The Cost Impacts of Conservation

September 15, 2016 - DRAFT

The increasing cost of electricity in Ontario is leading to higher bills for most ratepayers. This note responds to claims that conservation efforts do not reduce costs, and may even contribute to increasing ratepayer bills. It examines the contribution of conservation to electricity system costs and bill impacts, now and in the future. It also considers the historical performance of Ontario's conservation efforts and the intended role of conservation in the future.

Outline

1. **Rising electricity prices**
    a. Demand growth
    b. Resource investments
    c. Marginal cost of power
    d. Cost recovery and allocation
2. **The impact of conservation**
    a. Near-term and long-term outlook
    b. Participant versus non-participant
3. **Conservation historical performance**
4. **Conservation outlook**
5. **Comparison of Ontario's home energy costs to other jurisdictions in Canada**

1. RISING ELECTRICITY PRICES

Rising electricity prices are a function of slow demand growth, new resource investments, changes in the marginal cost of power, and how costs are recovered and allocated among ratepayers. Understanding each of these components and how they work together is fundamental to understanding increasing prices and higher bills.

a. Demand growth

The forecasted demand growth in IPSP 1 was slowed by the economic downturn of 2008 and 2009. Since then, Ontario has struggled to regain the economic prosperity seen in the early 2000s. Slow recovery and near flat forecasted demand have left Ontario's electricity system with surplus capacity and energy. This surplus and flat demand, as identified in the 2016 *Ontario Planning Outlook*[1] extends into the mid-2020s. It not only impacts the economic viability of near-term projects, but also the burden placed on ratepayers to recover costs (see further below).

b. Resource investments

Resource investments, past and future, are required to maintain a safe, reliable, and cost-effective electricity system. These investments are made to replace aging infrastructure, accommodate forecasted demand growth, provide system flexibility and move Ontario toward a clean and sustainable energy future.

Recent and ongoing investments

The following is a summary listing of Ontario's electricity system investments.

- Renewable generation
    - Early adoption of technologies (mostly wind and solar), facilitated through various procurements, and in an effort to rebuild Ontario's economy and reduce its carbon footprint.

- Flexible capacity
    - Mostly made up of natural gas supply, procured as a cleaner alternative to coal, and necessary to meet system operability requirements.

- Transmission and distribution replacement and upgrades
    - Replacement of assets reaching end of life, and new infrastructure to enable renewables and demand growth.

[1] http://www.ieso.ca/Pages/Ontario's-Power-System/Ontario-Planning-Outlook/default.aspx

- Refurbishment and life extension of Ontario's nuclear fleet
    - Assessed as economic, the nuclear fleet will continue to provide cheap and clean electricity, and contribute to supply portfolio diversity.

- Emerging technologies
    - Development and investment in these technologies now creates potential for large gains in the future.

- Conservation
    - The IESO is establishing a culture of conservation, building capability in the marketplace for times when it is needed. Conservation can incent changes in consumption patterns through rate design and awareness; or subsidize more efficient technologies, avoiding the need for less economic resource alternatives – both of which are of value to the system and engaged participants.

c. Marginal cost of power

The marginal cost of power is dependent on Ontario's demand profile and resource portfolio. With flat demand growth and recent investments in low marginal cost technologies (wind and solar), the Hourly Ontario Energy Price (HOEP) has dropped significantly during off- and mid-peak periods. During these periods, HOEP is often $0/MWh, or potentially negative when actions to mitigate surplus baseload generation (SBG) are required.

During on-peak periods, HOEP for the most part is set by natural gas-fired generation. As such, on-peak HOEP is closely linked to the commodity cost of natural gas, and will soon be linked to the price of carbon established through Ontario's new cap and trade regime[2]. These trends will continue until Pickering NGS reaches end of life, and nuclear units at Bruce and Darlington go on refurbishment outages. With less nuclear energy available, the electricity system will experience less SBG, and the amount of time natural gas-fired generation will be on the margin, setting price, will increase.

