

Emission Reduction and Long Term Energy Planning

Ontario Climate Consortium Symposium: The Next 150

May, 2017



Emission Reduction and Long Term Energy Plan

Project Overview and Discussion Points

Perceived Challenge:

- Inputs sought for LTEP consultation submissions
- No data on emission reduction implications for electricity

Syndicated peer reviewed study inspired by Bob Chiarelli and John Godfrey

- Approached diverse Ontario energy system stakeholders
 - Natural gas distribution companies
 - Local distribution companies, Baseload energy providers
 - Emission reducing technology stakeholders/researchers

Project Objectives:

- Identify Ontario stakeholders ideas for reducing emissions
- Quantify the associated cost of emission reduction
- Assess the electrification implications for Long Term Energy Plan
- Seek out an alternative electricity system approach at much lower cost

Discussion Points

- Ontario's Emissions Targets
- Politics of "Claiming Victory" vs "Value to Taxpayers"
- Buildings: Example of The Challenge
- Known solutions are expensive
- Electrification Implications
- Politics of "Green Image" vs the Politics of "Cost"

Ontario's Emission Challenge

Ontario has set out legislated GHG emission reduction targets.

These legislated emission reduction targets are:

- 15% below the Province's 1990 emission level by 2020;
- 37% below 1990 levels by 2030;
- 80% below 1990 levels by 2050;

Under a “no climate policy” assumption, emissions are projected to be 176 Mt in 2030.

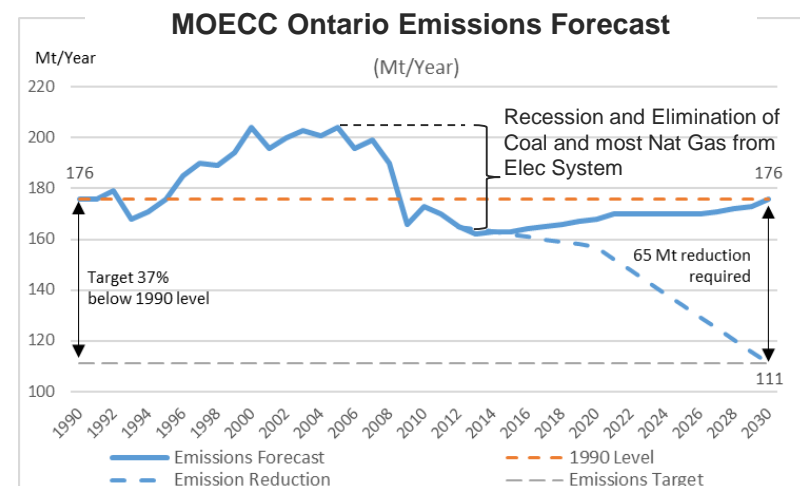
- The emission target for 2030 means 65 Mt of emissions must be removed from the projected level by 2030.

Background on Ontario's emissions

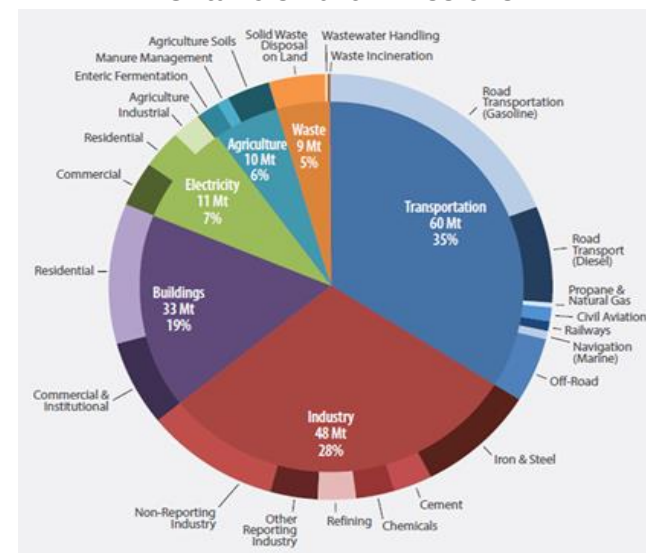
Emissions in Ontario are generated from six sectors.

82% of the province's 171 million tonnes (Mt) of emissions came from three sectors:

- Transportation (60 Mt)
- Industry (48 Mt)
- Buildings (33 Mt)



