target (MW) | LDC's Share of Aggregate Provincial Peak Demand Target (per cent) | 2014 Peak Demand Reduction (MW) | Amount of 2014 Demand Target Achieved (per cent) |
| Hearst Power Distribution Company Limited | 3.91 | 0.07% | 2.6 | 67.3% | 0.68 | 0.05% | 0.3 | 50.0% |
| Horizon Utilities Corporation | 281.42 | 4.69% | 302.5 | 107.5% | 60.36 | 4.54% | 48.8 | 80.8% |
| Hydro 2000 Inc. | 1.04 | 0.02% | 1.7 | 159.8% | 0.19 | 0.01% | 0.2 | 109.0% |
| Hydro Hawkesbury Inc. | 9.28 | 0.15% | 7.6 | 82.2% | 1.82 | 0.14% | 0.7 | 39.6% |
| Hydro One Brampton Networks Inc. | 189.54 | 3.16% | 239.4 | 126.3% | 45.61 | 3.43% | 27.9 | 61.2% |
| Hydro One Networks Inc. | 1130.21 | 18.84% | 898.3 | 79.5% | 213.66 | 16.06% | 167.4 | 78.4% |
| Hydro Ottawa Limited | 374.73 | 6.25% | 414.9 | 110.7% | 85.26 | 6.41% | 60.1 | 70.5% |
| Innisfil Hydro Distribution Systems Limited | 9.20 | 0.15% | 7.8 | 84.4% | 2.50 | 0.19% | 1.2 | 49.3% |
| Kashechewan Power Corporation | 0.33 | 0.01% | 0.1 | 42.9% | 0.07 | 0.01% | 0.0 | 11.3% |
| Kenora Hydro Electric Corporation Ltd. | 5.22 | 0.09% | 1.9 | 37.2% | 0.86 | 0.06% | 0.3 | 31.1% |
| Kingston Hydro Corporation | 37.16 | 0.62% | 46.0 | 123.7% | 6.63 | 0.50% | 7.5 | 112.9% |
| Kitchener-Wilmot Hydro Inc. | 90.29 | 1.50% | 103.0 | 114.1% | 21.56 | 1.62% | 15.8 | 73.3% |
| Lakefront Utilities Inc. | 13.59 | 0.23% | 10.4 | 76.9% | 2.77 | 0.21% | 1.1 | 40.2% |
| Lakeland Power Distribution Ltd. | 10.18 | 0.17% | 10.3 | 101.3% | 2.32 | 0.17% | 1.1 | 45.4% |
| London Hydro Inc. | 156.64 | 2.61% | 194.1 | 123.9% | 41.44 | 3.12% | 19.3 | 46.6% |
| Midland Power Utility Corporation | 10.82 | 0.18% | 13.6 | 125.4% | 2.39 | 0.18% | 2.1 | 88.4% |

*(continued)*

## Table B.7: Continued

| LDC | Target 1: Energy Savings | | | | Target 2: Peak Demand Reduction | | | |
|---|---|---|---|---|---|---|---|---|
| | Target | | Achieved | | Target | | Achieved | |
| | 2011-2014 Cumulative Energy Savings Target (GWh) | LDC's Share of Aggregate Provincial Energy Target (per cent) | 2011-2014 Cumulative Energy Savings (GWh) | Amount of 2011-2014 Energy Target Achieved (per cent) | 2014 Peak Demand Reduction Target (MW) | LDC's Share of Aggregate Provincial Peak Demand Target (per cent) | 2014 Peak Demand Reduction (MW) | Amount of 2014 Demand Target Achieved (per cent) |
| Milton Hydro Distribution Inc. | 33.50 | 0.56% | 30.9 | 92.2% | 8.05 | 0.61% | 3.9 | 47.9% |
| Newmarket - Tay Power Distribution Ltd. | 33.05 | 0.55% | 36.2 | 109.5% | 8.76 | 0.66% | 4.6 | 52.9% |
| Niagara Peninsula Energy Inc. | 58.04 | 0.97% | 69.9 | 120.5% | 15.49 | 1.16% | 6.7 | 43.2% |
| Niagara-on-the-Lake Hydro Inc. | 8.27 | 0.14% | 10.6 | 128.1% | 2.42 | 0.18% | 1.4 | 56.7% |
| Norfolk Power Distribution Inc. | 15.68 | 0.26% | 14.5 | 92.2% | 4.25 | 0.32% | 1.8 | 41.8% |
| North Bay Hydro Distribution Limited | 26.10 | 0.44% | 28.0 | 107.3% | 5.05 | 0.38% | 3.5 | 70.1% |
| Northern Ontario Wires Inc.* | 5.88 | 0.10% | 5.9 | 100.5% | 1.06 | 0.08% | 0.6 | 54.4% |
| Oakville Hydro Electricity Distribution Inc. | 74.06 | 1.23% | 69.1 | 93.3% | 20.70 | 1.56% | 10.9 | 52.8% |
| Orangeville Hydro Limited | 11.82 | 0.20% | 10.8 | 91.1% | 2.78 | 0.21% | 1.7 | 59.9% |
| Orillia Power Distribution Corporation | 15.05 | 0.25% | 34.1 | 226.9% | 3.07 | 0.23% | 2.7 | 87.4% |
| Oshawa PUC Networks Inc. | 52.24 | 0.87% | 39.5 | 75.7% | 12.52 | 0.94% | 5.7 | 45.4% |
| Ottawa River Power Corporation | 8.97 | 0.15% | 9.4 | 105.0% | 1.61 | 0.12% | 1.0 | 62.6% |
| Parry Sound Power Corporation | 4.16 | 0.07% | 2.1 | 50.9% | 0.74 | 0.06% | 0.2 | 27.0% |
| Peterborough Distribution Incorporated | 38.45 | 0.64% | 35.0 | 91.0% | 8.72 | 0.66% | 7.2 | 83.0% |
| PowerStream Inc.*** | 407.34 | 6.79% | 496.3 | 121.8% | 95.57 | 7.19% | 73.8 | 77.2% |

*(continued)*

**Table B.7: Continued**

| LDC | Target 1: Energy Savings | | | | Target 2: Peak Demand Reduction | | | |
|---|---|---|---|---|---|---|---|---|
| | Target | | Achieved | | Target | | Achieved | |
| | 2011-2014 Cumulative Energy Savings Target (GWh) | LDC's Share of Aggregate Provincial Energy Target (per cent) | 2011-2014 Cumulative Energy Savings (GWh) | Amount of 2011-2014 Energy Target Achieved (per cent) | 2014 Peak Demand Reduction Target (MW) | LDC's Share of Aggregate Provincial Peak Demand Target (per cent) | 2014 Peak Demand Reduction (MW) | Amount of 2014 Demand Target Achieved (per cent) |
| PUC Distribution Inc. | 30.83 | 0.51% | 30.5 | 99.1% | 5.58 | 0.42% | 3.3 | 59.5% |
| Renfrew Hydro Inc. | 4.86 | 0.08% | 4.7 | 96.4% | 1.05 | 0.08% | 0.5 | 52.3% |
| Rideau St. Lawrence Distribution Inc. | 5.10 | 0.09% | 7.3 | 142.2% | 1.22 | 0.09% | 0.7 | 59.3% |
| Sioux Lookout Hydro Inc. | 3.32 | 0.06% | 1.3 | 40.0% | 0.51 | 0.04% | 0.2 | 29.8% |
| St. Thomas Energy Inc. | 14.92 | 0.25% | 17.9 | 119.8% | 3.94 | 0.30% | 2.4 | 61.6% |
| Thunder Bay Hydro Electricity Distribution Inc.* | 47.38 | 0.79% | 47.2 | 99.5% | 8.48 | 0.64% | 5.9 | 70.1% |
| Tillsonburg Hydro Inc.* | 10.25 | 0.17% | 7.4 | 71.9% | 2.29 | 0.17% | 2.4 | 104.3% |
| Toronto Hydro-Electric System Limited | 1303.99 | 21.73% | 1582.6 | 121.4% | 286.27 | 21.52% | 206.3 | 72.1% |
| Veridian Connections Inc. | 115.74 | 1.93% | 106.4 | 91.9% | 29.05 | 2.18% | 16.0 | 55.0% |
| Wasaga Distribution Inc. | 4.01 | 0.07% | 4.3 | 107.9% | 1.34 | 0.10% | 0.6 | 42.1% |
| Waterloo North Hydro Inc. | 66.49 | 1.11% | 66.2 | 99.6% | 15.79 | 1.19% | 8.1 | 51.1% |
| Welland Hydro-Electric System Corp. | 20.60 | 0.34% | 23.9 | 115.9% | 5.56 | 0.42% | 2.7 | 48.4% |
| Wellington North Power Inc. | 4.52 | 0.08% | 3.3 | 73.2% | 0.93 | 0.07% | 0.5 | 51.7% |
| West Coast Huron Energy Inc. | 8.28 | 0.14% | 4.0 | 48.8% | 0.88 | 0.07% | 0.5 | 53.8% |
| Westario Power Inc. | 20.95 | 0.35% | 23.2 | 110.9% | 4.24 | 0.32% | 2.4 | 57.1% |

*(continued)*

## Table B.7: Continued

| LDC | Target 1: Energy Savings | | | | Target 2: Peak Demand Reduction | | | |
|---|---|---|---|---|---|---|---|---|
| | Target | | Achieved | | Target | | Achieved | |
| | 2011-2014 Cumulative Energy Savings Target (GWh) | LDC's Share of Aggregate Provincial Energy Target (per cent) | 2011-2014 Cumulative Energy Savings (GWh) | Amount of 2011-2014 Energy Target Achieved (per cent) | 2014 Peak Demand Reduction Target (MW) | LDC's Share of Aggregate Provincial Peak Demand Target (per cent) | 2014 Peak Demand Reduction (MW) | Amount of 2014 Demand Target Achieved (per cent) |
| Whitby Hydro Electric Corporation | 39.07 | 0.65% | 32.4 | 83.0% | 10.90 | 0.82% | 6.1 | 55.5% |
| Woodstock Hydro Services Inc. | 18.88 | 0.31% | 38.1 | 202.0% | 4.49 | 0.34% | 3.1 | 68.5% |
| **TOTAL (as reported by IESO)** | | | | | | | | |
| | **6000** | **100.00%** | **6553.2** | **109.2%** | **1330** | **100.00%** | **927.7** | **69.8%** |
| **TOTAL (including late adjustments and savings from PowerStream custom program)*** | | | | | | | | |
| | **6000** | **100.00%** | **6560** | **109.3%** | **1330** | **100.00%** | **929** | **69.8%** |

Notes:

* Results for marked local distribution companies (LDCs) and overall province-wide totals include minor updates to reflect late adjustments. Results shown here may therefore differ slightly from those reported by individual LDCs or by the Independent Electricity System Operator (IESO).

** Does not include savings from Greater Sudbury Hydro's custom conservation programs. These custom programs were delivered using funding approved prior to 2011, and the Ontario Energy Board has not considered these programs to be eligible to contribute to the 2011-2014 conservation targets. If results from these programs were included, Greater Sudbury Hydro's final results would be 47.0 GWh cumulative energy savings (107.5 per cent of its energy savings target) and 4.4 MW peak demand reduction (52.9 per cent of its peak demand target).

*** Includes savings from PowerStream's custom Business Refrigeration Incentive Program.

Sources: Independent Electricity System Operator, Ontario Energy Board, PowerStream, Greater Sudbury Hydro

## B.3 Electricity Policy in 2015

Policy activity in 2015 for electricity proceeded at the steady pace typical of this sector for many of the last few years. In contrast to 2014, activities did not include the overarching or foundational policies that were unveiled in 2014, such as: the updated Long-Term Energy Plan, the Conservation First vision paper, and new regulatory frameworks for conservation by distribution utilities. Rather, the year was dominated by undertaking the low-key tasks of the detailed regulations, guidance and workflows required for 2014's broad strategies and targets.

### Industrial Consumers

In 2015, the Northern Industrial Electricity Rate program was made permanent. First announced in 2010 to run three years, and extended in 2012, the program provides lower rates for industries based in Northern Ontario[30] by rebating charges by two cents per kilowatt-hour. Under the terms of the program, participating companies must implement an energy management plan.

Also in the year, the Minister of Energy requested enhancements to another existing industrial rate program called the Industrial Electricity Incentive (IEI). Under the program, Ontario's current surplus supply of power is used to stimulate economic activity and potentially encourage better management of electricity demand through increased off-peak consumption. Responding to the minister's direction, the Independent Electricity System Operator (IESO) awarded several contracts under a newly created stream 3 of the IEI. Stream 3 expanded the program from previous industries like mines and refiners to include additional energy-intensive businesses like data centres and greenhouses. The electricity costs of IEI participants are reduced over a multi-year term in return for building new plants or expanding production at existing ones. For expansion of existing plants, a consumption baseline will be calculated based on a formula set by the IESO and a rate applied to the incremental consumption; new facilities will have a baseline set to zero for calculation of incremental consumption. Participants must provide an energy management plan when applying to the program to ensure that additional power is efficiently used.