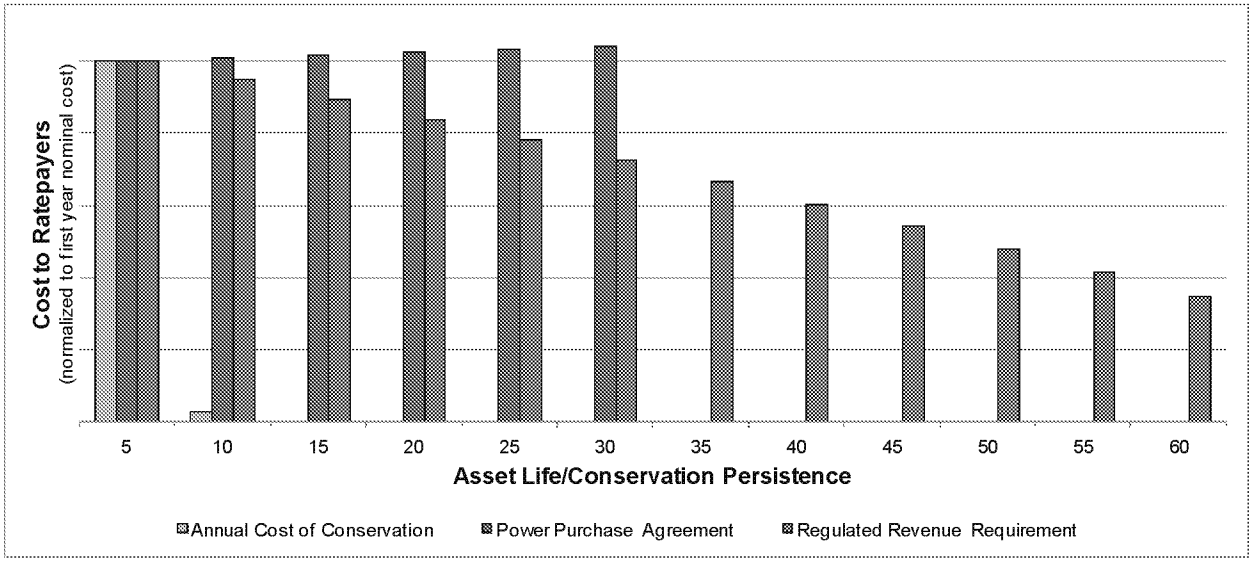
d. Cost recovery and allocation

Resource costs can be broken down into both fixed and variable costs. Fixed costs include capital, operating and maintenance not associated with energy production or transfer, and conservation program development and subsidies. Variable costs include fuel, and operating and maintenance associated with energy production or transfer. The proportion of these costs and how the costs are recovered are dependent on the resource.

[2] https://www.ontario.ca/page/cap-and-trade

Cost recovery mechanisms

The graph below illustrates the most common cost-recovery mechanisms – annual cost of conservation[3], power purchase agreement, and regulated revenue requirement/cost of service – and the typical longevity of the resources recovered through each mechanism.



Annual cost of conservation

Unlike other resources, there is a disconnect between when conservation costs are recovered and the utility or persistence of the conservation benefits. For example, subsidies paid out to program participants in a single year are submitted for recovery in that same year, while the reduced consumption associated with that subsidy may last 10 years or longer. In the past, the former OPA administered programs and submitted conservation-related costs to the Ontario Energy Board (OEB) through its revenue requirement submission. Under the new Conservation First Framework (2015-2020), local distribution companies (LDCs) play a greater role in the administration of programs, and will submit the related costs to the OEB through their revenue requirement submissions.

Power purchase agreement

Non-regulated generators that do not operate as merchant have a contract with the IESO[4]. These agreements can be capacity based, energy based, or both. The contracts typically have cost

[3] Not an official mechanism, but is how conservation costs flow and impact system costs and bills.

components indexed to inflation (annual cost increases year to year) and have a service life of over 20 years. The contract costs that are not recovered through Ontario's energy market are included in the IESO's revenue requirement submission (more on this in the following section).

Regulated revenue requirement

Regulated assets include OPG-operated nuclear and hydro, transmission infrastructure (mostly owned by Hydro One), and distribution infrastructure (mostly owned by the ~70 LDCs in Ontario)[5]. The costs associated with these resources are submitted to the OEB through rate filings, and costs are recovered annually as they are incurred. This mechanism of cost recovery means that costs are front-end loaded (as shown in the illustration above). These resources typically last for more than 40 years, becoming intergenerational, so ratepayers reap the benefits of assets procured in the past, but also pay a large component of new investments that will be used by future ratepayers.