Ontario's 2013 Emissions



Source: MOECC Climate Change Strategy 2016

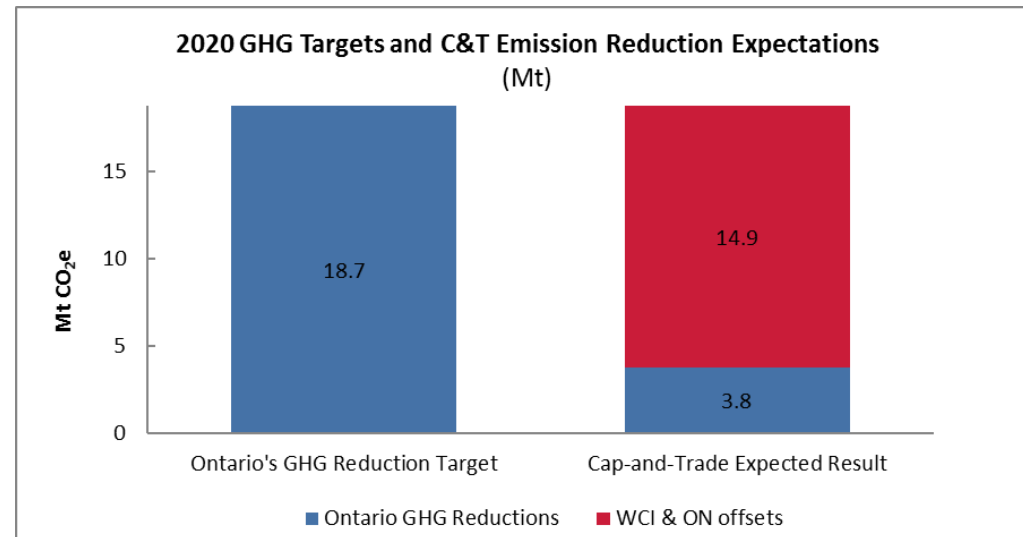
The Politics of “Claiming Victory” vs “Value to ‘Tax’ payers”

→ Cap & Trade program not expected to achieve reductions

Auditor General: Cap & Trade program only “allows claim” of target achievement

- MOECC C&T Economic Assessment:
→ No intent to achieve targets
- Reducing Emissions: → Harder in Ontario than California
- Cap & Trade: → Untracked cost to taxpayers/ ratepayers
- MOECC CCAP: → Targeted use of proceeds fall short

Neither Cap & Trade or CCAP are currently designed to achieve emission reduction targets



Why?

Because emission reduction is HARD and EXPENSIVE

Secondary Research Sources for Emission Reduction Ideas

Energy Solution Provider/ /Transmitters/Distributors	Energy Consumers	Interest Groups
Association of Power Producers of Ontario (APPrO)	Association of Major Power Consumers of Ontario (AMPCO)	Canadian Environmental Law Association (CELA)
Canadian Biogas Association (CBA)	Association of Municipalities Ontario (AMO)	Clean Economy Alliance (CEA)
Canadian Electricity Association (CEA)	Building Owners and Managers Association of Canada (BOMA Canada)	Clean Energy Canada
Canadian Energy Efficiency Alliance (CEEAA)	Business Council of Canada (BCC)	Environmental Defence
Canadian Gas Association (CGA)	Canadian Manufacturers and Importers (CME)	Greenpeace Canada
Canadian Nuclear Association (CNA)	Canadian Vehicle Manufacturers' Association (CVMA)	Ontario Clean Air Alliance (OCCA)
Canadian Solar Industries Association (CanSIA)	Ontario Chamber of Commerce (OCC)	Ontario Sustainable Energy Association (OSEA)
Canadian Wind Energy Association (CanWEA)	Ontario Home Builders' Association (OHBA)	Ontario Society of Professional Engineers (OSPE)
Electricity Distributors' Association (EDA)	Ontario Road Builders' Association (ORBA)	Ontario Trucking Association (OTA)
Decentralized Energy Canada (DEC)	Toronto Atmospheric Fund (TAF)	Pembina Institute
Energy Storage Ontario (ESO)	Ontario Petroleum Institute (OPI)	Pollution Probe
Ontario Energy Association (OEA)		Toronto Environmental Alliance (TEA)
Ontario Waterpower Association (OWA)		

Buildings Emission Reduction Challenge

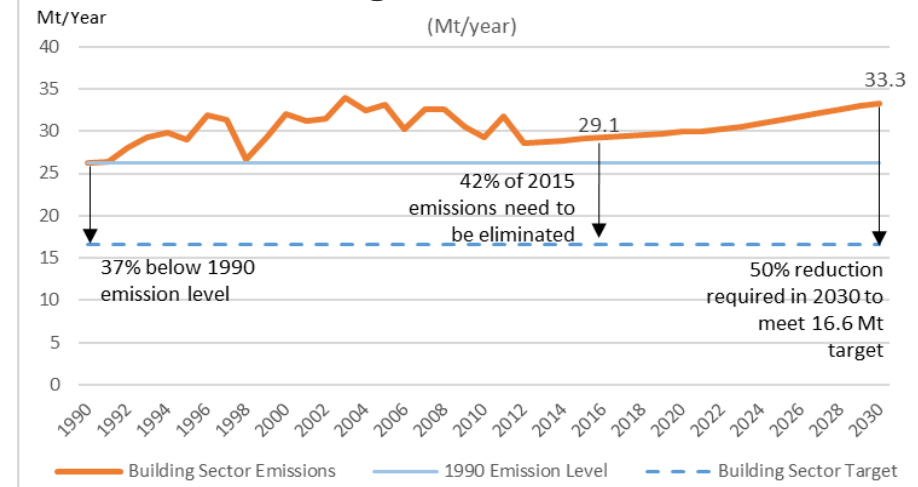
It is HARD

Buildings

Almost 17 Mt of emissions must be removed from Ontario's buildings by 2030 in order to meet the legislated targets.

