Conservation Achievable Potential in Ontario

Presentation to the Premier's Office

May 31, 2017

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Purpose

- To provide an overview of the achievable potential for conservation in Ontario

Outline

- Highlights
- Conservation goals and context
- Achievable Potential Study results
- Conclusions
- Appendices

Highlights

- The Achievable Potential Study (APS) released in June 2016 assessed achievable, cost-effective energy savings by 2020 and by 2035 from energy-efficiency measures, including behind-the-meter generation from combined heat and power (CHP)
  - 7.3 TWh of savings by 2020 were identified as achievable within the existing budget of the Conservation First Framework (CFF), compared to the CFF target of 7 TWh
  - The study showed that long term economically feasible conservation of 17.8 TWh is achievable by 2035 at a cost of ~$5.5B projecting current spending and customer incentives
- In response to advice provided by the independent expert panel established to guide the APS, the IESO developed an additional achievable potential scenario for the long-term potential to 2035 in November 2016 – the Market Achievable Potential*
  - Market Achievable Potential identifies the total cost-effective energy-efficiency potential based on adjusted historic market adoption rates, assuming customer incentives cover 100% of the incremental costs between the efficient measure and the standard measure
  - Market Achievable Potential indicates that 29 TWh of cost-effective achievable potential is available by 2035 at a cost of ~$15B. If combined with forecasted savings from codes and standards, a total of 46 TWh of cost-effective energy efficiency is achievable by 2035.
- ~~While additional conservation potential exists, in light of the current supply mix, pursuing all of the additional conservation at this time would result in an increase in electricity rates beginning in the 2020s.~~ Further work is needed to refine our understanding of opportunities and cost estimates and, if needed, how best to integrate additional conservation into long-term electricity system plans to maximize value for electricity consumers while achieving government policy objectives.
- The Ministry of Energy could consider reaffirming commitments to current conservation targets in the 2017 LTEP, but continue to explore options to best realize higher levels of conservation in view of opportunities for reductions in electricity costs and emissions.

*See appendix for detailed explanation of terms

Why Conservation?
Helps drive energy efficiency (EE)/reductions beyond codes and standards
Lowest cost resource (~$0.04/kWh)
Helps to create impetus, acceptance for more stringent codes and standards by upping the bar/normalizing efficient technology
(e.g. incandescent to CFLs to LEDs; CACs in HVAC)
Can be located anywhere (no siting issues)
Every home and business can participate and personally benefit from it (comfort, lighting/process quality)
Individual homes/businesses have always been implementers of EE; as decentralized energy resources grow and end-users take on new roles (Distributed generation, microgrids, storage) there is opportunity to apply the relationships/learnings we've had from Conservation to engage them in all aspects of energy

10 yr demand met by EE/codes

Per Chuck's presentation to mgmt group on Friday
Mid-2020s w/ nuclear refurb/end-of-life and NUG/renewable contracts ending, likely supply needs
B/c average savings persistence of program measures in 9-12 years, savings from CFF (both kWh/kW) will mitigate supply issues in 2020s
Over next 10 years, localized needs may be addressed w/ EE (discussed later) by bringing down demand overall

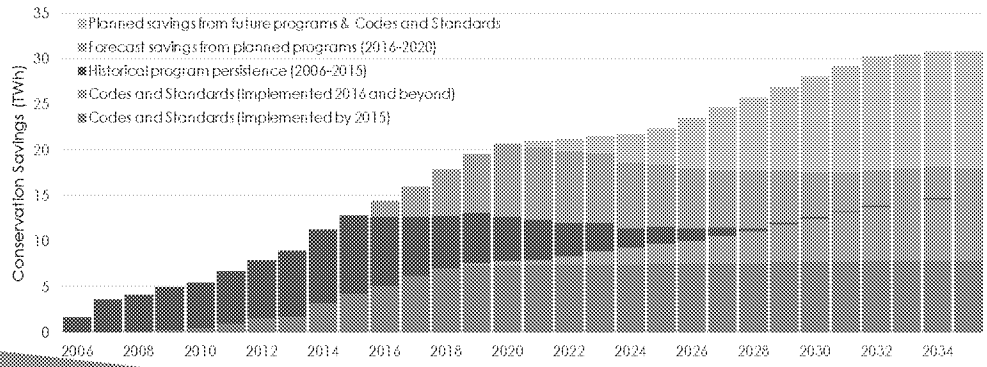
8.7 TWh
Based on 2014 achievable potential study conducted by IESO
APS currently being updated in collaboration w/ LDCs