In 2015, billing of new program participants of the Industrial Conservation Initiative (ICI) began. Previously in 2014, the rules of ICI program expanded eligibility and more businesses (those in select sectors with a peak demand greater than three, rather than five, megawatts) could apply to participate. Under the program, bills for industrial consumers that reduce their peak demand during high peak hours are lowered through a reduction in their global adjustment charge. The program has delivered significant conservation results; under the old rules when fewer businesses were eligible, the ICI resulted in a province-wide peak reduction of several hundred megawatts, and this amount may increase with more participants.[31]

### Residential and Other Consumers

With the intention of helping electricity customers monitor their use and react more quickly to avoid continued high consumption, the Ontario Energy Board (OEB) made changes to the Distribution System Code governing utilities' billing practices. LDCs will be required, starting January 2016, to bill residential and small business customers on a monthly basis using actual, not estimated, meter readings. Prior to the changes, some LDCs billed customers every two or three months and sometimes used estimated consumption amounts.

The OEB also issued a new rate design for the delivery charge portion of a consumer's electricity bill. Under the current design, there is a two-part delivery charge – part fixed and part variable, where the variable distribution charges are tied to the amount of electricity consumed. According to the OEB's decision,[32] delivery charges make up only 20-30 per cent of the total bill. Almost all distribution costs are fixed costs meaning that the cost of the distribution system is largely unaffected by the amount of power flowing through it. Examples of fixed costs are assets like wires, poles, transformers and meters. These have a fixed cost to purchase, install and maintain, and do not increase or decrease if the amount of power a customer uses goes up or down.

The Board's new rate design policy is to increase the amount of costs recovered through fixed charges and reduce those from usage charges. According to Board research, conservation is not affected by a lower variable charge; the electricity commodity charge, which makes up half of the total price of power, provides a stronger price signal to conserve. Furthermore, long-term distribution costs are driven by two main factors: number of customers and the peak demand on the distribution system. The new rate design will be fairer for consumers and provide stability for distributors to invest in new technology like the smart grid.

The new rate design, which will be phased in over four years and fully in effect by 2019, replaces the current mixture of fixed and variable charges with a monthly charge that is fully fixed, regardless of the amount of electricity used. The ECO has previously commented that this approach could reduce the incentive to conserve electricity and result in higher peak demand and higher distribution costs in the long term. A similar approach will be implemented for delivery charges paid by natural gas customers.

Finally, two other changes were made to power bills during the year. On December 31, 2015, the Ontario Clean Energy Benefit expired with the effect that residential, farm and small business customers will no longer receive a 10 per cent reduction on their total bill for the first 3,000 kWh per month consumed. (When the benefit was introduced in 2010, the ECO commented that it was a perverse incentive which rewarded increased consumption.) As a partial replacement, the government announced the Ontario Electricity Support Program, which applies a monthly rate reduction on electricity bills, but is only for low-income customers. Also, the Debt Retirement Charge (0.7 cents per kilowatt-hour in most areas) was removed from residential bills starting January 1, 2016, and will be removed for other classes of customers on April 1, 2018. The impact of this change on power consumption, if any, is unknown, although as a general rule price reductions tend to increase consumption of a good or service.

And in 2015, the OEB indicated that changes can be expected in the future to the way in which almost five million residential and small business customers are billed. Under the Regulated Price Plan (RPP) for such customers, consumers are charged for electricity under a time-of-use (TOU) structure whereby electricity used during peak hours costs more than off-peak times. TOU is an important conservation tool because it encourages demand shifting which reduces peak demand and lessens the need for additional generation and transmission facilities in the long term.

In November 2015, the OEB released a roadmap that flagged certain elements of the current structure, including the TOU pricing and time periods, which the OEB intends to redesign over the next three to five years.

To inform its thinking, the OEB commissioned a broad range of research. Two studies were completed on the effects of TOU rates and how pricing and time periods could be improved for conservation purposes. Also, consumer survey research and focus groups analyzed the public's awareness and understanding of TOU rates. A study using a behavioural economics approach experimented with presentation of bill information to test awareness and comprehension of the TOU price structure. And lastly, a review of dynamic pricing schemes in six North American and two international jurisdictions was completed to assess some effective program designs. The Board also considered regulations and features of the allocation of global adjustment and generation costs that may create barriers to an effective RPP.

## The RPP Roadmap Responds to ECO Concerns

The OEB's roadmap sets out a five-point plan that is aligned with observations made in previous ECO reports on TOU pricing. For example, it emphasizes using TOU pricing to minimize long-term system costs. The change in philosophy can be seen clearly in the new RPP objectives (changes are highlighted in italics):

- Set prices to recover the full cost of RPP supply, on a forecast basis, from the consumers who pay the prices.
- Set the price structure to reflect *current and future* RPP supply costs.
- *Set the price structure to support the achievement of efficient electricity system operation and investment.*
- Set both prices and the price structure to give consumers incentives and opportunities to reduce their electricity bills by shifting their time of electricity use *and reducing their peak demand.*
- Create *a price structure that is easily understood* by consumers.
- *Provide fair, stable and predictable commodity prices* to consumers.

The report also notes the need to develop a form of TOU pricing for mid-size customers that are too large for the RPP and too small for the ICI – a gap in conservation pricing policy previously noted by the ECO. The report noted that solar power is shifting the daily peak to later in the day; an issue that has been suspected for some time now. The roadmap also points out that government regulation – requiring weekday off-peak prices to begin by 7 p.m. – constrains the Board's ability to adjust rates to target such peaks. Finally, the roadmap contains some novel ideas as to how bills could be presented to ensure better consumer comprehension.

### The Roadmap's Five-Point Plan

The synopsis below outlines the roadmap's five-point plan for revision of the RPP.

1. ***Renewing the RPP objectives.***

   The OEB has already updated its RPP objectives to ensure that they reflect current policy objectives regarding peak demand reduction, efficient system operation and meeting long-term costs.

2. ***Empowering consumers – Enhancing energy literacy and non-price tools.***

   The public's understanding of TOU pricing is low. To address this, the OEB will: improve the communication on TOU pricing by making changes to the electricity bill; launch non-price pilots on benchmarking and load control to assess if technology gets a bigger response from customers; and gather better consumption data to understand what drives customer behavior.

3. ***Price pilots.***

   The OEB will work with LDCs to undertake several pricing (and non-price) pilots over the next 18 months to understand if there is a more effective pricing alternative to the current TOU structure.

4. ***Engaging with low volume business consumers.***

   Small business consumers are the least engaged in the current TOU structure and limited data exist to understand their consumption patterns. The OEB will examine these consumption patterns to better understand the needs of small business.

5. ***Working with government to reduce barriers.***

   The OEB will work with government and the IESO to address issues such as the inflexibility around the TOU periods and the recovery of Global Adjustment costs.

## Long-Term Energy Planning

Bill 135, the *Energy Statute Law Amendment Act, 2015* was introduced on October 28, 2015. The bill amends various laws, and changes the government's authority for electricity planning. It revises the *Electricity Act, 1998* and the *Ontario Energy Board Act, 1998* to repeal the requirement for an Integrated Power System Plan (IPSP). Bill 135 proposes to replace the IPSP with the Long-Term Energy Plan (LTEP) which sets out the objectives for energy and which would be afforded legal clout. (Prior to these proposed amendments, the LTEP was an informal plan, with no statutory authority, that was updated triennially by the government). Prior to issuing a revised LTEP, the IESO will be required to submit and publicly post a technical report on the adequacy and reliability of Ontario's electricity supply. As well, before issuing the LTEP, the Minister will consult stakeholders and publish notice of the consultations on the Environmental Registry. Once a revised LTEP is finalized, the Minister will publicly post it along with key technical data used to develop the plan.

The bill continues the Minister's power to issue directives to the IESO and OEB. On receiving a directive, the IESO or OEB will be required to submit an implementation plan outlining the steps it will take to meet the directive's requirements. The minister can issue directives related to: procurement contracts for electricity supply, conservation, and transmission systems; programs; funding; and, consultation. As with the IPSP, both the LTEP and any directives will be exempt from the *Environmental Assessment Act*.

## Conservation First Framework

As required under the Conservation First Framework, all local distribution companies submitted conservation and demand management plans to the IESO. Of the entire group of 75 distributors, about two-thirds plan to meet their assigned targets and a third expect to exceed their targets. Eighty-seven per cent of the planned energy savings are expected to come from programs that are already approved or proposed; where the other 13 per cent will come from remains to be determined.[33] However, the IESO reviewed and approved all but one plan (covering three LDCs) by the end of 2015. A mixture of legacy and new Conservation First Framework programs will be adopted with half of the LDCs planning to launch Conservation First Framework programs in 2015, and the other half in 2016. Eleven pilot programs were approved as of late 2015 and four new local residential programs were under review by the IESO.

The framework does not contain an aggregate or LDC targets for peak demand reduction. The ECO has previously noted that the main responsibility for peak shaving will fall to the IESO and OEB through market-based demand response and TOU pricing.[34] Progress against the 2013 LTEP target of a 10 percent peak reduction in 2025 should be closely monitored. If necessary, the Conservation First Framework should be revised to include a peak reduction goal at the framework's mid-term review in 2018.

In addition to the above-noted policies, there was new activity, as well as action on existing initiatives, that affect the use of energy in buildings. The Ministry of Energy began consultation on a home energy rating and disclosure policy. It proposes to require information on a home's energy efficiency performance to be provided to prospective buyers at the time a home is listed for sale. The ministry also proposed amendments to O. Reg. 397/11, Energy Conservation Plans. Key among these was the exempting of reporting of energy use for water and sewage pumps. The implementation of the regulation, including a review of conservation and demand management plans prepared by broader public sector institutions, is discussed in chapter four of our report.

Amendments to Ontario's regulation governing energy efficiency of appliances and products were made and these are explained in detail in chapter five of this report.

Over the year, several directives were issued that changed how renewable generation is procured in the province, and the ministry also began exploring the possible conversion of the microFIT program to a net metering program.[35] (Behind-the-meter customer-based generation falls under the definition of conservation in the Minister of Energy's direction on the Conservation First Framework). Almost all microFIT program participants generate electricity with solar panels and receive the feed-in tariff rate for solar installations. Three key features that are being considered in converting microFIT to net metering are: the size of generation eligible; the method for determining bill credits; and, whether barriers exist to integrating innovative technical features like storage.[36]

## Endnotes

1. Environmental Commissioner of Ontario, report, *Annual Energy Conservation Progress Report - 2010 (Volume One)*, section 5, June 2011, contains more information on the 2011-2014 conservation framework, and how and why it was developed.

   eco.on.ca/reports/2010-energy-report-vol-1-managing-a-complex-energy-system/

2. Environmental Commissioner of Ontario, report, *Annual Energy Conservation Progress Report - 2014*, section 2.4, January 2015, reviews the policy aspects of the 2015-2020 framework.

   eco.on.ca/reports/2014-energy-report-planning-to-conserve/

3. Final conservation results are also reported by the Independent Electricity System Operator, the Ontario Energy Board, and individual LDCs, each with slightly different perspectives. In particular, the individual LDC reports provide more detail on the specific programs offered and operational challenges and lessons learned from promoting and delivering these programs.

   Independent Electricity System Operator, report, *2011-2014 Conservation Results Report*, undated.

   www.ieso.ca/Documents/2011-2014_Conservation_Results_Report.pdf

   Ontario Energy Board, EB-2010-0215 report, *Conservation and Demand Management Report: 2011-2014 Results*, December 2015.

   http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/515795/view/CDM%20Summary%20Report_2011%20to%202014%20Results_20151223.PDF

   Ontario Energy Board, website, *CDM Strategies, Board-Approved CDM Programs, Performance Incentive and Annual Reports*, accessed April 2016.

   www.ontarioenergyboard.ca/oeb/Industry/Regulatory%20Proceedings/Policy%20Initiatives%20and%20Consultations/Conservation%20and%20Demand%20Management%20%28CDM%29/CDM%20Code/CDM%20Strategies%20Programs%20and%20Reports

4. Ontario Power Authority, presentation, *Generation and Conservation Tabulations and Supply/Demand Balance, 2013 LTEP: Module 3*, p. 35, January 2014.

   powerauthority.on.ca/sites/default/files/planning/LTEP-2013-Module-3-Supply-Demand-Balance.pdf

5. Demand response programs are essentially "call" options to reduce electricity use for short periods. IESO has tended to use these programs only in extreme conditions for a limited number of hours. As there have been few activations, they deliver little energy savings or greenhouse gas reductions.

6. Ontario Energy Board, report, *Monitoring Report on the IESO-Administered Electricity Markets for the period from May 2014 – October 2014*, figure 1.6, September 2015.

   www.ontarioenergyboard.ca/oeb/_Documents/MSP/MSP_Report_May2014-Oct2014_20151008.pdf

   The per cent of hours that natural gas was on the margin was estimated for the four quarters between November 2013 and October 2014 using this figure.

7. Independent Electricity System Operator, presentation (unpublished), *Overview of Electricity Conservation Program Avoided Costs: Presentation to Environmental Commissioner of Ontario (ECO)*, June 17, 2015.

8. *Ibid.*

9. The IESO has been directed by the Minister of Energy to "consider the system value of the {conservation} measures, including reductions at peak times" – however, in practice, this is only considered at the program screening stage, and is not a performance metric for LDCs.

10. The province-wide results reported in this chapter match those reported by the IESO. Minor updates for 5 LDCs due to late data, and savings from PowerStream's custom Business Refrigeration Incentive are not included, and would increase overall savings by about 0.1 per cent. Province-wide savings including these additional updates are 6560 GWh (109.3 per cent of energy savings target) and 929 MW (69.8 per cent of peak demand target). Results reported for individual LDCs do include these additional updates.