- Ontario economic and population growth will drive building emissions up
- Expected 2030 emissions must be reduced by 50%
- Building efficiency in BAU assumed improved by 11%
- Buildings is mostly about removal of natural gas use

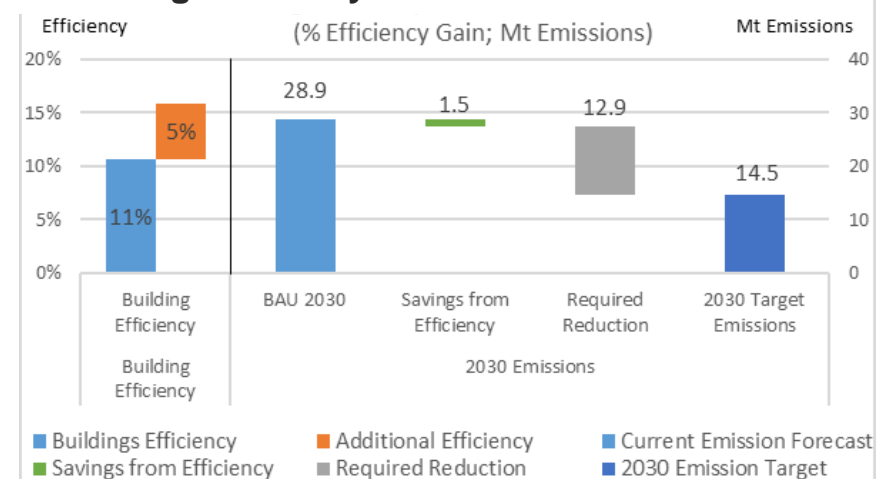
MOECC Building Sector Emission Forecast



Improving Building Efficiencies

- Modelling assumed 16.5% building thermal efficiency improvement, 50% more than from planned BAU building codes and standards
 - Across the province
- 1.5 Mt of emission reductions are assumed to come from efficiency improvements.
- To achieve this efficiency assumption, 50% of Ontario homes need a 33% increase in efficiency. → in 10 years
 - Transform TO seeks 40% by 2050

Building Efficiency Gains & Emission Benefits



Only natural gas heating options illustrated

Annual Cost of Emission Reduction

It is EXPENSIVE

\$27 Billion per year

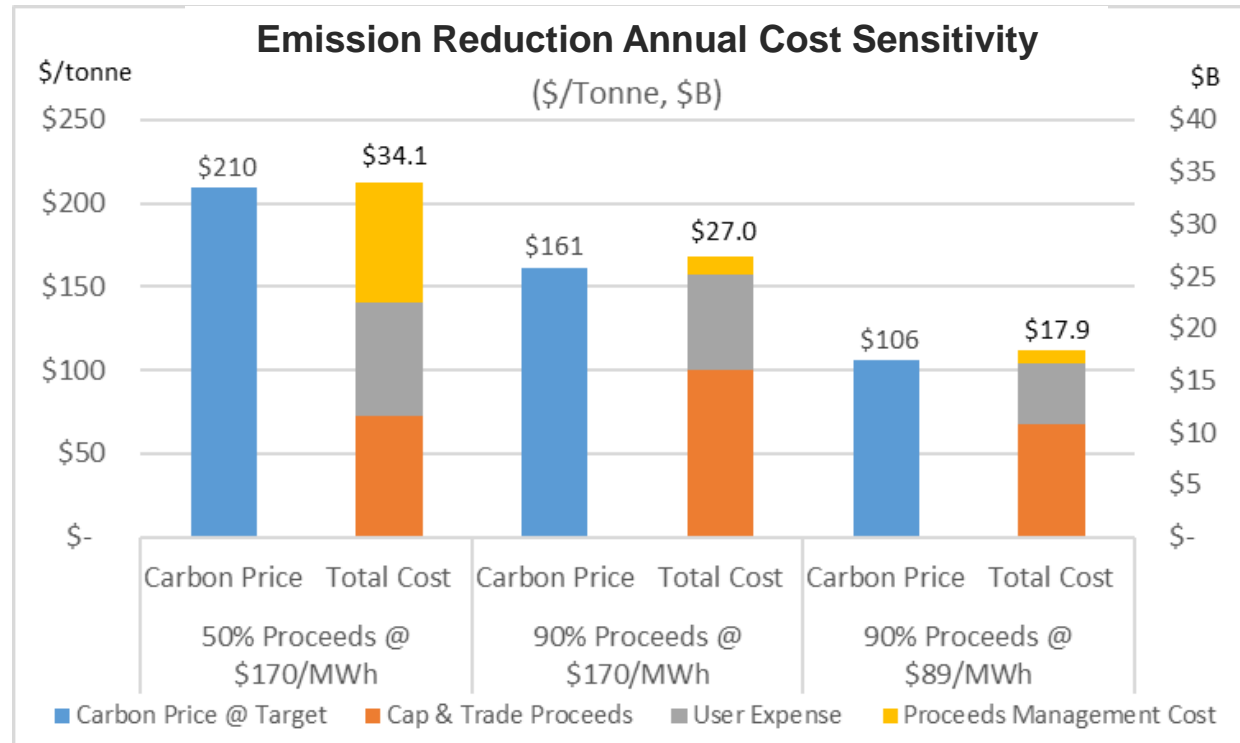
- if we are lucky

Purpose of carbon price:

- Increase cost on emitting technology to make low emission alternative equally attractive on a cost basis
- Creates a “User Pay Cost”

Market Carbon Price could vary from

- \$106/tonne if we are **Smart**
- to \$210/tonne if unlucky



Varies by Price of Electricity

- Determined by LTEP policy choices

Varies by Cost of Administration

- What effectiveness is humanly possible by a government in a \$16B/year candy store?