DR (move to market; collaboration b/w CCR & MRD)

10% = reduction of approx. 2,400 MW from gross forecast
Transition of DR3 program (multi-year, contract based) to annual DR auction (beginning 2015) is great example of collaboration between Conservation and MRD
Key next step towards DR will be to transition residential DR to market – informed by DR Working Group

How will conservation goals be met?

- The goals will be met through conservation programs, building codes and equipment standards addressing current electricity end uses
- Half of the target is expected to be achieved through existing and planned programs and codes and standards. The other half is to be achieved through new programs and/or new codes and standards
- Opportunities for conservation can vary with reductions or increases in demand for electricity. The value of conservation increases with demand, unlocking conservation potential otherwise considered uneconomic, and supporting higher investment in more efficient technologies.



Source: 2016 Ontario Planning Outlook

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2006-2011 = 1,900 MW of electricity - the equivalent of removing over 600,000 homes from the grid
Third Tranche funding – LDCs and IESO delivering CDM (generally separately – sometimes with competing programs)
Brands such as Every Kilowatt Counts
Programs like Great Refrigerator Round-up and peaksaver introduced

2011-2014
2011-2014 = 6,553 gigawatt-hours (GWh) (enough to power 170,000 homes for a year)
Introduction of consistent branding – Save on Energy
All LDCs delivering all province-wide programs
New programs introduced – e.g. Home Assistance (Low income), Aboriginal conservation program
Only one LDC program approve by OEB (Powerstream's business refrigeration) because of challenges of avoiding duplication with province-wide programs

Conservation First Framework: ambitious targets for 2015-2020

- 7 TWh of cost-effective electricity savings to be achieved by end of 2020 through LDC CDM Plans:
  - $2.2B budget over six years administered by IESO
    - $1.8B for LDC delivery costs
    - $0.4B for central services costs
  - Each LDC assigned six-year target and budget
- 1.7 TWh savings to be delivered by IESO from transmission-connected customers via Industrial Accelerator Program (IAP) with $500M budget
- LDC CDM six-year plans include:
  - Annual target and budget milestones set by LDC
  - Consideration of CDM in local/regional planning
  - Programs for all sectors set out in CFF direction
  - Province-wide, regional and/or local programs
- Core CFF elements:
  - Long-term, stable CDM funding; cost-effective savings
  - Flexibility for LDCs to meet needs with local programs
  - Introduces risk/reward financing (pay for performance)
  - Promotes LDC/gas collaboration and innovation

8.7
terawatt-hours
by the end of 2020

Programs for all sectors:

Residential
Low-income
Small business
Commercial
Agricultural
Institutional
Industrial