11. Ontario Energy Board, EB-2010-0215 letter, *Re: Conservation and Demand Management Report – 2013 Results*, December 17, 2014.

    www.ontarioenergyboard.ca/oeb/_Documents/EB-2010-0215/Brdltr_2013%20CDM%20Report_20141217.pdf

**12.** Another reason why the demand peak was so widely missed may be that time of use rates are not yet filling their potential to materially shift consumer demand. As the ECO has reported before, there are several reasons for this, including:

- An insufficient difference between on- and off-peak rates;
- the Minister of Energy's direction that off-peak rates should begin at 7 PM on weekdays, even though the actual system peak continues until later in the evening on hot summer days;
- limited consumer understanding of off-peak rates;
- the fact that many older appliances do not have easy to use delayed operation cycles which would, for example, allow a homeowner to run their dishwasher conveniently in the middle of the night;
- For about 35,000 rural customers, inadequate wireless communications infrastructure means that their installed smart meters cannot transmit data and they therefore cannot benefit from time of use rates.

Most of these are factors beyond the control of the individual LDCs and many are beyond the control of the IESO.

**13.** Ontario Energy Board, EB-2010-0215 letter, *Re: 2011-2014 Conservation and Demand Management Targets – Reporting and Performance*, August 26, 2015.

www.ontarioenergyboard.ca/oeb/_Documents/Documents/Brdltr_2014_CDM_Report_20150826.pdf

**14.** Minister of Energy, directive to the Ontario Energy Board, untitled, March 26, 2014.

www.ontarioenergyboard.ca/oeb/_Documents/Documents/Directive_to_the_OEB_20140326_CDM.pdf

Language from the directive is reflected in the license conditions assigned by the Ontario Energy Board to distributors.

**15.** *Supra*, note 6, displays the percentage of hours that each type of generation was at the margin over a quarterly period (the four quarters from November 2013-October 2014 are used). The estimate of emissions reductions assumes average emissions factors for fossil-fuelled generation (0.39 megatonnes $CO_{2eq}$ for gas-fired generation, and 0.94 megatonnes $CO_{2eq}$ for coal-fired generation), and assumes that the proportional reduction in electricity use due to conservation was the same in all hours.

**16.** The IESO reduced incentives for the Demand Response 3 (DR3) program in some areas of the province, and later was directed by the Ministry of Energy in March 2014 to institute a province-wide freeze on additional DR3 contracts in March 2014. The province-wide freeze was intended to facilitate the transition of DR away from an LDC program approach to an IESO-administered market approach. These actions had the impact of reducing the 2014 peak demand savings achieved from 2011-2014 conservation programs, but also reduced costs. Minister of Energy, direction to the Ontario Power Authority, *Re: Continuance of the OPA'S Demand Response Program Under IESO Management*, March 31, 2014.

www.powerauthority.on.ca/sites/default/files/news/MC-2014-853.pdf

**17.** Independent Electricity System Operator, report, *Ontario Reserve Margin Requirements, 2015-2019*, December 2014.

www.ieso.ca/Documents/marketReports/Ontario-Reserve-Margin-Requirements-2015-2019_v1.0.pdf.

The IESO's conclusion is based only on existing resources and planned resources that were already committed (signed contracts) or directed as of May 2014.

**18.** Actual savings of 309 MW peak demand reduction was achieved from demand response programs, while 416 MW of peak demand reduction from these programs was originally projected.

**19.** Ontario Energy Board, website, *CDM Strategies, Board-Approved CDM Programs, Performance Incentive and Annual Reports*, accessed April 2016.

www.ontarioenergyboard.ca/oeb/Industry/Regulatory%20Proceedings/Policy%20Initiatives%20and%20Consultations/Conservation%20and%20Demand%20Management%20%28CDM%29/CDM%20Code/CDM%20Strategies%20Programs%20and%20Reports

**20.** A separate target of 300 MW demand savings was set for the Industrial Accelerator program for transmission-connected customers, with an end date of June 23, 2015. No explicit target was set for the demand response programs for transmission-connected customers, although the Ministry of Energy provided limits on the maximum amount of demand response that the IESO could procure ("up to 500 MW").

**21.** Environmental Commissioner of Ontario, report, *Annual Energy Conservation Progress Report - 2014*, section 2.7, January 2015.

eco.on.ca/reports/2014-energy-report-planning-to-conserve/

**22.** *Supra*, note 16.

**23.** Indeco, report (filed as part of PowerStream's 2014 CDM annual report), *Evaluation of the Business Refrigeration Incentives Program*, April 2015.

www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/498238/view/PowerStream%202014%20Annual%20CDM%20Report_20150930.PDF

**24.** The total Global Adjustment was forecast by the Ontario Energy Board to be $9.1 billion from November 2013 to October 2014, and $341.5 million was recovered through the Global Adjustment in 2014 for spending on conservation initiatives. The statement that conservation spending counts for about 2% of the electricity bill is based on an estimated total electricity system cost (from 2012) of $18.7 billion:

Ontario Power Authority, presentation, *Cost of Electricity Service 2013 LTEP: Module 4*, p.5, January 2014. powerauthority.on.ca/sites/default/files/planning/LTEP-2013-Module-4-Cost.pdf.

The amount of spending on conservation programs reported for a given year does not exactly match the amount of funds recovered from the Global Adjustment. The difference is largely a timing issue – conservation administration funds are recovered from the Global Adjustment when they are advanced to LDCs, but are not reported in the spending totals until the LDC has spent these funds on conservation activities.

Over the four year period, the amount of reported spending varies for three reasons: Global Adjustment spending in 2011-2014 also includes about $35M spent on residual payments for pre-2011 conservation programs; Global Adjustment spending includes about $41M that had been advanced to LDCs, but not spent as of year-end 2014; and yearly reporting periods are slightly different (Global Adjustment spending year begins on Dec. 26, instead of the calendar year).

| Year | Funds Recovered through Global Adjustment | Spending on 2011-2014 Conservation Programs | Variance |
|---|---|---|---|
| 2011 | 328,754,087 | 269,764,342 | 58,989,744 |
| 2012 | 333,777,237 | 237,017,116 | 96,760,120 |
| 2013 | 345,873,817 | 349,870,602 | -3,996,785 |
| 2014 | 341,523,589 | 421,284,553 | -79,760,964 |
| **Total Spending** | **$1,349,928,729** | **$1,277,936,613** | **$71,992,116** |

**25.** The main difference between the two calculations is that additional conservation costs paid by participants in conservation programs (e.g. the incremental cost a customer pays for an energy-efficient furnace, net of any incentive received through the program) are included in the TRC test, but not the PAC test. Therefore, the benefit:cost ratios are usually higher in the PAC test.

**26.** Independent Electricity System Operator, information provided to the ECO in response to ECO inquiry, October 16, 2015; April 18, 2016.

**27.** Minister of Energy, direction to the Ontario Power Authority, *Re: Amending March 31, 2014 Direction Regarding 2015-2020 Conservation First Framework*, Oct, 23, 2014.

powerauthority.on.ca/sites/default/files/news/MC-2014-2415.pdf

**28.** Material changes to an LDC's portfolio, programs or budget will require the LDC to submit a revised conservation plan to the IESO for approval.

**29.** With the exception of the *peaksaver*PLUS demand response initiative for residential customers, for which a strategy has not yet been finalized.

**30.** Northern Ontario is defined under the program rules as being within the collective territorial Districts of Kenora, Rainy River, Thunder Bay, Cochrane, Algoma, Sudbury, Timiskaming, Nipissing, Manitoulin, and Parry Sound.

**31.** Environmental Commissioner of Ontario, report, *Annual Energy Conservation Progress Report – 2014*, section 2.7.4, January 2015.

eco.on.ca/reports/2014-energy-report-planning-to-conserve/

**32.** Ontario Energy Board, EB-2012-0410 report, *Board Policy: A New Distribution Rate Design for Residential Electricity Customers*, April 2, 2015.

www.ontarioenergyboard.ca/oeb/_Documents/EB-2012- 0410/OEB_Distribution_Rate_Design_Policy_20150402.pdf

**33.** Independent Electricity System Operator, presentation, *Conservation First Framework: Status of LDC CDM Plans*, p. 5, August 13, 2015.

www.ieso.ca/Documents/consult/sac/SAC-20150813-Status-of-LDC-CDM-Plans.pdf

**34.** Environmental Commissioner of Ontario, report, *Annual Energy Conservation Progress Report – 2014*, section 2.4, January 2015.

**35.** Ontario's current net metering regulation credits participating customers– mainly homeowners and farms – for excess renewable electricity generation provided to the distribution grid, at retail rates. Renewable generation up to 500 kW in capacity can participate. Program participants are net billed at retail rates based on the difference between the value of electricity exported (i.e., the value of electricity generated and injected into the grid after the participant has met its own consumption needs) and the value of electricity imported (i.e., the value of electricity purchased from the local distribution utility serving the participant).

**36.** The Ministry of Energy is developing proposals for a new net metering regime – eligibility may be limited to generation of 10 kW or less (as with the microFIT program), however, feedback on extending net metering to larger systems is being given consideration. Guiding principles for the program concept are as follows. It may credit program participants for their exported electricity based on the value of the power to the electricity system; conservation would be considered first by the appropriate sizing of systems to customer needs. Two compensation options were consulted on: one option where payment for electricity exported to the grid might involve the value of the power to the grid in terms of the avoided cost of adding new generation); the value-based payment could include environmental benefits, in addition to the avoided market costs. The second option proposed would involve crediting exports at retail rates and, in certain geographic areas, providing locational benefits (e.g., price adders) which would reflect the benefits provided by net metered generators where the grid is congested or demand growth would mean the addition of wires and transformers. Energy imported would continue to be valued at the retail price that utilities charge ratepayers.

# C

# Update on Government-Established Targets

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# Appendix C. Update on Government-Established Targets

The ECO's mandate includes reporting on Ontario's progress in meeting government-established targets to reduce or make more efficient use of energy. The ECO considers "government-established targets" to result from either a formal government policy or a Minister directing activities that specify an amount of energy to be conserved.[1]

To date, the ECO has completed a detailed analysis of progress towards most of these targets, and references have been provided in the summary tables to direct the reader to the location of the analysis.

The tables in this section provide an overview of progress towards government-established energy targets for the 2015-2016 reporting year. New this year, we add a scorecard (see chapter 2) to measure ministry performance as the completion date of several targets is approaching (2020 and 2021); province-wide electricity conservation targets have a longer timeline (2025 and 2032).

## A Guide to the Tables on Ministry and Agency Targets

**Table C.1** outlines the energy targets that are specifically set for government ministries. It is each ministry's responsibility to meet its respective target. While all targets are important, some influence activities across the entire province, while others influence activities internal to government.

**Table C.2** summarizes the provincial electricity conservation targets for the Ministry of Energy, Independent Electricity System Operator (IESO), and Local Distribution Companies (LDCs).

C

### Table C.1: Summary of Government-Established Targets for Ministries

| | |
|---|---|
| **Report Section** | 2009 (Volume Two), Section 3.1<br>2014 (Section 3.1) |
| **Initiative** | Premiers' agreement at the 2008 Council of the Federation |
| **Responsibility to Address** | Ministry of Energy |
| **Announced** | 2008 |
| **Completion Date** | 2020 |
| **Description** | 20 per cent energy efficiency improvement in Ontario by 2020. |
| **Progress on Target** | |
| Progress on the target is undetermined as the ministry has not established a methodology to measure progress against the 20 per cent target.<br>At the July 2015 Council of the Federation meeting, a Canadian Energy Strategy was issued that established three new goals but made no mention of the 20 per cent energy efficiency improvement by 2020 target. The goals are:<br>**1.** Strengthen Canadians' understanding of the benefits of energy efficiency and conservation.<br>**2.** Maximize access to energy savings by all energy consumers.<br>**3.** Encourage market transformation through targeted energy efficiency and conservation policies, including regulations. | |

*(continued)*

C

**Table C.1: Continued**

| | |
|---|---|
| **Report Section** | 2009 (Volume Two), Section 3.5<br>2012 (Volume Two), Section 2.1<br>2014 (Section 3.1)<br>2015-2016 (Section 3.5) |
| **Initiative** | Low Carbon Fuel Standard (LCFS) |
| **Responsibility to Address** | Ministry of Energy |
| **Announced** | 2007 |
| **Completion Date** | 2020 |
| **Description** | To reduce the carbon intensity of transportation fuels by 10 per cent by 2020. |
| **Progress on Target** | |
| Little measurable progress towards this target has been made. The Ministry of Energy has provided no data measuring the carbon intensity of Ontario's transportation fuels.<br>The Ministry states that the intensity has been reduced through federal and provincial regulations mandating biofuels.<br>Also, the Ministry of Energy advises that Ontario's proposed cap and trade program will apply to suppliers of transportation fuels, and will result in higher costs for conventional fuels; this price signal – in addition to existing incentives like fuel tax exemptions and biofuel mandates – will increase drivers' use of low carbon fuels.<br>The Ministry of the Environment and Climate Change advises the 5 per cent ethanol mandate for gasoline reduces annual GHG emissions by 800,000 tonnes, and the Greener Diesel regulation (2017 mandate of 4 per cent diesel blend be bio-based with this component having 70 per cent lower GHG emissions than petroleum diesel) will reduce annual GHG emissions by about 600,000 tonnes. | |