Emission Cost Curve

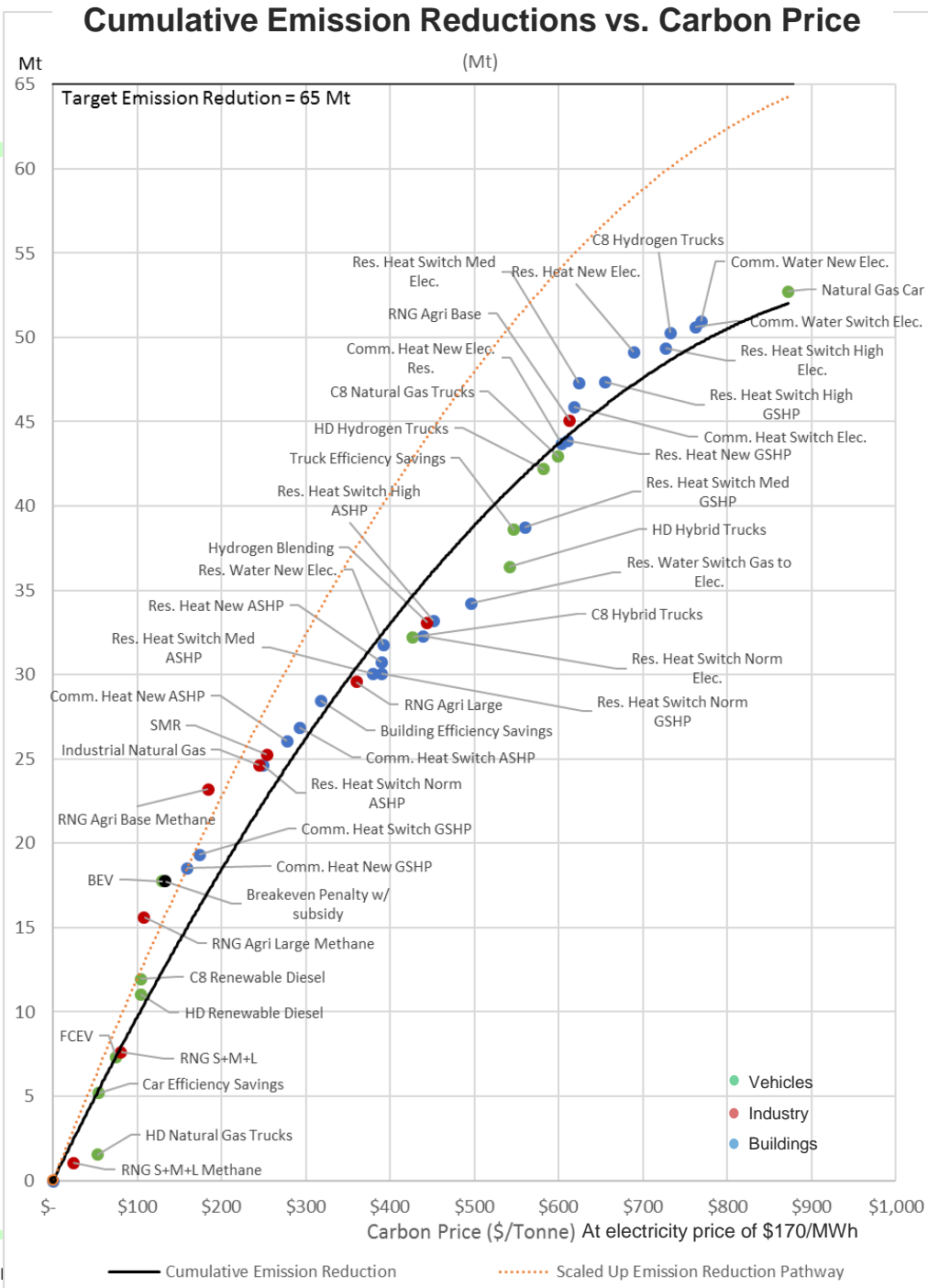
45 technology switching options evaluated