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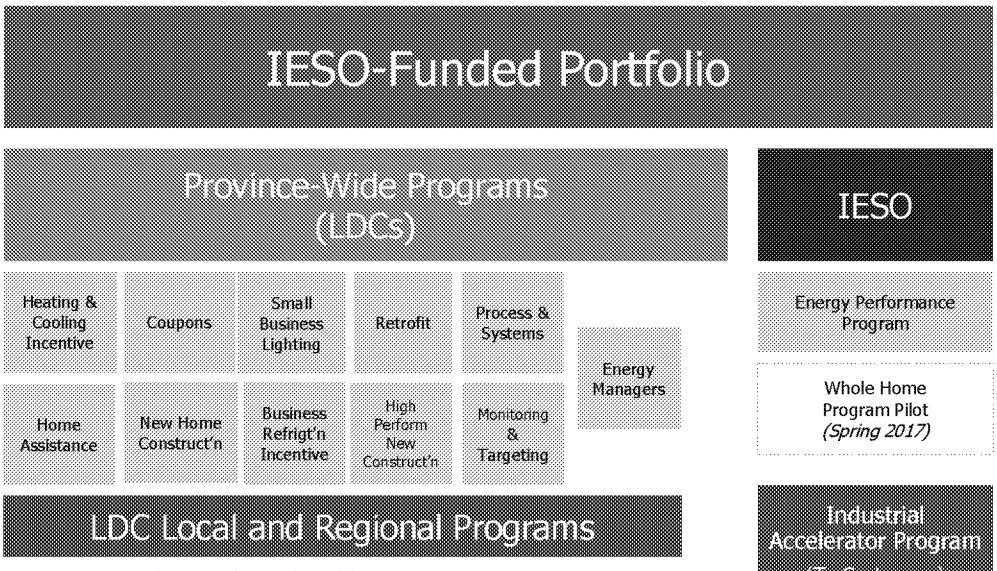
Conservation First Framework programs serve all Ontarians



Consumers in the residential and business sectors can access information on energy-efficiency programs through the Save on Energy website at saveonenergy.ca.

What is a conservation achievable potential study?

- A conservation APS estimates the electricity savings that could be realized over time through the implementation of electricity conservation measures in the market, starting from the current state of technology penetration
  - IESO study includes both energy-efficiency measures and behind-the-meter generation (BMG) from customer-owned CHP
- Such studies can be used to inform:
  (i) long-term electricity system planning
  (ii) target/goal-setting for CDM
  (iii) CDM program planning

Why conduct a new achievable potential study?

- Updated and more detailed information can help guide policy/program development, and regional and long-term electricity system planning
- The IESO is required to conduct this study every three years by a March 31, 2014 ministerial direction
- The Energy Conservation Agreement (ECA) between the IESO and LDCs (governing their CDM targets and budgets)
  - established the parameters for the study, including timing, creation of a working group with LDCs and IESO members, and the method for the study (bottom-up with emphasis on local data)
  - LDC mid-term financial incentives under the CFF are based on achievement of the lesser of 50% of their CDM plan target, or 50% of the achievable potential in their service area per the APS

Long-term energy-efficiency potential from existing programs, codes and standards and Market Achievable Potential

- 2013 LTEP target is **30 TWh** by **2032**
  - 8.6 TWh from forecasted codes and standards
  - 1.6 TWh from future savings from existing codes and standards
  - 20 TWh from CDM programs from 2013 and beyond
- Further analysis since 2013 LTEP increased the forecasted savings from codes and standards to **15 TWh** by **2035** (vs. 10.2 TWh in 2013 LTEP for 2032)
- The Market Achievable Potential indicates that **29 TWh** of customer level (31 TWh at generator level) conservation potential could be achieved between 2015 and **2035**
- Accordingly, between the 2016 OPO forecasted savings from codes and standards plus the Market Achievable Potential, a total of **46 TWh** of cost-effective CDM is achievable by 2035

Comparison of Budget-Constrained Achievable Potential and Market Achievable Potential

- Under the Market Achievable Potential scenario, by 2035, 29 TWh of CDM could be delivered at a cost of approximately $15B vs. 17.8 TWh at a cost of $5.5B by 2035 under the Budget-Constrained scenario
- The Market Achievable Potential reflects incentive levels set at 100% of the incremental cost whereas the Budget-Constrained Achievable Potential is consistent with the current Conservation First Framework
- Competitive procurement could reduce the cost associated with program delivery and increase the Market Achievable Potential or decrease the associated acquisition cost

Scenario	2035*	
	TWh	$B
Market Achievable	29	$15
Budget-Constrained Achievable	17.8	$5.5

*Based on Market Achievable Potential study.