*(continued)*

**Table C.1: Continued**

| | |
|---|---|
| **Report Section** | 2009 (Volume Two), Section 3.6<br>2014 (Section 3.1)<br>2015-2016 (Section 3.5.2) |
| **Initiative** | Electric vehicle (EV) purchases |
| **Responsibility to Address** | Ministry of Transportation; Economic Development, Employment and Infrastructure; and, Energy |
| **Announced** | 2009 |
| **Completion Date** | 2020 |
| **Description** | 1 in 20 vehicles driven in Ontario by 2020 to be an EV. |
| **Progress on Target** | |
| As of December 31, 2015:<br>4,594 purchase incentive grants have been issued for electric vehicles under the Electric Vehicle Incentive Program since the program was established in July 2010.<br>1,074 home charging station rebates were paid under the electric vehicle Charging Incentive Program since it launched on January 1, 2013.<br>5,110 green licence plates have been issued, allowing access to High Occupancy Vehicle lanes for eligible plug-in hybrid and battery electric vehicles.<br>(On December 8, 2015: $20 million from the Ontario Green Investment Fund was announced for building more public EV charging stations). | |

*(continued)*

**Table C.1: Continued**

| | |
|---|---|
| **Report Section** | 2011 (Volume Two), Section 4.0 |
| **Initiative** | Education sector energy consumption reduction |
| **Responsibility to Address** | School boards assisted by the Ministry of Education |
| **Announced** | 2008 |
| **Completion Date** | Not applicable. |
| **Description** | Ministry did not commit to setting targets for school boards. It established a database to gather energy consumption data and enable benchmarking. |
| **Progress on Target** | |
| The Utility Consumption Database was launched in August 2009. The Database started collecting electricity and natural gas consumption data in the 2010 fiscal year, the baseline year of September 1, 2009 to August 31, 2010. (School boards' fiscal year runs from September 1st to August 31st).<br>The provincial average weather normalized[2] energy intensity for the sector was:<br>0.60 gigajoules per square metre in fiscal year 2012<br>0.60 gigajoules per square metre in fiscal year 2013<br>0.59 gigajoules per square meter in fiscal year 2014 | |

*(continued)*

**Table C.1: Continued**

| | |
|---|---|
| **Report Section** | 2009 (Volume Two), Section 4.7<br>2014 (Section 3.1) |
| **Initiative** | Ontario Public Service energy consumption reduction |
| **Responsibility to Address** | Treasury Board Secretariat |
| **Announced** | 2009 |
| **Completion Date** | Part 1: March 31, 2015<br>Part 2: March 31, 2021 |
| **Description** | Part 1: Annual reduction of 5 per cent for the period 2009-2014 in each of vehicle fuel consumption, air travel, and energy used in government buildings. These annual energy targets are part of the Ontario Public Service goal to reduce its GHG emissions by 19 per cent by fiscal year 2014/2015, compared against a 2006 baseline.<br>Part 2: Reduce GHG emissions from the Ontario Public Service by 27 per cent by 2020/2021, compared against the 2006 baseline. |
| **Progress on Target** | |
| The government achieved its overall GHG reduction target, but only because it exceeded targets for two out of three categories (vehicle travel and energy used in government buildings). Performance for the third category (air travel) was lower than expected, and the annual number of miles flown by OPS staff each year has been trending upwards.<br>Part 1 final results against the 2006 baseline are as follows:<br>• For vehicle fuel consumption, the government has reduced its GHG emissions by 22.2 per cent.<br>• For air travel, the government has reduced its GHG emissions by 15.4 per cent.<br>• For energy use in government buildings, the government estimates it has reduced its GHG emissions by 30.4 per cent.<br>(Refer to the endnote section of this Appendix for year-over-year results of past years.)[3] | |

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**Table C.2: Summary of Government-Established Provincial Electricity Conservation Targets for the Ministry of Energy, IESO, and LDCs**

| | |
|---|---|
| **Report Section** | 2014 (Section 2.3) |
| **Initiative** | Province-wide electricity conservation target contained in the 2013 Long-Term Energy Plan |
| **Responsibility to Address** | Ministry of Energy and Independent Electricity System Operator |
| **Announced** | December 2013 |
| **Completion Date** | 2032 |
| **Description** | A 30 TWh reduction of electricity consumption in 2032 due to conservation efforts from 2005 onwards. |
| **Progress on Target** | |
| As of December 31, 2014: 9.9 TWh of energy savings (33 per cent of 2032 target).<br>The reported number does not include codes and standards savings which will be added in 2016. | |

| | |
|---|---|
| **Report Section** | 2014 (Section 2.3) |
| **Initiative** | Province-wide demand response target contained in the 2013 Long-Term Energy Plan |
| **Responsibility to Address** | Independent Electricity System Operator |
| **Announced** | December 2013 |
| **Completion Date** | 2025 |
| **Description** | Use Demand Response to meet 10 per cent of peak demand in 2025. Procure an expected total of 2,400 MW under current forecast projections. Demand Response will include peak reduction amounts from demand response programs for large industrial and commercial consumers, aggregated Demand Response from small and medium industrial and commercial consumers, residential Demand Response (e.g., *peaksaver* program), pricing strategies such as time-of-use rates and the Industrial Conservation Initiative. |
| **Progress on Target** | |
| As of April 2015, all Demand Response 3 contracts held by the IESO were transitioned to a new transitional market called the Capacity-Based Demand Response (CBDR) program, moving Demand Response 3 into the wholesale market. The CBDR program will evolve into a competitive procurement process for demand response capacity using an auction. There are currently 526 MW enrolled in the program, and the transition schedule is:<br>• 367 MW will expire on April 30, 2016, leaving 159 MW in the program;<br>• 37 MW will expire on April 30, 2018, leaving 122 MW in the program;<br>• 122 MW will expire on October 31, 2018, after which there will be no capacity enrolled in the program. | |

*(continued)*

**Table C.2: Continued**

| | |
|---|---|
| **Report Section** | 2015/2016 (Appendix B)<br>2011 (Volume Two, Section 3.2) |
| **Initiative** | Conservation and Demand Management Directive for electricity distributors for the period 2011-2014 |
| **Responsibility to Address** | Local Distribution Companies, with oversight by the Ontario Energy Board |
| **Announced** | March 2010 |
| **Completion Date** | 2014 |
| **Description** | 1,330 MW of provincial peak demand reduction persisting at the end of the four year period, and 6,000 GWh of reduced electricity consumption accumulated over the four year period.<br>Distributors were allocated a share of the province-wide target and are required to submit annual reports on progress to the Ontario Energy Board.<br>Achievements contribute to, but are measured separately from Long-Term Energy Plan targets (which also include savings from codes & standards, pricing policy, and non-IESO/LDC programs). |
| **Progress on Target** | |
| 928 MW (70 per cent of 2014 peak demand target) and 6,553 GWh of energy savings achieved (109 per cent of 2011-2014 energy target). | |

*(continued)*

**Table C.2: Continued**

| | |
|---|---|
| **Report Section** | 2014 (Section 2.4) |
| **Initiative** | 2015-2020 Conservation First Framework direction to the Ontario Power Authority |
| **Responsibility to Address** | Local Distribution Companies, with oversight by the Ministry of Energy/ Independent Electricity System Operator |
| **Announced** | March 2014 |
| **Completion Date** | December 31, 2020 |
| **Description** | 7 TWh of electricity reduction in 2020, due to conservation activities between January 1, 2015 and December 31, 2020.<br><br>Distributors were allocated a share of the province-wide 2020 target and are required to submit conservation plans for approval by the Independent Electricity Market Operator.<br><br>Achievements contribute to, but are measured separately from, the province's conservation target of 30 TWh by 2032, as set out in the 2013 Long-Term Energy Plan (which also includes savings from codes & standards, and other programs not delivered by LDCs and the IESO). |
| **Progress on Target** | |
| As of the third quarter 2015, LDCs achieved 90 MW and 487 GWh of savings (unverified results) from 2011-2014 framework extension programs.[4] These savings count towards LDCs 2015-2020 Conservation First Framework Targets. | |

*(continued)*

**Table C.2: Continued**

| | |
|---|---|
| **Report Section** | 2014 (Section 2.3) |
| **Initiative** | Energy Storage |
| **Responsibility to Address** | Independent Electricity System Operator |
| **Announced** | December 2013 and March 2014 |
| **Completion Date** | 2014 |
| **Description** | 50 MW of energy storage capacity, as specified in the 2013 Long-Term Energy Plan.<br>As indicated in the March 2014 direction to the OPA and IESO:<br>Phase 1: IESO-led procurement for as much as 35 MW of storage.<br>Phase 2: OPA-led procurement, coordinated with the IESO, for the balance of capacity required to meet the 50 MW target. |
| **Progress on Target** | |
| In the first phase, the IESO procured 33.54 MW of storage for ancillary services to support system reliability. The first projects are expected to come into service before the end of the third quarter 2016.<br>The second phase of procurement was open to energy storage technologies with a variety of performance characteristics. The IESO specifically focused on: the capacity value of storage (the ability to provide storage when it is needed); and the arbitrage value (storing energy when prices are low, and then using this energy when prices rise). The IESO offered five companies contracts for nine separate projects, totalling 16.75 MW. | |

| | |
|---|---|
| **Report Section** | 2014 (Section 3.1) |
| **Initiative** | Industrial Accelerator Program |
| **Responsibility to Address** | Independent Electricity System Operator |
| **Announced** | July 25, 2014 |
| **Completion Date** | December 31, 2020 |
| **Description** | 1.7 TWh of electricity savings from transmission-connected customers by the end of 2020.<br>The program helps transmission-connected electricity users make capital investments in major energy efficiency projects. |
| **Progress on Target** | |
| As of December 31, 2014: 71 GWh of electricity savings.<br>The updated program started June 23, 2015. | |

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# Endnotes

**1.** Some targets include a deadline for conclusion of the conservation activities and some specify energy savings from a particular sector or class of customers. Although not stated, the ECO assumes, unless otherwise indicated, that the quantity of energy specified represents net savings (i.e., adjusted for free riders and other factors).

**2.** Through a statistical analysis, the above numbers have been normalized or corrected for weather effects since outdoor temperature and other meteorological factors affect the amount of energy used for heating or cooling a building. Therefore, the values can be compared from year to year.

**3.**

| | Baseline Energy Amount (2006/07) | Energy Consumption in 2009/10 | Energy Consumption in 2010/11 | Energy Consumption in 2011/12 | Energy Consumption in 2012/13 | Energy Consumption in 2013/14 | Energy Consumption in 2014/15 (Target Year) | % GHG Reduction from Baseline | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 09/10 | 10/11 | 11/12 | 12/13 | 13/14 | 14/15 |
| **Vehicle Fuel** [Litres and kilotonnes $CO_2e$ (GHG)] | 41,365,508 L<br>98.3 kt $CO_2e$ | 37,638,885 L<br>89.4 kt $CO_2e$ | 37,897,815 L<br>90.1 kt $CO_2e$ | 36,858,804 L<br>87.6 kt $CO_2e$ | 34,656,113 L<br>82.3 kt $CO_2e$ | 33,867,331 L<br>80.5 kt $CO_2e$ | **32,188,324 L**<br>**76.5 kt $CO_2e$** | 9.1% $CO_2e$ | 8.3% $CO_2e$ | 10.9% $CO_2e$ | 16.2% $CO_2e$ | 18.1% $CO_2e$ | **22.2% $CO_2e$** |
| **Air Travel** [Air miles and kilotonnes $CO_2e$ (GHG)] | 29,197,253 air miles<br>3.67 kt $CO_2e$ | 23,732,087 air miles<br>2.98 kt $CO_2e$ | 24,579,468 air miles<br>3.08 kt $CO_2e$ | 23,377,226 air miles<br>2.94 kt $CO_2e$ | 21,722,619 air miles<br>2.74 kt $CO_2e$ | 23,782,638 air miles<br>3.00 kt $CO_2e$ | **24,765,747 air miles**<br>**3.10 kt $CO_2e$** | 18.8% $CO_2e$ | 16.1% $CO_2e$ | 19.9% $CO_2e$ | 25.6% $CO_2e$ | 18.2% $CO_2e$ | **15.4% $CO_2e$** |
| **Emissions in Facilities*** (provided by MEDEI) [kilotonnes $CO_2e$ (GHG)] | 2006 Baseline<br>****174.877 kt $CO_2e$** | 2009 Calendar Year | 2010 Calendar Year | 2011 Calendar Year | 2012 Calendar Year | 2013 Calendar Year<br>*****133.100 kt $CO_2e$** | 2014 Calendar Year<br>******121.748 kt $CO_2e$** | 2009 | 2010 | 2011 | 2012 | 2013<br>**23.9% $CO_2e$ from baseline** | 2014<br>**30.4% $CO_2e$ from baseline** |
| **Total: OPS Environmental Footprint** [kilotonnes $CO_2e$ (GHG)] | **276.85 kt $CO_2e$** | | | | | | **201.35 kt $CO_2e$** | | | | | | **27.3%** |

Footnotes:

* Energy in Facilities data is presented in calendar not fiscal years and includes consumption from all fuel types (e.g. electricity, natural gas, steam, fuel oil, etc.)

** Baseline will change as a result of changing real estate portfolio. For guidance, the WRI standard for corporate reporting is used as guidance in making baseline adjustments.

***Previous reporting year (in this case 2013) values are a true-up from the last reporting cycle where they were estimated. Values are estimated due to lag in emission factor updates.

****Current reporting year (in this case 2014) is based on estimated emission factor data supplied by the Ministry of Energy. Data will be trued-up in the next annual report.