- Only addresses 80% of needed emission reductions

Carbon price calculation

- Cost difference between emitting technology and cleaner alternative

Home heating and trucking challenges lead to very high carbon prices



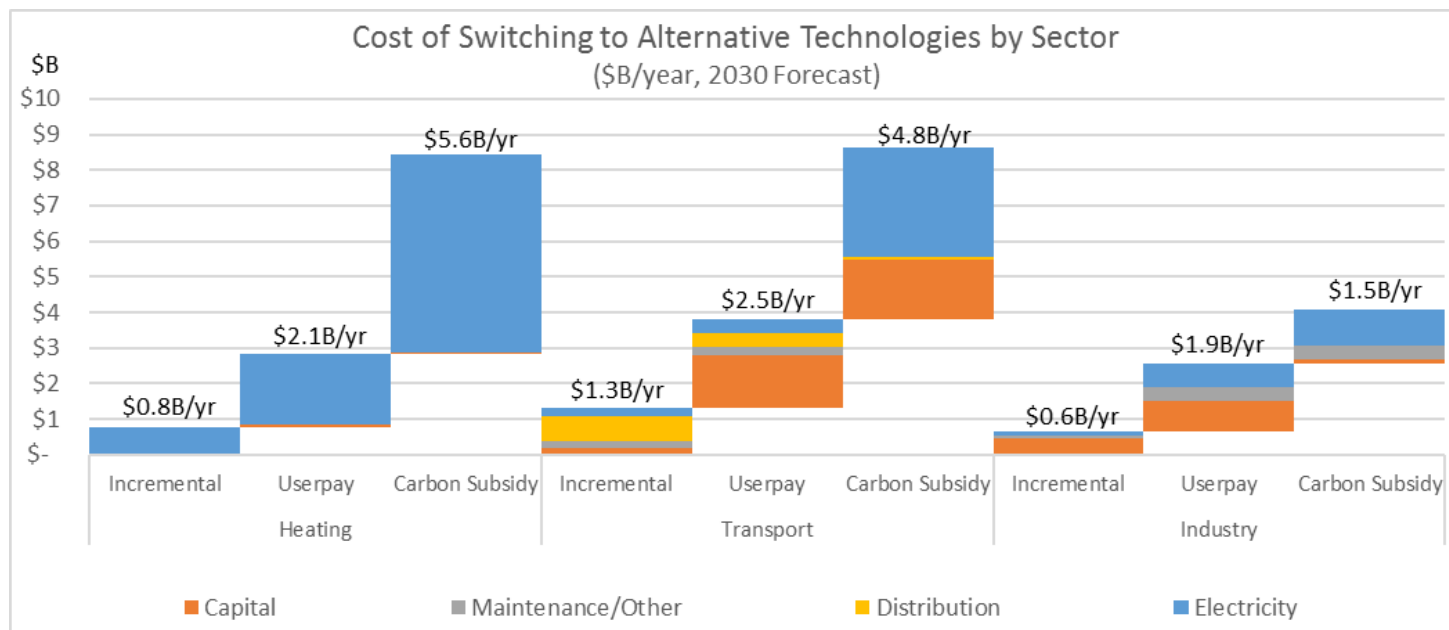
Source: Strapolec Analysis

Electrification: A significant component of switching cost

Cost of each technology depends on many factors, including:

- Capital cost of switching
- Cost of fuel/electricity
- Distribution cost of the fuel

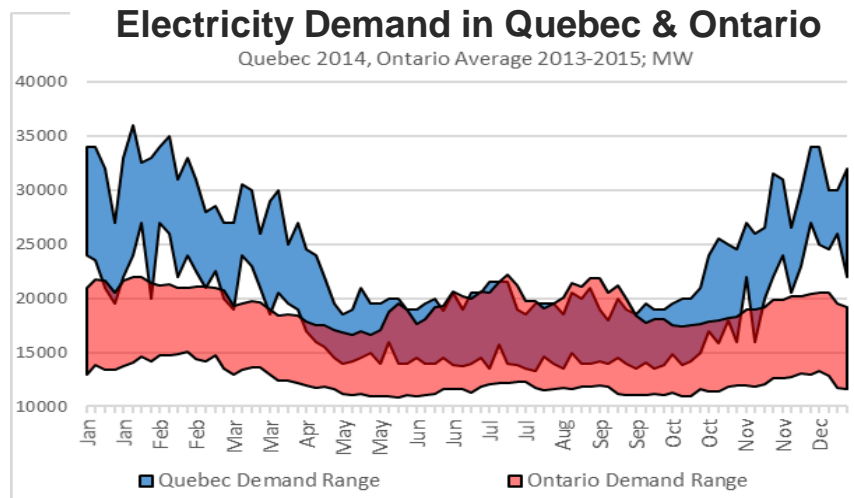
The impact of the cost of electricity to consumers will mostly be to heat homes



Source: Strapollec Analysis, \$2016 for electricity at \$170/MWh, only directly assessed technology options illustrated,