Market and out-of-market costs

HOEP is Ontario's hourly average market clearing price, set by supply and demand. Market participant generators submit offers to produce electricity and market participant dispatchable loads submit bids to reduce consumption. When the offer and bid curves intersect, the market clearing price for that interval is established, and dispatch instructions are issued to generators and loads that clear the price.

Generators receive HOEP for each unit of electricity they produce, which results in revenue to cover their marginal cost of production, and depending on the contract/cost recovery mechanism, revenue to offset some or all of the remaining fixed cost obligations owed by the IESO[6]. To the extent fixed cost obligations remain, these costs are recovered outside of the energy market through the Global Adjustment (GA). Although it is not one to one, there is an inverse relationship between HOEP and GA. If HOEP is high, more costs can be recouped inside the market and GA decreases. If HOEP is low, the inverse occurs.

Conservation and demand management costs are also recovered through GA, while transmission, distribution, market operation, the Debt Retirement Charge (DRC), and other system costs are recovered through uplifts. All of these costs flow to the ratepayer.

---

[4] Contracts executed with the former Ontario Power Authority (OPA) are administered by the IESO following the merger of the two agencies effective January 1, 2015. Some non-utility generator (NUG) contracts are still administered by the Ontario Electricity Financial Corporation (OEFC).

[5] Natural gas utilities (Union and Enbridge) in Ontario are also regulated and submit costs that are to the benefit of the electricity system.

[6] Generators typically offer their marginal cost of production, so if they set price, they will not earn revenue to offset their fixed costs.

Setting prices

The OEB sets electricity rates – tiered rates or time-of-use (TOU) – to cover the variable and fixed costs associated with HOEP and GA. Although GA is essentially a tool to recover fixed costs, it is charged volumetrically, and the revenue earned based on consumption may or may not be sufficient to cover costs. This surplus or deficit in revenue is accounted for and corrected year to year through rate adjustments.

The DRC is also a volumetric charge to customers, while delivery charges (transmission and distribution) and regulatory charges (all other) are a blend of volumetric and fixed monthly charges.

Volumetric charges associated with fixed costs place the highest burden on ratepayers. If investments are made in anticipation of higher demand that does not materialize, fixed costs increase, but without a proportional increase in volume, and rates go up.

Customer classes

Consumers are separated into two categories – Class A and Class B customers. Class A customers are made up of large-scale commercial and industrial loads, with peak consumption greater than or equal to 3 MW. The remaining commercial and industrial customers, and residential customers, form Class B. Class A customers are afforded an opportunity to avoid some or all of costs recovered through GA by reducing consumption during system peaks, an opportunity not available to Class B customers.

2. THE IMPACT OF CONSERVATION

Conservation reduces consumption, adds to system costs through program administration and subsidies, and has the potential to reduce HOEP and avoid other resource investments.

a. Near-term and long-term outlooks

Under current surplus conditions, which are expected to persist over the next eight years or so, conservation will do little to reduce HOEP during off-, mid- and on-peak periods, and will not avoid bulk-system supply investments. Some conservation initiatives may prove to be cost-effective, especially when coupled with other potential value streams (e.g., local area capacity or distribution investment deferral or avoidance), but for the most part, and over the next eight years, planned and incremental conservation will increase system costs and consumer bills.

Beyond eight years, when a system capacity need emerges and natural gas-fired generation is increasingly on the margin, conservation will have the potential to reduce HOEP over all

periods, and avoid bulk-system supply investments, resulting in greater cost-effectiveness and the potential to lower system costs and consumer bills.

b. Participant versus non-participant

Although conservation programs are generally to the benefit of the system, they may result in winners and losers. A program will result in a decrease in system costs (avoided costs net of program-related costs), and a decrease in system energy requirements, both attributable to the program participant. If the net impact of these changes results in a higher overall rate, the system and participant will benefit from lower overall costs, but the non-participant's bill will increase. If the net impact of these changes results in a lower overall rate, all stakeholders will benefit.

3. CONSERVATION HISTORICAL PERFORMANCE

The success of conservation is measured at the portfolio level, considering the fact that some programs are pilot projects, intended to garner learnings that can be applied to future programs, while other programs are intended to realize broader benefits, such as assisting low-income households.