**Additional Notes – Emissions in Facilities:**

Data has been removed from 2009-2012 to align with annual energy reporting. As the baseline changes, each dataset from 2009-2012 would also need to be updated creating a significant amount of additional work. The current reporting structure captures progress towards target, true-up from previous year and estimated current reporting year. There is little value in updating past years' data.

Energy (GWh) data was estimated as MEDEI does not report on energy for custodial ministries. All energy data is available through ministry specific annual energy reports.

Emissions factors are adjusted annually as per Natural Resources Canada publications. 2014 Emission Factor is based on Ministry of Energy estimates.

Figures include both Infrastructure Ontario managed facilities, Alternative Financing Procurement facilities, and custodial ministry managed facilities (include MCSCS, MCYS, MTO, MNR and EDU).

Consumption differences from year to year result from:

- IO's conservation efforts for energy target
- Operational and program use changes
- Alternative Financing Procurement net new consumption. The added facilities (from 2009-current) have strict energy efficiency guidelines. However, all have been built after the 2006 baseline. The consumption has only added to total inventory consumption.

**4.** Framework extension programs are the programs from the 2011-2014 Conservation Framework that were extended into 2015 to bridge between the end of the old conservation framework (2011-2014) and the new Conservation First framework (2015-2020). LDCs that have not begun to deliver under the Conservation First framework continue to make programs available in their respective service territories with framework extension programs. Savings achieved from the 2011-2014 framework extension programs (and installed after January 1, 2015) count towards the LDCs' 2015-2020 Conservation First framework targets.

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# D
# Thanks and Acknowledgments

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# Appendix D. Thanks and Acknowledgments

The Environmental Commissioner would not have been able to produce this Energy Conservation Progress Report without the invaluable assistance, input and feedback of many individuals and organizations, including those listed below.

However, this report represents the views of the ECO and does not imply endorsement from any other individual or organization.

## ECO Staff and Contractors

Ellen Schwartzel (Deputy Commissioner); Martin Whicher (Manager); Mike Parkes (Senior Policy Analyst); Emily Cooper (Senior Policy Analyst); Nancy Palardy (Senior Policy Analyst); Kyra Bell-Pasht (Policy Analyst); Charlotte Friel (Policy Analyst); Cinzia Ruffolo (Project Manager); Tyler Schulz (Director of Operations); Stevenson & Writers; Fizzz Design Corp.; Maracle Press Ltd.; Don Huff and his team at Environmental Communications Options.

## Energy Efficiency Practitioners and Researchers

360 energy; ARCA Canada; Association of Municipalities of Ontario; Building Code Conservation Advisory Council; Chiefs of Ontario; Energy @ Work; Energy Services Association of Canada; Enerlife Consulting; EnerQuality; Ernst & Young; Fraser & Company; Greensaver; IndECO; International Center for Trade and Sustainable Development; International Institute for Sustainable Development; Itron; MCW Custom Energy Solutions; NAIMA Canada; Ontario Clean Air Alliance; PSE Healthy Energy; Sustainable Buildings Canada; Toronto Atmospheric Fund; Windfall Ecology Center.

## Academics

Cornell University; Department of Civil Engineering, University of Toronto; Duke University; Transportation Engineering Research Group, University of Toronto; University of Toronto Transportation Research Institute; York University Faculty of Environmental Studies.

## Transportation Policy Experts

David Suzuki Foundation; Fleet Carma; International Council on Clean Transportation; Pembina Institute; Plug'n Drive.

## Ontario and Canadian Government Ministries, Agencies, and Officers of the Legislature

Auditor General; British Columbia Ministry of Energy and Mines; Federal Buildings Initiative; Financial Accountability Officer of Ontario; Infrastructure Ontario; Metrolinx; Ministry of Agriculture, Food and Rural Affairs; Ministry of Economic Development, Employment and Infrastructure; Ministry of Education; Ministry of Energy; Ministry of the Environment and Climate Change; Ministry of Finance; Ministry of Municipal Affairs and Housing; Ministry of Training, Colleges and Universities; Ministry of Transportation; Natural Resources Canada; Ontario Financing Authority; Statistics Canada; Toronto and Region Conservation Authority; Treasury Board Secretariat.

## Ontario's Electricity and Gas Industry

Bullfrog Power; Electricity Distributors Association; Enbridge Gas Distribution; Festival Hydro; Independent Electricity System Operator; Ontario Energy Board; Oshawa Power and Utilities Corporation; Union Gas.

## Other Organizations

CivicAction; Mattamy Homes; New Zealand Environmental Commissioner's Office; Ottawa Catholic School Board; Rainy River Health Centre; Simcoe County District School Board; The Organization for Economic Cooperation and Development.

# E

# Ministry Responses to This Report

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# Appendix E. Ministry Responses to This Report

**Ministry of Energy**

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Ontario

May 20, 2016

Ms. Dianne Saxe
Environmental Commissioner of Ontario
605 - 1075 Bay Street
Toronto ON M5S 2B1

Dear Ms. Saxe:

**RE: Annual Energy Conservation Progress Report – 2015/2016**

Thank you for providing the Ministry of Energy with an opportunity to respond to your 2015/2016 Annual Energy Conservation Progress Report. We welcome and thank you for your advice and we will carefully consider your comments and recommendations as we continue to implement Ontario's Conservation First policy.

As we plan for Ontario's energy needs for the next 20 years, conservation will be the first resource considered, wherever cost-effective. It is the cleanest and most cost-effective energy resource, offers consumers a way to reduce their energy bills and greenhouse gas emissions, and reduces the need to build new generation, transmission and distribution infrastructure.

With respect to your recommendations, I am pleased to provide the following information.

**Recommendations 1 and 3:**

1. **All public bodies in Ontario should get serious about a "cleaner, leaner, greener" approach to energy, especially reducing the use of fossil fuels.**
3. **Public bodies should be accountable to the public for the energy they use.**

Under Ontario Regulation 397/11, Ontario continues to demonstrate leadership in broader public sector (BPS) energy reporting. Under the regulation, BPS organizations submit annual energy consumption and greenhouse gas emission reports to the Ministry, and develop 5-year energy conservation and demand management plans – the first in 2014. Reporting under the regulation has been 93% - 95% for the first three years of energy reporting and 82% of organizations developed energy conservation and demand management plans.

**Recommendation 2: Ontario should adopt formal targets for reducing fossil fuel consumption.**

On October 28, 2015, the Minister of Energy introduced the *Energy Statute Law Amendment Act, 2015* (Bill 135) that would enshrine in legislation a long term energy planning framework that is transparent, efficient and responsive to changing technology, policy and program needs. If passed, Bill 135 would ensure that energy planning takes a transparent and pragmatic

approach, and that future Long-Term Energy Plans are developed consistent with a common set of principles.

Additionally, the Ministry of Energy is undertaking and promoting a number of initiatives aimed at reducing fossil fuel consumption.

In response to a directive from the government, the Ontario Energy Board released a new six-year Demand Side Management Framework on December 22, 2014 to support the delivery of natural gas conservation programs. The Framework establishes targets for Enbridge Gas Distribution and Union Gas to achieve over the Framework period.

Ontario's Green Investment Fund (GIF) is providing $100 million to expand existing home audit and retrofit programs offered by the province's natural gas utilities (Enbridge Gas Distribution and Union Gas). Homeowners across the province who heat their homes with natural gas or other fuels (including oil, propane and wood) will have access to the GIF Program, allowing these homeowners to improve the energy efficiency of their homes and reduce greenhouse gas emissions.

Both the Ontario Building Code and Ontario's Energy Efficiency regulation for products and appliances (O.Reg. 404/12) include and continue to regularly update efficiency standards that reduce energy use from all fuels (electricity, oil, natural gas, propane).

**Recommendation 8: The Minister of Energy should:**

**a. Set energy use intensity targets for all public buildings**

The Ministry of Energy has developed a Reporting Guide for Broader Public Sector organizations who are required to report under O. Reg. 397/11, which encourages BPS organizations to set energy reduction targets. The ministry will continue to explore the benefits and impacts of setting mandatory energy intensity reduction targets for BPS.

**b. Implement Green Energy Act, 2009 provisions that protect consumers by mandating home energy use disclosure prior to sale**

The Ministry of Energy continues to explore a proposed initiative that would require the disclosure of home energy ratings by homeowners at the time of listing a residential property for sale.

**c. Require large private buildings to disclose their energy intensity**

On October 28, 2015, the Minister of Energy introduced the *Energy Statute Law Amendment Act, 2015* (Bill 135), which includes amendments to the *Green Energy Act, 2009* that, if passed, would enable the implementation of a proposed large building energy and water reporting and benchmarking initiative. On February 25, 2016, the Ministry of Energy posted a plain language description of a proposed regulation to the Environmental Registry and Regulatory Registry; the posting period concluded on April 15, 2016. Feedback received in response to the posting is currently being reviewed by Ministry staff and will inform the development of a regulation. The proposed reporting initiative would apply to commercial and multi-unit residential buildings 50,000 square feet and above, phased in over a three-year period starting in 2017.

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**Recommendations 10 and 11:**

10. **The Minister of Environment and Climate Change and the Minister of Energy should establish product standards for the efficient use of water in fixtures.**
11. **Response to Recommendation 11: The Minister of Environment and Climate Change should obtain authority to inspect and enforce compliance with product efficiency standards.**

On October 28, 2015, the Minister of Energy introduced the *Energy Statute Law Amendment Act, 2015* (Bill 135), which includes amendments to the *Green Energy Act, 2009* that, if passed, would enable the regulation of water efficiency for products and appliances which consume both energy and water. Pending passage of Bill 135, this would enable setting water efficiency standards for products such as clothes washers and dishwashers through Ontario's energy efficiency regulation.

The *Green Energy Act, 2009* does not include authority to set minimum efficiency standards for non-energy using products, such as those that consume water (e.g. faucets, showerheads, pre-rinse spray valves). This authority exists under the *Ontario Water Resources Act, 1990* administered by the Ministry of Environment and Climate Change.

The Ministry of Energy works closely with key stakeholders including manufacturers and industry associations to ensure that any proposed and adopted changes in regulations are communicated in a timely manner. The Ministry's experience in working with key stakeholders on the most recent amendments to energy efficiency regulation has been positive. Accordingly, the Ministry does not expect any significant non-compliance issues in Ontario.

**Recommendation 12: Ontario should focus electricity conservation on times of higher demand when conservation displaces natural gas-fired generation.**

The 2013 Long-Term Energy Plan committed to aiming to use demand response to meet 10% of peak demand by 2025. Achieving this goal is supported by a number of demand response initiatives aimed at reducing peak demand, including time-of-use pricing, Independent Electricity System Operator (IESO)'s demand response auction, the Industrial Conservation Initiative and dispatchable customer loads under contract in the IESO administered market.

The 2015-2020 Conservation First Framework continues to encourage the development of conservation programs that reduce demand during peak periods. The March 31, 2014 Conservation First Framework direction requires that the IESO encourage local distribution companies to incent conservation and demand management measures that have longer persistence and that consider system value, including reductions at peak times.

**Ministry of Energy Conservation Scorecard**

With respect to the "F" the Ministry received for its progress toward meeting a 20% energy efficiency improvement target in Ontario by 2020 – established in 2008 – the Ministry believes giving this score for our inability to track progress against this outdated target is not appropriate.

As the Ministry has noted previously, the energy savings target of 20% was based on a commitment made by Premiers at the 2008 Council of the Federation (COF) meeting, and since that time the energy landscape has evolved. Premiers agreed at the 2012 COF meeting to develop a renewed Canadian Energy Strategy (CES). Through the Progress Report to the COF in July 2013, the provinces and territories provided an update to the strategy and identified

challenges and opportunities in achieving the Premiers' vision for energy in Canada. At the July 2015 COF meeting, a renewed CES was issued that established new goals to strengthen Canadians' understanding of the benefits of energy efficiency and conservation; maximize access to energy savings by all energy consumers; and encourage market transformation through targeted energy efficiency and conservation policies, including regulations. The new CES does not include any reference to the 20% energy efficiency improvement by 2020 target.

As a result, any score assigned to the Ministry should reflect its progress and achievements in meeting Ontario's commitments to improve conservation and energy efficiency, as set out in the Long-Term Energy Plan.

With respect to the "D" the Ministry received on its target of reducing the carbon intensity of transportation fuels by 10% by 2020, the Ministry would like to note that Ontario continues to take actions to reduce the carbon intensity of transportation fuels. Measures like the "Ethanol in Gasoline" regulation, the Greener Diesel mandate, financial support for electric vehicle purchases and investments to expand electric vehicle infrastructure deliver real reductions in carbon intensity. Moreover, the imminent introduction of Ontario's economy-wide cap and trade program, which will increase the cost of conventional transportation fuels, can be expected to further reduce emissions and incent consumers to transition to lower carbon transportation fuels. Ontario's existing policies, in conjunction with cap and trade, position the province to continue to reduce emissions intensity in the transportation sector.

Thank you again for your report and opportunity to provide additional information.

Sincerely,

*Original signed by*

Serge Imbrogno
Deputy Minister

**Ministry of the Environment and Climate Change**

Deputy Minister

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**Ministère de l'Environnement et de l'Action en matière de changement climatique**

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Ontario

May 11, 2016

Dr. Dianne Saxe
Environmental Commissioner of Ontario
1075 Bay Street, Suite 605
Toronto, Ontario, M5S 2B1

Dear Dr. Saxe:

**Re: Annual Energy Conservation Progress Report – 2015/2016**

Thank you for providing the Ministry of the Environment and Climate Change with an advanced copy of your Annual Energy Conservation Progress Report – 2015/2016.