Not all new electricity demand is the same

The face of home heating



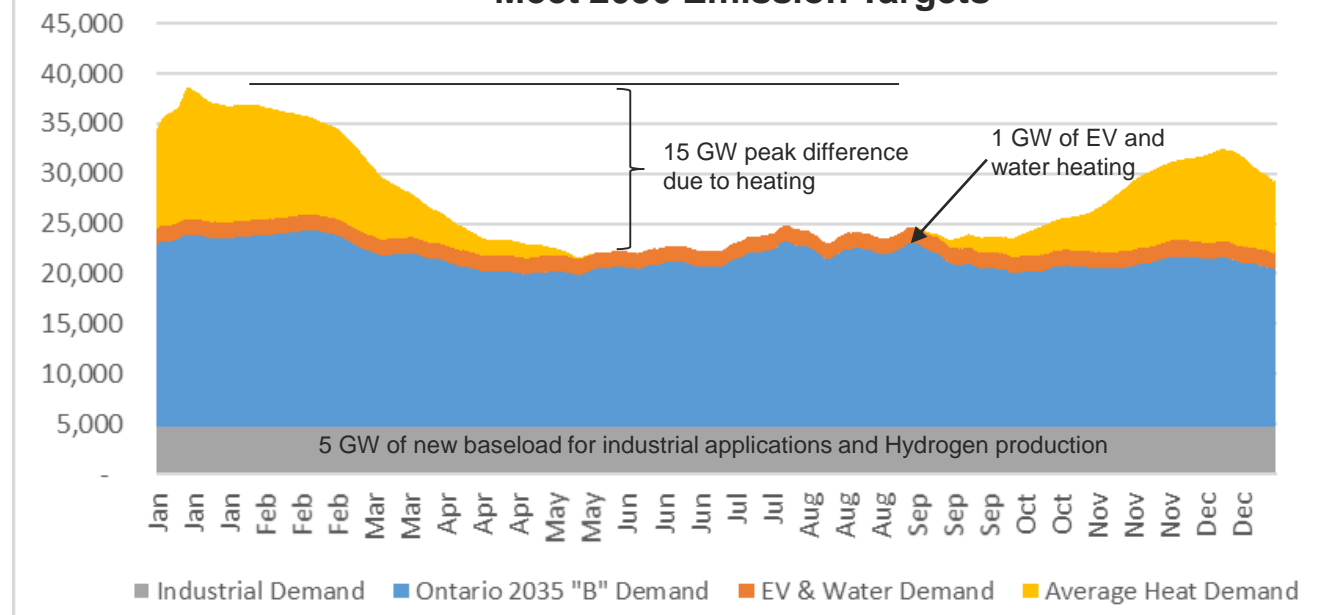
TODAY: The Quebec/Ontario Electricity Trade agreement

- Quebec needs capacity from Ontario in Winter
- Ontario needs capacity from Quebec in summer

Tomorrow (2030):

There is not enough electricity
Need 20 GW of new peak supply

Projected Ontario Demand Changes to Meet 2030 Emission Targets



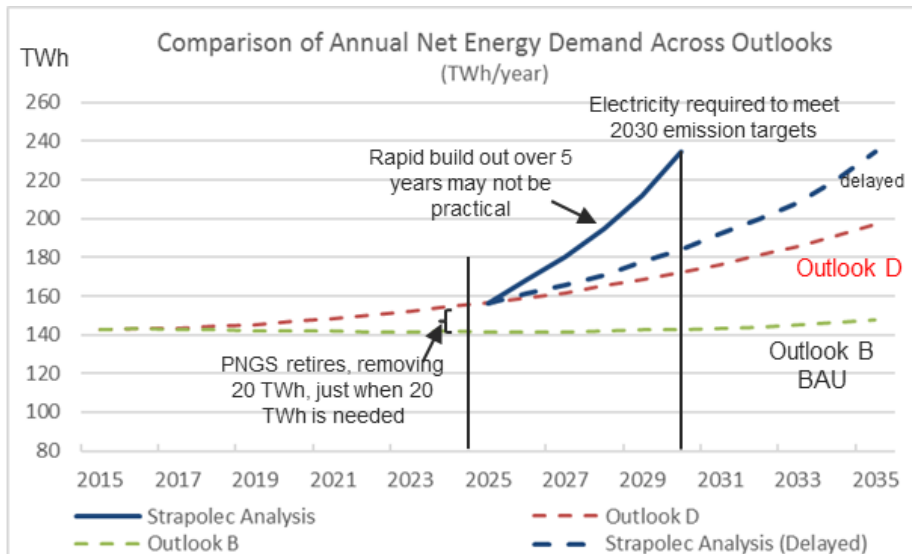
Electrification Implications:

Is Government even trying? But costs are committed...

New electricity generation **Cannot be Built** in time to achieve 2030 emissions reduction target

- Particularly after loss of Pickering's 20 TWh
- Emission targets **Cannot be Met**

90 TWh of new generation required, much more than today



Cap & Trade commits Ontario to purchasing allowances

- IESO outlook D misses target by ~40 Mt,
 - @ \$50/tonne = \$2B/year
 - @ \$160/tonne = \$6B/year

Source: Strapolec Analysis, IESO OPO, Environmental Commissioner of Ontario, 2016

Ontario's Environmental Commissioner concurs
MoE commissioned plans do not reflect goals