Conservation programs undergo a rigorous evaluation, measurement and verification (EM&V) process to ensure accuracy of results, and to determine their cost-effectiveness. Since 2009, the former OPA and IESO have administered one of North America's leading EM&V programs.

Between 2006 and 2010, approximately $2B of spending on conservation led to approximately $4B of avoided costs for new supply. The $2B in conservation costs include all incentives, program administration costs for the former OPA and LDCs, as well as the incremental equipment costs borne by the participants in conservation programs. The $4B in avoided cost is based on the alternative resource portfolio needed in the absence of conservation.

The avoided costs used to assess the 2011-2014 value of conservation reflect the assumptions used for long-term energy planning. Using avoided costs at a bulk-system and regional level to assess the value of conservation is industry best practice, taking the long-term view to consider all potential future system benefits. The avoided cost is calculated by determining the cost of the supply resources needed to run the electricity system with conservation and comparing it to the cost of the system without conservation. The difference equals the avoided cost.

4. CONSERVATION OUTLOOK

The Conservation First Framework will provide LDCs with long-term, stable funding for conservation programs, through to 2020. LDC-delivered conservation programs are planned to account for a reduction of 7 TWh in electricity consumption by the end of 2020. The IESO will work with industrial consumers to achieve an additional reduction of 1.7 TWh through the Industrial Accelerator Program (IAP). Each LDC has to maintain a cost-effective portfolio; each portfolio is annually subjected to IESO's EM&V process.

The long-term achievable potential study[7], conducted by Nexant Consulting, estimates that the province can achieve electricity savings of 18 TWh by 2035 if conservation incentive levels and budgets in place today continue into the future. This represents a 12% reduction in Ontario's electricity use. There is potential to achieve cost-effective savings of up to 45 TWh if additional funding were available, or if additional savings were realized for each dollar invested in CDM. (e.g., through operational cost-efficiencies resulting from increased collaboration among utilities).

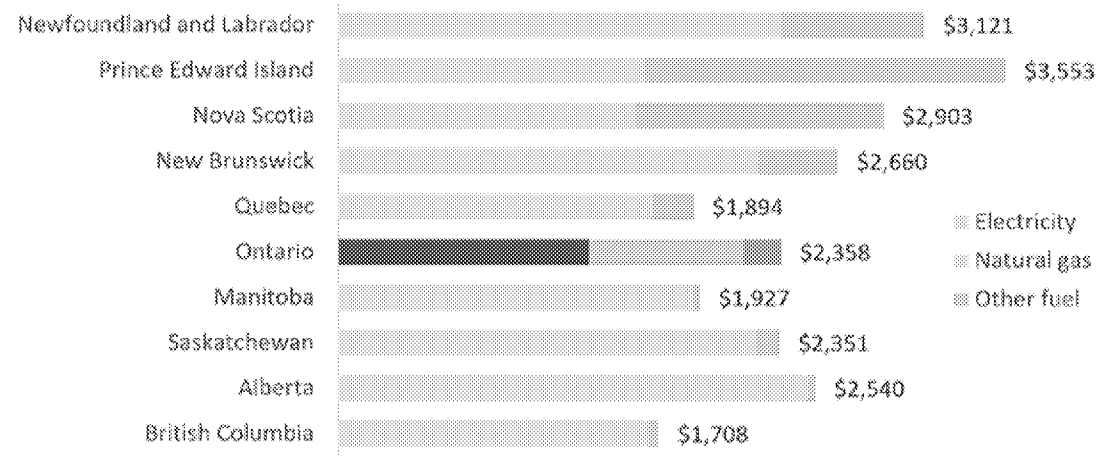
5. COMPARISON OF ONTARIO'S HOME ENERGY COSTS TO OTHER JURISDICTIONS IN CANADA[8]

Ontario home energy costs are higher than in Quebec, Manitoba, and British Columbia, but lower than in Atlantic Canada and Alberta. The average household home energy cost in 2014 was $2,358.

The following table shows that Ontario's electricity costs are on the lower end when compared to other provinces.