The ministry appreciates the Environmental Commissioner's recognition of its work on energy conservation and climate change in 2014 and 2015. Making better and more productive use of all natural resources, including energy, water and land, is crucial to addressing climate change. Ontario has already come a long way in this regard. In 2014, about 90 per cent of Ontario's electricity generation came from low-carbon sources, including nuclear, hydro, wind, biomass and solar. The province has some of the most advanced energy conservation programs in North America.

Building on Ontario's Climate Change Strategy (released November 2015), the upcoming Climate Change Action Plan will outline a number of critical measures and invest proceeds from the cap and trade program to further reduce emissions, support innovation, and help Ontarians benefit from the clean energy economy. ECO recommendations have been considered in the development of the action plan, including how the broader public sector approaches low carbon energy technology. Energy conservation will continue to play a key role in our efforts to lower greenhouse gas emissions, fight climate change, and transition to a low carbon economy.

MOECC recognizes the importance of enforcement and compliance for the success of any regulation or standard. To that end, we will continue to consider how the ministry could leverage its experience to support Ministry of Energy's product energy efficiency standards.

Your report criticizes the government for not taking serious efforts to meet its 2007 goal of reducing the carbon intensity of transportation fuel by 10 per cent by 2020. While we share your concern for addressing the largest source of emissions in the province, the Ministry of the Environment and Climate Change is proud of the progress we have made in reducing the climate change and air quality impacts of transportation fuels.

Since 2007, Ontario has required that gasoline contain a minimum of 5 percent ethanol on average. Since April 2014, Ontario's Greener Diesel regulation has required an average of 2 percent renewable content in diesel fuel. By 2017, when it is fully phased in, the regulation will require average renewable content of least four percent, with 70 percent lower lifecycle GHG emissions in the renewable component. Ontario's greener diesel approach is expected to reduce GHG emissions by about 600,000 tonnes a year - equivalent to taking 140,000 cars off the road by 2017.

MOECC supports further actions to increase energy conservation and efficiency, including energy benchmarking and reporting, addressing fossil fuel subsidies, and improving codes and standards.

Thank you again for your thoughtful recommendations and the opportunity to review an advanced copy of your report.

Sincerely,

Paul Evans
Deputy Minister
Ministry of the Environment and Climate Change

E

**Ministry of Transportation**

Office of the Deputy Minister

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**Ministère des Transports**

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Ontario

May 20, 2016

Ms. Dianne Saxe
Environmental Commissioner of Ontario
1075 Bay Street, Suite 605
Toronto, Ontario
M5S 2B1
Email: conservation_report@eco.on.ca

Dear Ms. Saxe:

Thank you for the opportunity for the Ministry of Transportation (MTO) to review and respond to the 2015/2016 Energy Conservation Progress Report. The ministry appreciates the opportunity to provide the following response to sections of your report.

Section 3.1 Transportation: A Huge Challenge

As you acknowledge in your report, the magnitude and profile of fuel consumption is a direct result of growth and development patterns, how people in Ontario have chosen to live, work, and play, and broader activities of governments at various levels.

MTO is working closely with partner ministries to shift these patterns, for example through proposed strengthened policies requiring increased density, transit-supportive development, and active transportation options, through the Coordinated Review of Provincial Plans.

In support of this shift, Ontario is making significant investments in transit and transportation infrastructure through its *Moving Ontario Forward Plan*, which will make $31.5 billion available over 10 years for investments in priority infrastructure projects across the province. Regional Express Rail is part of this 10-year plan and will give people throughout the GTHA new travel options, with faster and more frequent GO rail service and electrification on core segments of the GO rail network.

Additionally, under MTO leadership, many of the initiatives cited in the 2015/2016 report, such as the Electric Vehicle Incentive Program, Electric Vehicle Chargers Ontario Program, High Speed Rail and the #CycleON strategy, support ongoing and future energy conservation efforts through fuel shifts, mode shift and electrification.

Section 3.6 Recommendations
*1.i. Accommodating population growth within complete communities serviced by good transit and active transportation*

MTO understands and supports the need to plan for a transportation system that contributes to reduced fuel demand. MTO has collaborated with the Ministry of Municipal Affairs and Housing and

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other ministries on the Coordinated Review of Provincial Plans, and supports recommendations to achieve complete communities with a focus on increased density and transit-related planning and development.

MTO prepares long-range, multi-modal transportation plans and strategies to provide options and support more efficient and fuel conscious movement of people and goods. Currently, MTO has two such plans under development, in the Greater Golden Horseshoe and in Northern Ontario.

In addition to the Transit-Supportive Guidelines mentioned in the report, MTO has recently released Freight Supportive Guidelines. These tools demonstrate the ministry's ongoing support for municipal implementation of provincial policies for land use and transportation planning.

*1.ii. Making transit faster and more reliable, through cost-effective transit investments and by granting transit vehicles priority on key arterials and highways*

The Province is dedicated to continue exploring opportunities to optimize transit infrastructure investments to build an integrated transportation network and maximize value for money. Due diligence review of transportation infrastructure project business cases ensures that provincial infrastructure investments are accountable and that major transportation infrastructure investments align with provincial transportation priorities and broader government policies, plans and objectives.

In addition to Regional Express Rail mentioned above, since 2004, the Province has supported municipal transit through the Gas Tax program, and has committed more than $3.4 billion to municipal projects through this program. Funding is distributed on the basis of transit ridership and population, to ensure it balances the needs of transit providers in large and small municipalities. Ontario has also committed more than $590 million to develop dedicated transit-ways (BRT/ LRT) in Waterloo Region, Mississauga, Brampton and Durham region.

The ministry supports priority for transit vehicles. MTO maintains high occupancy vehicle (HOV) lanes on an increasing portion of its highway network, and buses and other carpooling vehicles are able to travel in HOV lanes. Through the Greater Golden Horseshoe multimodal transportation plan, the ministry will analyze longer term high occupancy vehicle (HOV)/high occupancy toll(HOT) network options, with an ultimate goal of building a network of HOV/HOT lanes across the region, when and where it makes sense to do so. MTO will be looking at the suitability of incorporating HOV/HOT lanes for all upcoming major highway projects in the GTHA to help manage congestion and complement transit options.

*1.iii. Supporting the rapid growth of low carbon transportation vehicles and fuels including electrification*

The Report notes that MTO has made modest progress towards the goal of 5% of vehicles on the road in Ontario being electric by 2020 and that this target is unlikely to be achieved. However, it is important to consider the global adoption rate of electric vehicles. As noted on page 41 of the Report, electrical vehicles currently represent less than 0.5% of annual passenger sales globally, reflecting the ambitious nature of this goal.

The ministry has introduced new investments and programs that better support and encourage increased adoption of electric vehicles in Ontario. A modernized Electric Vehicle Incentive Program

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D. Saxe
Page 3

and complementary measures, such as the Electric Vehicle Charging Incentive Program for home and workplace chargers and the Green Licence Plate programs, address key barriers to electric vehicle adoption such as cost and range anxiety to encourage uptake and increase the number of electric vehicles on the road.

MTO is also looking beyond electrification to consider other low-carbon fuels, such as Renewable Natural Gas and biodiesel, especially in efforts to support conservation within the commercial sector.

Through the $10 million Ontario Municipal Cycling Infrastructure Program, the Province is helping 37 municipalities improve cycling infrastructure. These projects will improve cyclist safety and better connect local cycling networks, helping to make cycling a viable transportation choice for more Ontarians.

*2. Public bodies should report the energy use of their fleets*

MTO, as the OPS fleet manager, is demonstrating leadership through fleet greening by right-sizing, and transitioning to low-carbon vehicles. MTO has reduced fuel consumption by 43% since 2008, which translates to more than 9 million litres in fuel conservation.

MTO tracks energy use (e.g. fuel use) as part of the Green Fleet Strategy and the OPS Green Transformation Strategy. Working with the Treasury Board Secretariat, this data is reported annually to the ECO for inclusion in the Annual Energy Conservation Progress Report.

The ministry thanks the Environmental Commissioner of Ontario for the analysis and recommendations, which will be considered in future policy and program development.

Sincerely,

Stephen Rhodes
Deputy Minister of Transportation

# F

# Does the ECO Walk the Talk?

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# Appendix F. Does the ECO Walk the Talk?

As the Legislative Officer tasked with holding the government to its energy conservation, climate and environmental commitments, it is only right for the ECO to minimize our own energy consumption. How are we doing?

## F.1 How Much Energy do We Use?

The first step in managing anything is to measure it.[1]

**The first step in managing anything is to measure it.**

The ECO uses energy both directly and indirectly in our everyday operations. Our most significant impacts include: natural gas and electricity use within the office, staff transportation to work and to events, water use (kitchen and bathrooms), paper use, and waste production. However, measuring these impacts is very challenging because we are tenants leasing part of a floor in a multi-tenant office building without any electricity or utility sub-metering.[2]

Like most tenants, the ECO has access to very little data. The ECO has no statistics on our water, electricity or natural gas use, or the waste production within our office. Our efforts to arrange sub-metering of our space were not completely successful, since the wiring of the building does not coincide with the space that we occupy.[3]

**Like most tenants, the ECO has access to very little data.**

We therefore turned to an "educated guess" technique for bulk-metered buildings suggested by Bullfrog Power (see Table F.1). Our best educated guess is that our office space annually produces approximately 22.84 tonnes of GHGs.

**Table F.1: ECO's 2015 Estimated Energy and Emissions Footprint for its Office Space**

| ECO's estimated annual energy use | | GHG emissions (tonnes/year) |
|---|---|---|
| electricity usage[4] | 113,280 kWh | 9.06[5] |
| natural gas usage | 7,807.73 $m^3$ | 13.78[6] |
| **Total $CO_2e$ emissions (tonnes/year)** | | **22.84** |

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This electricity estimate is equivalent to the average electricity usage of a LEED certified office (28 per cent lower than average for the type of building we occupy).[7] However, the natural gas estimate was about 40 per cent higher than the national average for commercial office space.[8] This is likely due to a combination of factors, namely the blunt estimating methodology, the cold winter in 2014, the contribution of a restaurant to the building's overall energy use, and the age of the building.

## F.2 The ECO's Sustainability Practices

This electricity usage estimate is reasonable because of our numerous sustainability initiatives.

**Within the workplace**, we reduce energy wastage by buying energy efficient equipment and turning off electronic equipment and lights when not in use. Whenever possible, we shift to low-wattage, high-lumen LED lights. Excess overhead lighting was both wasting energy and causing eyestrain; the ECO has become more comfortable to work in now that unwanted ceiling fixtures have been turned off. We hope to do the same for excess air conditioning.

When we renovated our space to accommodate the increased staff complement by over 50 per cent (from 17 to 26 people),[9] we squeezed into the same suite footprint (square footage) and took every opportunity to increase energy efficiency. This included high efficiency lighting, light motion sensors, data server replacements with high efficiency blade servers, and installing second window panes in some areas to reduce winter heat loss. This resulted in an estimated 30 per cent increase in energy efficiency.

The office greening committee has had many successes:

- We minimize paper use (e.g., defaulting to double-sided printing and printing only when necessary). We reuse and recycle where possible. E-waste and batteries go to the building owner's recycling programs;
- We offset our non-renewable electricity use, as a result of our Bullfrog Power certification; and[10]
- We remind each other about energy efficiency and waste reduction (e.g., signage to turn off unused electronics, and listing waste items suitable for diversion, landfill or compost).

Some of these successes have benefited the entire building, including:

- a soil health regeneration project for the building's small green space, which has included a soil health test, annual compost applications, seeding with grass and clover, and nutrient enrichment; and
- successfully persuading the building manager to implement building-wide organic waste collection.

ECO **staff travel** is encouraged to be environmentally friendly, efficient, and cost-effective. Staff travel to local meetings mostly by transit, foot or bicycle. When vehicle use is necessary, compact or electric cars are encouraged. Where possible, we do not travel, but instead attend and host virtual meetings. Air travel is used sparingly. Most staff (including the Commissioner) also travel to work by transit, foot or bicycle, which is why we score so well in Pollution Probe's annual "Healthy Commute" competition.[11]

To green our **supply chain**, the ECO is committed to ordering, using, and recycling office supplies in an economical and responsible manner. Environmental impact and price are given equal weight. For events, catered food must be local and sustainable where possible, meat (if served) must be sustainably raised, and vegetarian and vegan options are always provided. We do not serve bottled water or soft drinks.

Finally, the ECO only uses recycled paper. Many of our reports are printed using a waterless production process and made digitally available to reduce the need for paper copies. In this report, the Appendices (intended for a specialized audience) are made available only online.

## F.3 Room to Improve

We know that we still have many opportunities to improve. In particular, we still use too much electricity on weekends when the office is vacant (see Figure F.1). With this information in hand, we can now begin to address this issue.