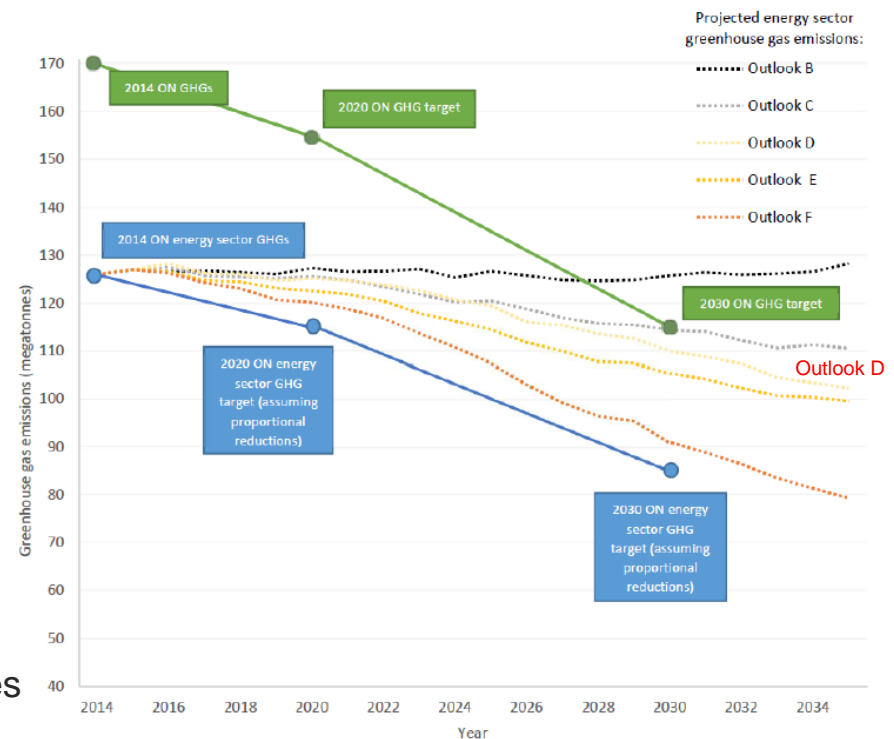


Figure 3: Comparison of LTEP Energy Sector Greenhouse Gas Emissions Projections with Ontario Climate Targets

The Politics of “Green Image” vs the Politics of Cost

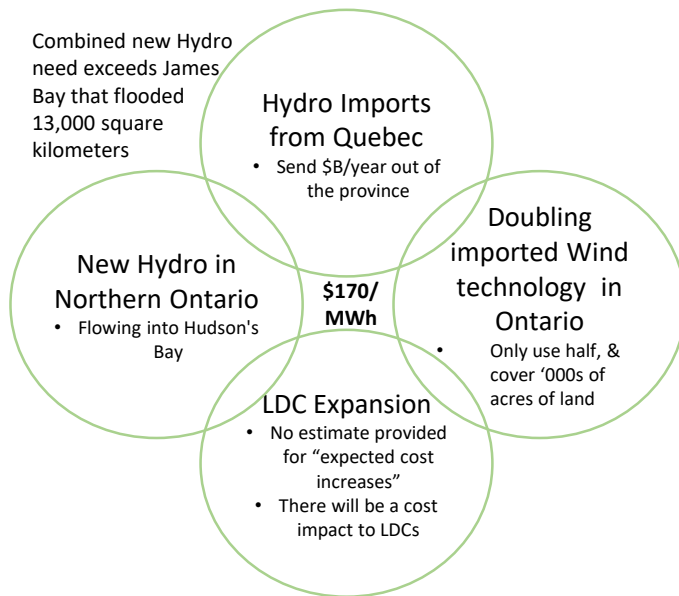
→ Supply Mix Choices: *Popular or Smart?*

Ontario needs a smart solution that reduces electricity cost by half

And makes Ontario an economic powerhouse in the global combat against climate change

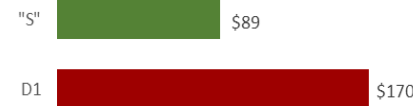
A Political Solution Does not Benefit Ontarians

Propagating alternative facts will cost a lot of money



Benefits of Smart over OPO D1*

Incremental Unit Cost (\$/MWh)



Carbon Price (\$/t)



Cost of Emissions Reduction (\$B/year)



■ Benefit of Enhanced Economic Activity
■ Additional Trade Loss

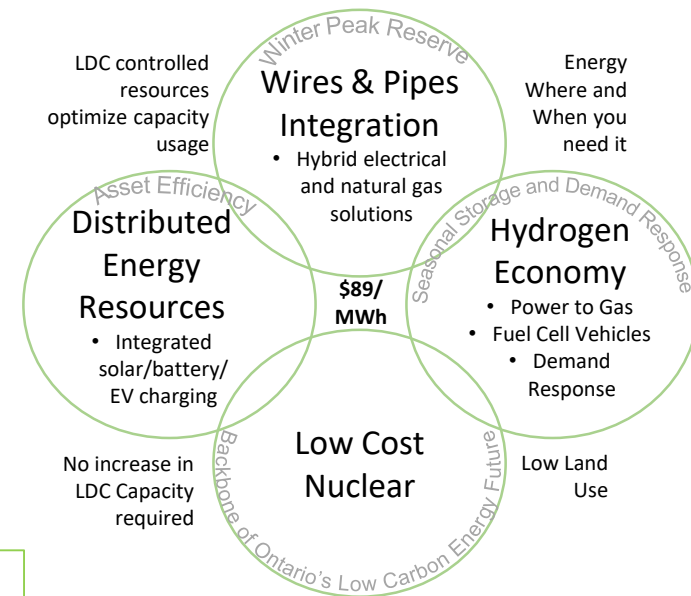
* Capacity scaled to achieve emission targets

Enhanced Economic Activity From:

- Improved Trade Balance
- Low cost domestic energy
 - Export energy
 - New industries
- Global low carbon solution exports

A Smart Solution addresses Ontario's unique needs with Homegrown innovations

Enabled by four paradigm shifts



*OPO D1 = IESO Ontario Planning Outlook, Outlook “D” demand forecast, Option 1 supply mix