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Check – what's in the 1.3B

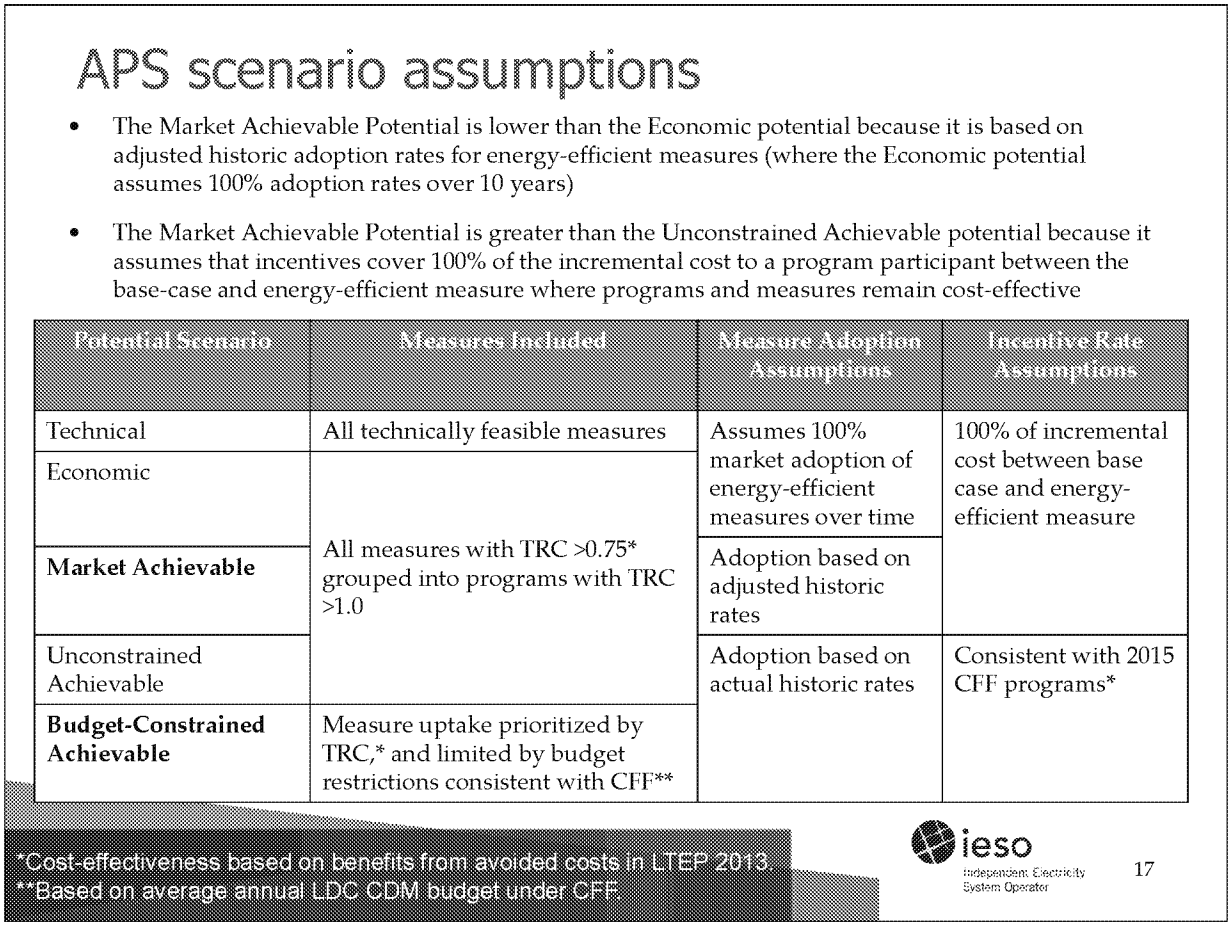
Conclusions

- The Market Achievable Potential study indicates that there is significant incremental cost-effective achievable potential available in the long term in Ontario
  - As much as 46 TWh of energy efficiency is achievable in Ontario by 2035 through codes and standards and cost-effective conservation as per the Market Achievable Potential study
- Pursuing the full higher level of conservation at this time, compared to current conservation targets would result in:
  - A reduction in electricity demand by about 10%
  - Generally no change in the timing of capacity needs but a reduction in longer-term resource needs
  - Reduction in greenhouse gas emissions by an average of about 0.7 MT per year between 2017 and 2035
  - Increases in surplus energy by an average of about 2 TWh per year starting in 2021
  - Increases in total system costs by an annual average of about $100M to $200 M per year, ranging from an increase of $600 M per year in the earlier years of 2021 to a decrease of $300 M per year by 2035
  - Increase in average residential bills by $1/month and industrial rates by $1/MWh to $3/MWh
  - The above assumptions do not factor in any cost savings that could be realized through competitive acquisition of CDM resources, or decreases in technology costs that could be realized over time with increased adoption
- Further work is needed to improve understanding of conservation potential and to enhance the value of this resource in long-term electricity system plans:
  - Better timing of investments, targeting and right-sizing conservation could improve cost-effectiveness, reduce surpluses, and help achieve policy objectives such as reducing greenhouse gas emissions in the context of climate change strategies
  - Better optimizing supply system adaptations to higher levels of conservation would improve cost-effectiveness, reduce surpluses, and reduce emissions