Unfortunately, the ECO (and the public purse that pays our bills) gets no financial benefit from our conservation efforts. Since our leasing agreement requires us to pay utilities according to a set fee based on square footage, the financial benefits from our conservation successes go to the landlord.[12]

**The financial benefits from our conservation successes go to the landlord.**

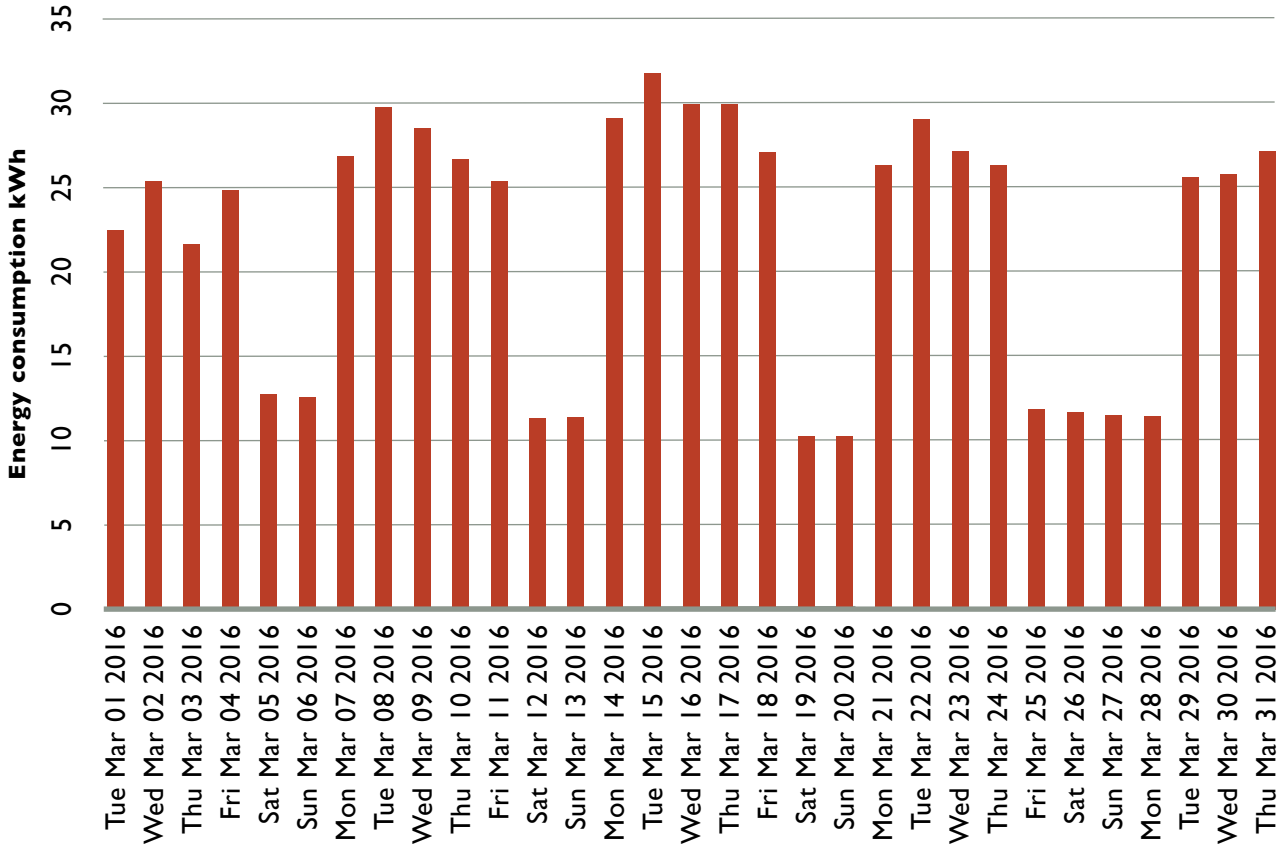


**Figure F.1: A sample month of ECO's electricity consumption, based on limited circuit metering undertaken to date**

Note: The above data does not cover all of ECO's electricity use due to our inability to complete circuit metering for our office space.

## Endnotes

**1.** Several frameworks exist for tenants in office buildings seeking to reduce their environmental footprint. For example: Canada Green Building Council's LEED-CI (Leadership in Energy and Environmental Design- Commercial Interiors), and the International Organization for Standardization's 14000 series, which provides a system for monitoring any organization's environmental performance (see specifically, ISO 14001:2015). What both frameworks share in common is the need to first conduct an analysis of the organization's major environmental impacts, then to measure those impacts.

**2.** Although sub- or suite-metering is recognized as a best practice (per *Energy Standard for Buildings Except Low-Rise Residential Buildings*, ANSI/ASHRAE/IES Standard 90.1-2010), it is only required in Ontario for new multi-residential buildings (per O. Reg. 389/10, s.39.1, made under the *Energy Consumer Protection Act, 2010*), not existing commercial buildings. The Ontario Building Code references this standard as a potential partial compliance path to meet the Ontario code's energy efficiency requirements, but does not require compliance with the specific prescriptive requirements of the ASHRAE 90.1-2010 standard.

**3.** In an effort to learn more about the office's energy use, the ECO undertook an initiative in 2015 to map our electricity circuits in order to measure the electricity consumed by each plug. Because some circuits are linked to panel boards located within other offices on the same floor, this proved technically complex, time consuming and expensive. To date, the ECO has only succeeded in mapping some of the plugs in our office (the servers, lighting and fridge still need to be added). As a result, the ECO has data on about 10 per cent of our total electricity use, which provides a somewhat more informed approach to electricity conservation. For example, Figure F.1 shows that during weekends, when the office is unoccupied, about 50% of the ECO's circuit-metered electricity is still being consumed, albeit during off-peak time periods. We continue to investigate opportunities for further reductions.

**4.** Bullfrog Power estimated ECO's office electricity use to be 16 kWh/sq.ft.

**5.** According to Bullfrog Power's Electricity Emissions Calculator for Ontario, Ontario's electricity consumption intensity rate is 80 grams of carbon dioxide equivalents ($CO_2e$) per kilowatt hour, therefore 113,280 kWh X 80= 9,062,400 g (See: www.bullfrogpower.com/wp-content/uploads/2015/09/2015_bullfrog_power_electricity_emission_calculator.pdf)

**6.** Methodology used is based on advice from Bullfrog Power. It is the building's total natural gas use for 12 months (in 2015, it was 250,248 $m^3$), broken down to reflect the ECO's per cent of the total square footage (ECO occupies 3.12 % of the building). Therefore, 3.12 % of 250,248 cubic metres equals 7,807.7 cubic metres (or 2812.41 therms).

- If there are 0.005 metric tonnes of $CO_2$ per 1 therm of natural gas, and
- 1 million British thermal units (mmBtu) is equivalent to 28.3278 $m^3$ of natural gas, then
- the ECO office's 7,807.7 $m^3$ share of natural gas use is equivalent to 2,756.2 therms
  - 7,807.7 $m^3$/ 28.3278 = 275.619709 mmBtu or 2,756.2 therms
- 2,756.2 therms X 0.005 = 13.781 metric tonnes of $CO_2$.

**7.** Based on discussions with Bullfrog Power. See also: REALPAC, report, *2014 Energy Benchmarking Report, Performance of the Canadian Office Sector*, Figure 18, February 11, 2015. c.ymcdn.com/sites/www.realpac.ca/resource/resmgr/Industry-Sustainability-Energy/RP_2014_EnergyReport_06_FINA.pdf?hhSearchTerms=%22electricity%22 (On average Ontario's office sector in 2013 used about 19.7 KWh/ $ft^2$.)

**8.** Average natural gas use for Canadian office space was 671 $m^3$ /1,000 $ft^2$ in 2013 (REALPAC, report, *2014 Energy Benchmarking Report, Performance of the Canadian Office Sector*, Figure 19, February 11, 2015). ECO's average natural gas use in 2015 (7,807.73 $m^3$/7.08 - ECO's square footage is 7,080 $ft^2$) was 1,103 $m^3$ /1,000 $ft^2$ in 2015.

**9.** To accommodate our new responsibilities to report on climate change and energy conservation.

**10.** Bullfrog certification offsets the office's estimated electricity use by injecting an equivalent amount of green energy onto the grid (see: www.bullfrogpower.com/green-energy/how-it-works/).

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**11.** For several years, the ECO has received special recognition for office-wide participation in this initiative, which tracks the modes of transportation staff use to commute and encourages low-carbon travel (e.g., walking, cycling, and public transit.) During the 2015 Healthy Commute week, the ECO staff offset over 370 kg of $CO_2$ compared to a single-passenger car commute of the same distance, which largely reflects staff members' regular, sustainable commuting practices. These commuting behaviours are enabled by our office's central downtown location—near transit hubs and along the city's growing bike lane network—as well as facilities like secure bike racks and a shower.

**12.** Notwithstanding the fact that the ECO office is located within a building that has a silver BOMA Best Building Environmental Standards certification. The minimum requirements to achieve basic BOMA certification are meeting 14 best practices, most notably relating to the building's water use, indoor air quality, waste management, and energy use. Silver is awarded to buildings that have met these best practices and have achieved between 70-79% on the BOMA questionnaire (see: www.bomabest.com/wp-content/uploads/4.-BESt-Practices.pdf).

# Guide to Energy Units and Conversion Factors

The report switches between measurements of energy in common everyday units – like cubic meters of natural gas ($m^3$), litres of gasoline, and kilowatt-hours of electricity (kWh) – to more universal and comparable units of energy – like joules (J) or equivalent kilowatt-hours (ekWh). The latter allows for an apples-to-apples comparison between different energy sources (e.g., electricity and natural gas).

Below are some typical examples of activities and their relative energy uses expressed in both styles.

## Units of Measurement for Everyday Uses of Energy

| Activity | Approximate Amount of Energy | |
|---|---|---|
| | Customary Units | Joules /ekWh |
| Using an LED reading lamp for 1 hour | 6.3 Wh | 22.7 kJ |
| Watching a flat screen television for 1 hour | 100 Wh | 360 kJ |
| Running an electric clothes dryer for 1 hour | 2.8 kWh | 10 MJ |
| Heating water for a bath (with natural gas) | 0.5 $m^3$ | 19 MJ / 5.2 ekWh |
| Amount of energy in a propane barbecue cylinder | 17 L | 500 MJ / 139 ekWh |
| Amount of energy in a compact car's gasoline tank | 30 L | 1 GJ / 278 ekWh |
| Average Ontario annual household electricity use | 9,000 kWh | 32.4 GJ |
| Average Ontario annual household natural gas use | 2,389 $m^3$ | 92 GJ / 25.5 eMWh |
| Electricity use for Sick Kids Hospital in 2012 | 59.4 GWh | 213.8 TJ |
| Estimated annual transportation fuel use of light-duty vehicles of residents of Guelph, Ontario | 176.2 ML | 6.3 PJ / 1.7 eTWh |
| Annual electricity use of the province in 2014 | 144 TWh | 518.4 PJ |

## Prefixes for Units of Measurement

| Prefix | Quantity |
|---|---|
| kilo (k) | Thousand (1,000 or $10^3$) |
| mega (M) | Million (1,000,000 or $10^6$) |
| giga (G) | Billion (1,000,000,000 or $10^9$) |
| tera (T) | Trillion (1,000,000,000,000 or $10^{12}$) |
| peta (P) | Quadrillion (1,000,000,000,000,000 or $10^{15}$) |

To easily convert energy metrics, we recommend this website:

**www.onlineconversion.com/energy.htm**

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ISSN 1923-2241 (Print)
ISSN 1923-225X (PDF)

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# *Time-of-Day Rate Study*

## *Summary of Results*

***(For Discussion Purposes)***

***Newfoundland Power***

***November 12, 2017***

## 1.0 Background

In 2011, Newfoundland Power (the "Company") began a study to: (i) determine how time-of-day ("TOD") rates would change customers' electricity use during the winter season; and (ii) provide the Company with experience in administering TOD rates.

Overall, the study showed shifts in customer load during the morning peak. However, it did not show a shift in customer load during the evening peak.

## 2.0 Study Design

The TOD study included 240 residential participants: 120 in a Study Group using a TOD rate and 120 in a Control Group using the standard domestic rate.[1] Residential participants were categorized based on heating source as Electric, Dual Fuel, or Non-Electric.[2] Participants were included from Western, Central and St. John's regions.

The study only attracted 4 large general service customers.[3] Large general service customers who declined to participate indicated they did not believe there were sufficient opportunities to shift their load.

TOD rates, provided in Table 1, were in effect for Study Group participants from December 2011 to November 2013. Participants were encouraged to shift their electricity use to off-peak hours, with load-recording meters in place to track consumption. Residential participants in the Study Group and Control Group were also provided with home energy monitoring devices.

**Table 1:**
**TOD Study Rates[4]**

| | Energy Charges (¢/kWh)[5] | | Demand Charge |
|---|---|---|---|
| **Rate Design** | **Non-Winter** | **Winter** | **$ per kVA** |
| Domestic | 9.166 All kWh | 15.271 on-peak kWh<br>10.266 off-peak kWh | - |
| Large General Service | 7.637 All kWh | 13.343 on-peak kWh<br>8.538 off-peak kWh | 1.84 |

The on-peak rate was approximately 48% higher for residential and 56% higher for large general service participants. The differential was designed to provide an incentive to shift load to off-peak hours.

1 Results from 31 participants were excluded due to major changes in their service (e.g. changing addresses).
2 Electric participants were those whose primary heating source was electric. Dual Fuel participants were those with electric heat and a supplementary heat source. Non-Electric participants are those with oil or other heating.
3 Large general service customers are those falling under Rate 2.4 (>1000 kVA).
4 Rates were updated on July 1, 2012 and July 1, 2013 to reflect routine changes in electricity rates.
5 Winter on-peak was from 8:00am to 12:00pm and 4:00pm to 8:00pm, Monday through Friday, for December through March. Non-Winter months were April through November.