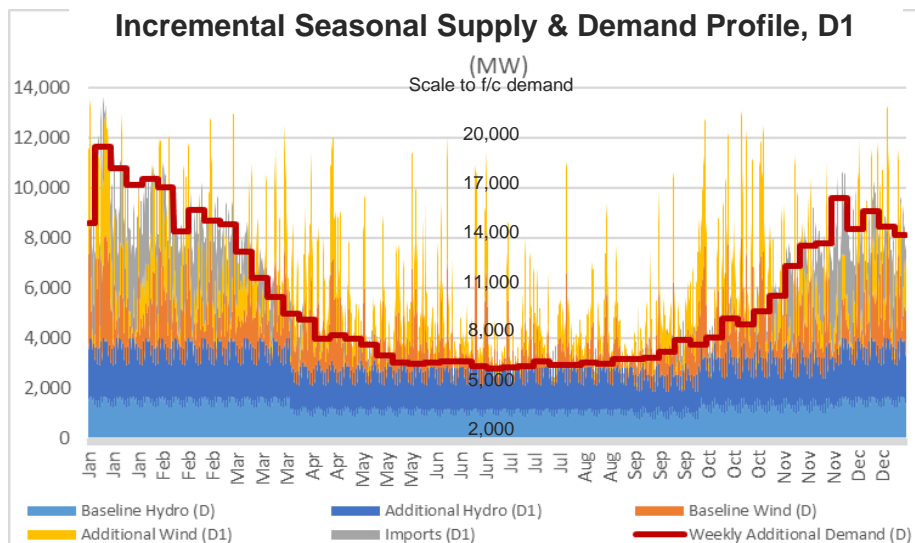
The new demand complicates options for supplying it

Ontario Power Outlook assumptions

- Illustration based on extrapolating 2015 patterns
- Only use 50% of wind generation, drives up the cost
- Imports from Quebec assumed in winter, significant new reservoir based supply is required and assumed to “dance” with wind
- New hydro supply in Ontario operates mostly all year

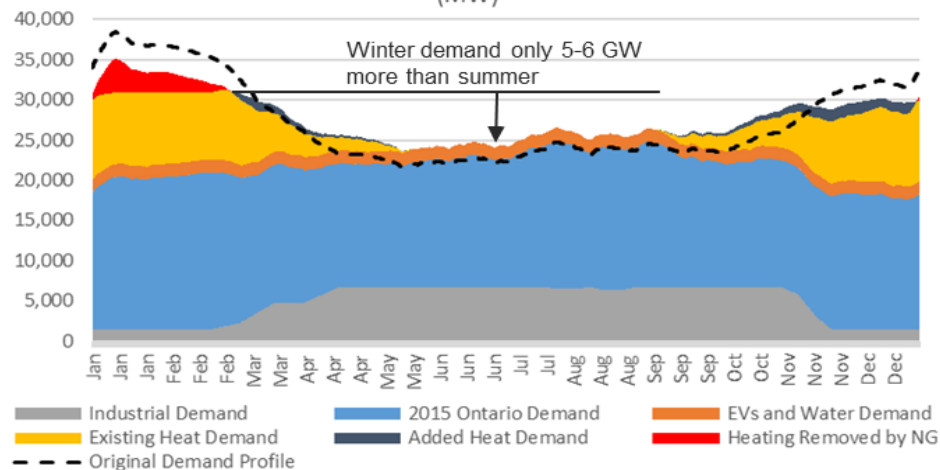
A Smart Energy solution helps flatten demand and make it easier to supply

- Flatten seasonal peaks by using Natural Gas for coldest temperatures
- Concentrating hydrogen production in the summer to further flatten annual profile
- Smart DER coupled with LDC controls for EV charging and water heating all year to help flatten daily demand



Projected Ontario Demand to Meet 2030 Emissions Smart Energy Solution

(MW)



Summary

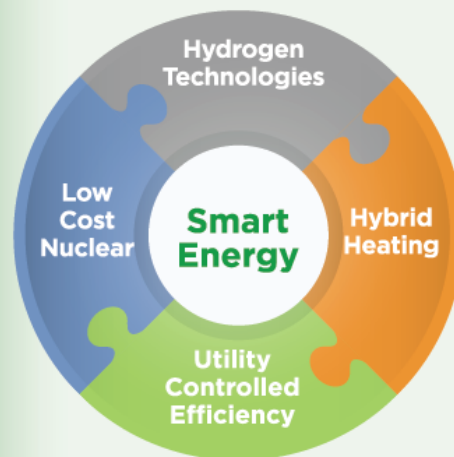
- Achieving emissions targets is hard
- Available technologies represent \$27B/year of new costs on how Ontarians use energy
- Required electrification cannot be achieved
- Cap and Trade will cost Ontarians \$2B/year in purchased allowances after 2024
- Ontario can be an economic powerhouse in combatting climate change if we are **Smart**

Fighting Climate Change in Ontario could cost **Up to \$27 Billion per year**

Ontario's next Long-Term Energy Plan is intended to help meet the province's legislated 2030 emission reduction targets. Options include Quebec electricity imports, northern Ontario hydro, increased wind, and more natural gas.

Fortunately

Made-in-Ontario **Smart Energy** Innovations could reduce the economic cost to almost **\$0** while delivering many benefits



Smart Energy Economic Benefits

- Electricity at half the price
- Less energy imports
- More industry & jobs
- Global leadership in exporting innovative climate solutions

To learn more about Ontario's options for combatting climate change go to **PoweringOntario.ca**

A public awareness service from Strategic Policy Economics