  - Opportunities may exist to enhance value of conservation by pursuing additional savings through codes/standards and improving allocation/funding of program budgets/expenditures

Appendices

Achievable potential scenario descriptions

- **Technical potential scenario**: savings potential when every technically feasible energy-efficiency measure is implemented at their full market potential, disregarding all rates of adoption, economics, and other non-engineering constraints
- **Economic potential scenario**: a subset of technical potential; the savings potential when every possible economically feasible energy efficiency measure is implemented
- **Market achievable potential scenario**: identifies the total cost-effective energy-efficiency potential based on adjusted historic market adoption rates, assuming customer incentives cover 100% of the incremental cost between the efficient measure and the standard base case measure
- **Unconstrained achievable potential scenario**: a subset of economic potential; the savings potential that further considers the rate of adoption of measures (i.e., even though energy efficiency measures may be cost-effective, they aren't acquired by the whole population all at once). The adoption rates used for this study were based on historic experience in Ontario. Adoption rates can be increased by increasing program incentive rates.
- **Budget-constrained achievable potential scenario**: a subset of achievable potential; this savings potential is limited to what can be obtained within a limited budget, prioritizing the most cost-effective savings. The budget limits set for this study were consistent with what was provided for the Conservation First Framework.



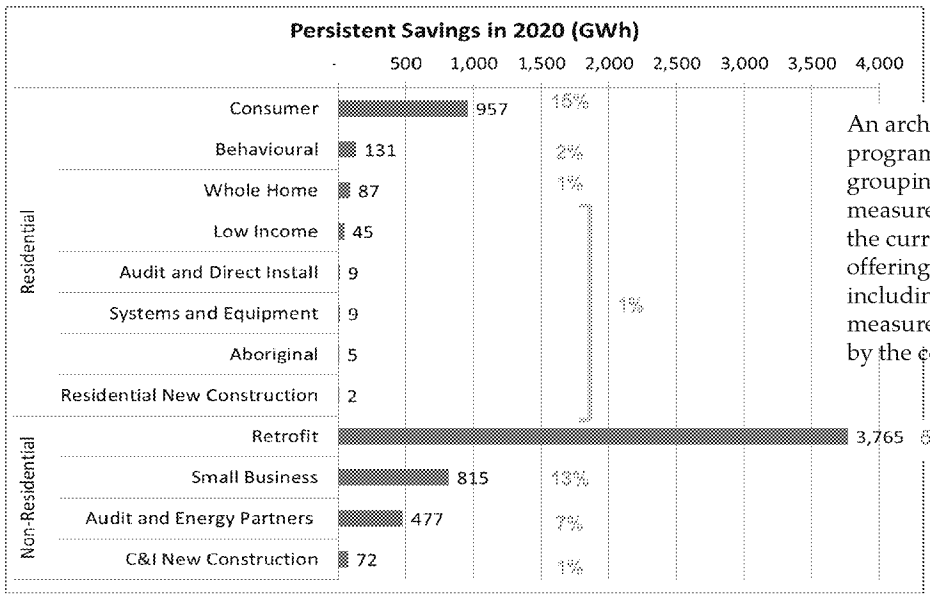
Explanation of stock conversion assumptions:

Tech and econ:
If something is newly acquired or breaks and needs to be replaced, it is assumed to be replaced by the efficient technology. Every year, 10% of the existing stock gets converted to the efficient technology such that the entire stock will be converted within 10 years.