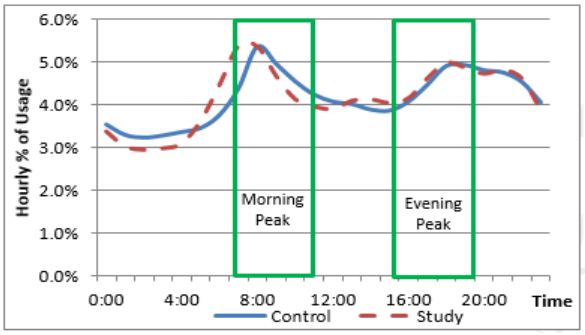
## 3.0 Results – Load Shifting

The study showed residential Study Group participants could achieve shifts in load during the morning peak, but could not achieve any material reduction or shift in load during the evening peak.

Figures 1 to 3 provide load shapes for each residential category for both the Study Group and the Control Group. These graphs show the percentage of daily use per hour.

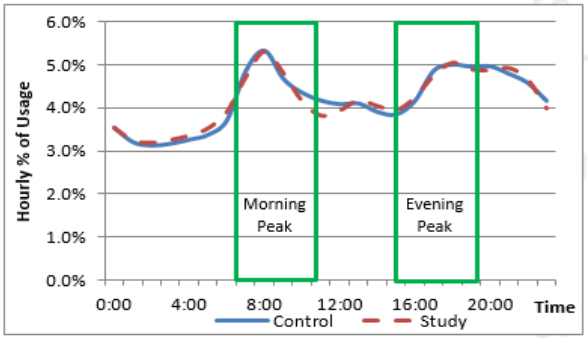
Electric participants shifted their morning peak to earlier. This reduced the amount of energy consumed at peak by 0.6 kWh per customer, or 5% of morning peak usage. There was no material difference for the evening peak.

**Figure 1: Electric - Load Shape**



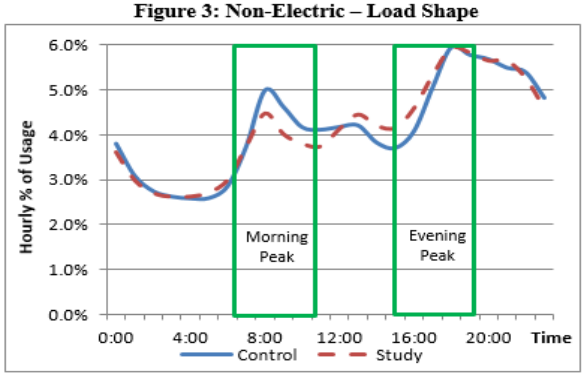

Dual Fuel participants achieved a shift in the latter part of the morning peak, with no material difference for the evening peak.

**Figure 2: Dual Fuel - Load Shape**




Non-Electric participants consumed less of their daily load requirements during the morning peak, reducing their morning peak usage by 11%. However, participants appeared to experience an increase during the evening peak.

**Figure 3: Non-Electric – Load Shape**




Of the 4 large general service participants, 3 exhibited energy savings that ranged from 2.3% to 3.2% during the morning peak, and 1.7% to 3.6% during the evening peak.

There was insufficient participation among large general service participants to produce a meaningful analysis of results.

## 4.0 Results – Energy Conservation

Among residential participants, analysis shows only Dual Fuel participants achieved a statistically significant reduction in average energy use. However, this change was more pronounced in the Dual Fuel Control Group than the Study Group, suggesting energy conservation could not be attributed to the TOD rate.

**Table 2:**
**Average Daily Winter Energy Use**

| Heating type | Change in Daily Use (kWh) | | Average Daily Use (kWh) | | Percentage Change | |
|---|---|---|---|---|---|---|
| | Study Group | Control Group | Study Group | Control Group | Study Group | Control Group |
| Electric | -1.12* | -0.50* | 73.6 | 74.8 | -1.5% | -0.7% |
| Dual Fuel | -3.12 | -3.67 | 64.0 | 64.9 | -4.9% | -5.7% |
| Non-Electric | 1.08* | 0.96* | 26.5 | 26.6 | 4.1% | 3.6% |

* Change in daily use was not statistically significant.

## 5.0 Results – Customer Bills

On average, in comparison to the Control Group, the Study Group experienced a reduction in energy charges of about 0.2%. Table 3 shows the change in total customer billings per year.

**Table 3:**
**Study Group – Residential Billing Impact**
**(% of Participants)**

| Annual Impact (%) | Electric | Dual Fuel | Non-Electric |
|---|---|---|---|
| Decrease of 4% or more | - | - | 2.7 |
| Decrease of 2-4% | - | 13.7 | 70.2 |
| Decrease of 0-2% | 48.4 | 48.3 | 24.3 |
| Overall % receiving decreases | 48.4 | 62.0 | 97.2 |
| Increase of 0-2% | 48.4 | 34.5 | 2.7 |
| Increase greater than 2% | 3.2 | 3.5 | - |
| Overall % receiving increases | 51.6 | 38.0 | 2.7 |

Electric participants were most likely to experience a billing increase using TOD rates, while Non-Electric participants were least likely to experience a billing increase.

All billing increases that occurred during the study were refunded as a condition of participation.

## 6.0 Results – Participant Feedback

Overall, 35% of participants indicated they would chose the TOD rate. However, only 17% thought a TOD rate should be mandatory. Approximately 61% of participants responded positively when asked how easy it was to shift their load.

Both the Study Group and the Control Group participants were asked how often they completed various household end-use activities during on-peak periods. Table 4 shows how Study Group and Control Group participants responded.

**Table 4:**
**Frequency of Use for Various Household End-Use Activities[6]**

| | Morning Peak | | Evening Peak | |
|---|---|---|---|---|
| | **Study Group** | **Control Group** | **Study Group** | **Control Group** |
| Dishwasher | - | 8% | 23% | 43% |
| Clothes Washer/Dryer | 4% | 23% | 28% | 31% |
| Shower/Bath | 40% | 74% | 17% | 33% |
| Electric Heaters | 46% | 58% | 69% | 61% |
| Electric Range/Oven | 14% | 21% | 69% | 76% |

[6] Results show survey respondents who indicated they "always" or "usually" completed a particular end-use activity during on-peak periods.

# Dynamic pricing

## New offerings for winter 2019–2020

We've developed two new rate offerings, the Winter Credit Option and Rate Flex D, which will apply starting in winter 2019–2020. They will enable customers to save money by reducing their electricity use in critical peak periods, at our request. Customers who voluntarily help us reduce our electricity needs at times when demand is high will be compensated accordingly.

Details will be posted on April 1, when all rates are announced.

## Winter Credit Option

The Winter Credit Option is combined with the base rate. You'll receive a credit if you use less electricity during a critical peak event than you would have normally used. This option is risk-free, because your bill can only get smaller. The greater the effort you make, the more you'll save.

## Flex D

Rate Flex D is a new rate that includes a higher electricity price during critical peak events, but a lower price than the base rate the rest of the winter. The base rate applies outside the winter period. Rate Flex D requires a certain ability to curtail or displace electricity use, but offers greater potential savings than the winter credit.

## COMPARISON OF DYNAMIC RATE OFFERINGS WITH THE BASE RATE

| | RATE D (BASE RATE) | RATE D WITH WINTER CREDIT | RATE FLEX D |
|---|---|---|---|
| Summer period* | Base rate price | Base rate price | Base rate price |
| Winter period**, **outside of** critical peak events | Base rate price | Base rate price | Price lower than base rate |
| Winter period**, **during** critical peak events (Max. 100 hours/winter) | Base rate price | Base rate price minus credit of 50¢ per kWh curtailed | Price higher than base rate: 50¢ per kWh consumed |
| Impact on bill in relation to base rate | – – – | **Potential for savings.** Risk-free: the bill can only get smaller. | **Potential for substantial savings.** The bill can increase if consumption is not reduced during the critical peak events. |

*Summer period: April 1 to November 30
**Winter period: December 1 to March 31

## COMPARISON OF DYNAMIC RATE OFFERINGS WITH THE BASE RATE

### Summer period*

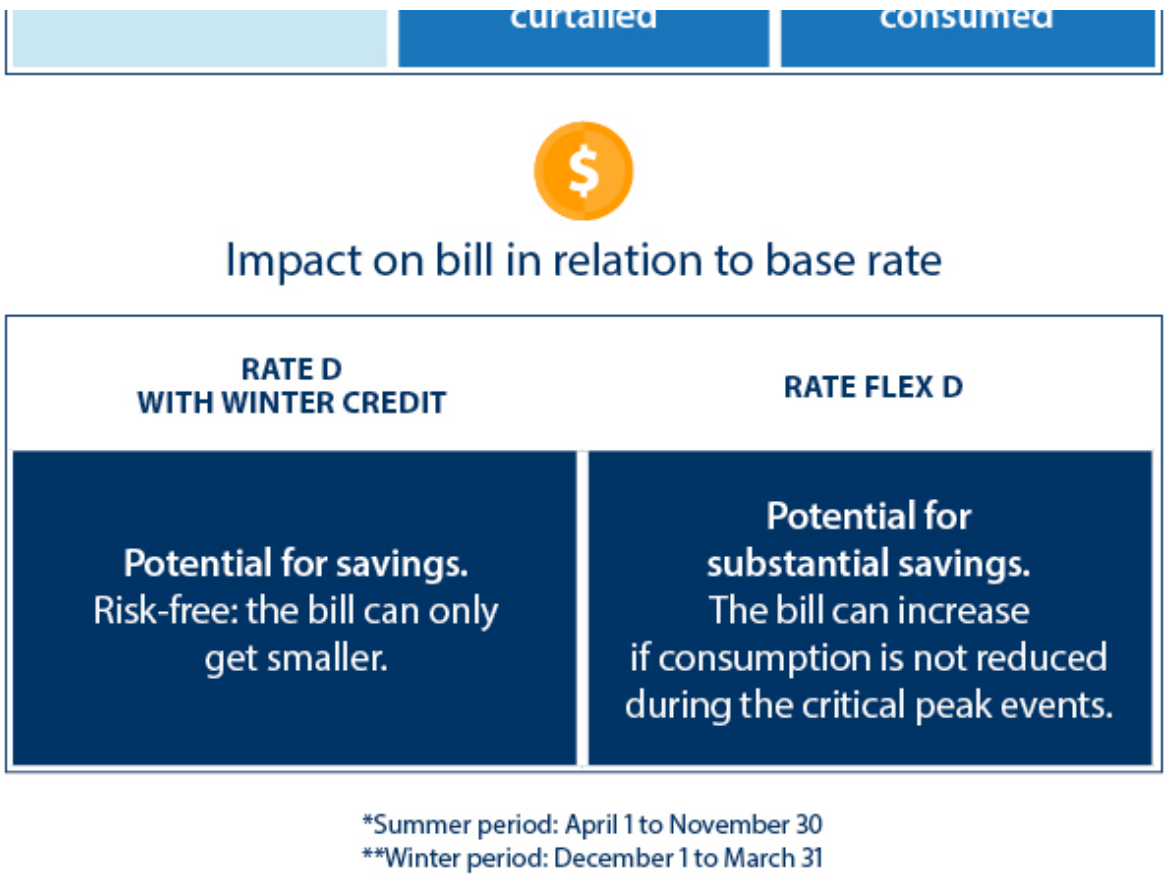
| RATE D (BASE RATE) | RATE D WITH WINTER CREDIT | RATE FLEX D |
|---|---|---|
| Base rate price | Base rate price | Base rate price |

### Winter period** **outside of** critical peak events

| RATE D (BASE RATE) | RATE D WITH WINTER CREDIT | RATE FLEX D |
|---|---|---|
| Base rate price | Base rate price | Price lower than base rate |

### Winter period** **during** critical peak events (Max. 100 hours/winter)

| RATE D (BASE RATE) | RATE D WITH WINTER CREDIT | RATE FLEX D |
|---|---|---|
| Base rate price | Base rate price minus credit of 50¢ per kWh curtailed | Price higher than base rate: 50¢ per kWh consumed |




## Gradual rollout

To provide optimum support to customers and ensure the success of the new rate offerings, they will be rolled out gradually.

- For winter 2019–2020, the rollout will be limited to 18,000 customers.
- Customers will be selected randomly from among all our customers in fall 2019.
- Only customers who have a Customer Space and a valid email address will be part of the selection pool.

  **If you haven't created your Customer Space yet**, it's the perfect time to do so!
  Create My Customer Space or add email address to my profile (https://www.hydroquebec.com/portail/en/group/clientele/gerer-mon-compte)
- Selected customers will receive an email invitation to sign up. They can opt for one of the new rate offerings or stay at their current rate.

# Frequently asked questions

## Who's eligible for dynamic pricing?

Both offerings are intended for customers who pay Rate D and are able to reduce or displace their electricity use at Hydro-Québec's request. For winter 2019–2020, randomly selected customers will be able to opt for one of them, if they wish.

## Do I have to sign up for the Winter Credit Option or Rate Flex D?

## Why has Hydro-Québec come up with these new rate offerings?

## What's a critical peak event?

## When do critical peak events occur?

## What's the difference between the Winter Credit Option and Rate Flex D?

## Why limit the number of participants the first year?

## How will you select participants?

## I'm very interested in dynamic pricing. Can I sign up right away?

## Can I put my name on a waiting list?