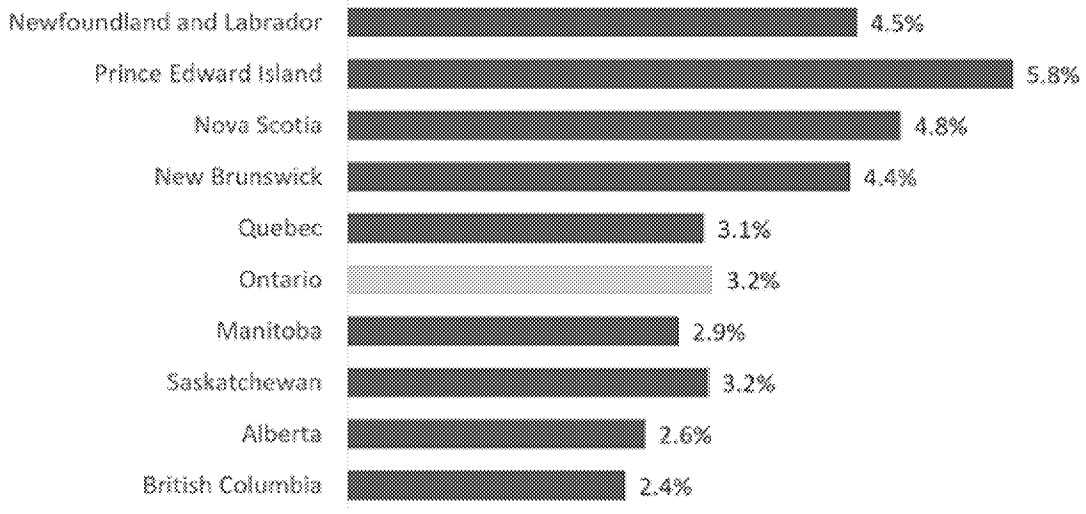
[7] Estimates do not consider behind-the-meter generation.
[8] Financial Accountability Office commentary posted August 25, 2016.

Figure 1: Average Household Home Energy Cost, 2014*



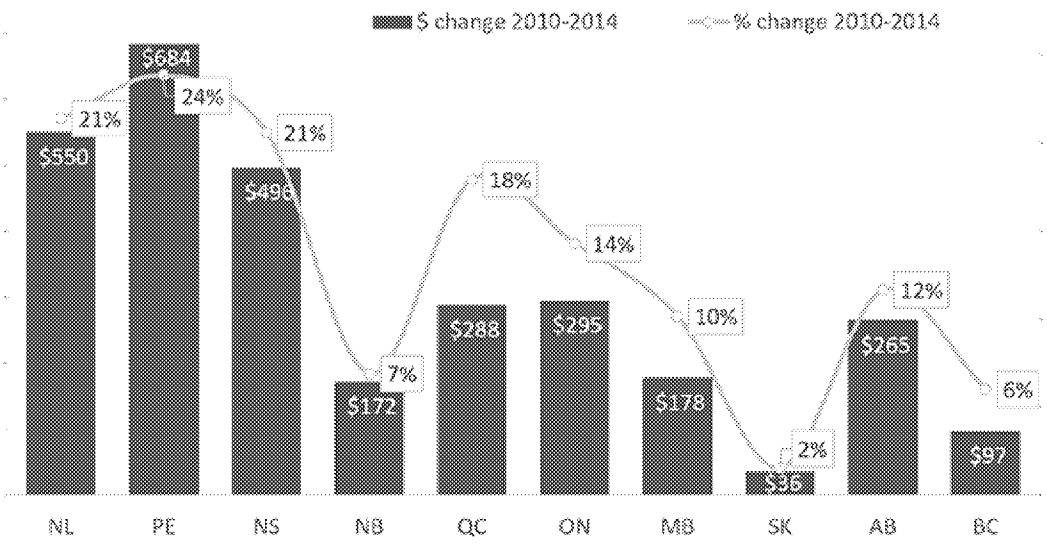
However, the share of after-tax income spent by Ontarians (3.2 percent) on home energy costs is similar to shares in Quebec and Manitoba, significantly less than in Atlantic Canada, but higher than in Alberta and British Columbia.

Figure 2: Average Household Home Energy Cost as a Share of Average After-Tax Income, 2014*



From 2010 to 2014, Ontarians experienced average increases in home energy costs relative to residents of other provinces – an increase of $295 or 14 percent.

Figure 3: Change in Average Household Home Energy Cost, 2010-2014



It should also be noted that consumers have also experienced large increases in other home services such as cable, internet and phone in recent years.