Achievable:
Stock turnover is governed by adoption rates, built from historical experience with similar programs and existing participation. Adoption rates are elastic to varying degrees based on the incentive rates. If a greater proportion of the incremental costs are funded by the program administrator, the adoption curves become more aggressive and the efficient technology is adopted more quickly.

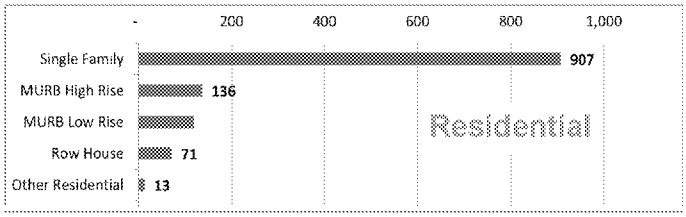
Can't Ontario achieve the economic potential?
The technical and economic potential are meant to set a theoretical upper bound for potential, and are not meant to reflect anything remotely similar to what programs can achieve.
Even at 100% incentive rates, economic potential cannot be captured.

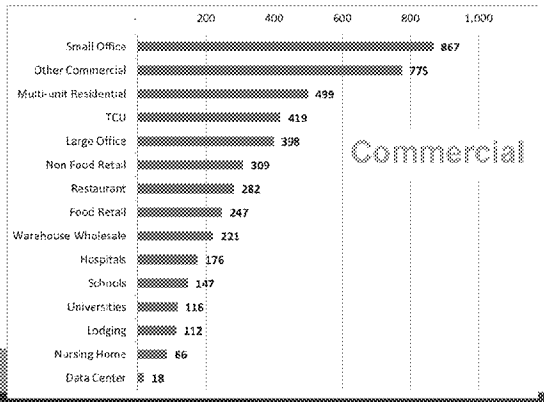
Budget-constrained achievable potential savings by archetype program: commercial retrofits still largest opportunity

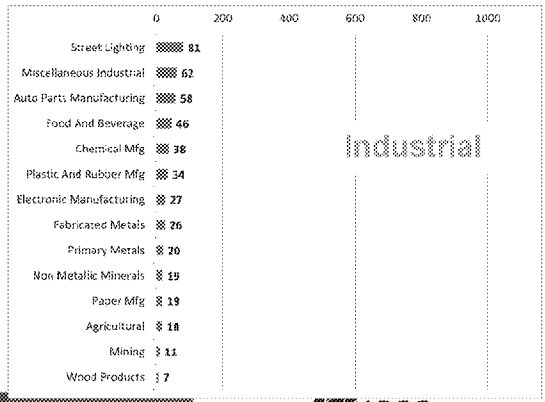


An archetype program is a grouping of like measures, similar to the current program offerings but including other measures identified by the consultant

2020 Budget-constrained achievable potential (GWh) by subsector: single-family residential and commercial office have greatest opportunity in their sectors







Cost-effectiveness and acquisition cost by archetype program: business programs are most cost-effective opportunity

	Archetype Program	TRC	PAC	Acquisition Costs ($/MWh)
	Audit and Direct Install	23.9	22.3	$284
C&I	Small Business Program	3.5	4.1	$319
C&I	C&I New Construction	2.0	5.3	$211
C&I	Retrofit Program	1.9	5.5	$191
C&I	Audit and Energy Partners	1.7	3.4	$191
	Residential New Construction	1.5	2.3	$504
	Whole Home	1.5	2.0	$1,241
	Consumer	1.3	1.6	$647
	Systems and Equipment	1.2	1.8	$1,028
	Behavioral	1.1	1.0	$775
	Low Income	0.7	0.6	$1,113
	Aboriginal	0.7	0.6	$1,282
	Portfolio	**1.8**	**3.6**	**$311**