Ontario's Coal Phase-Out

Jan Carr
former CEO Ontario Power Authority

presented to
"Is There a Blueprint for Coal Phase-Outs?"
Expert Workshop at Institute for Advanced Sustainability Studies

Potsdam, November 22-23, 2016

Outline

1. constitutional and political context
2. history and status of electricity system
3. economic and commercial factors
4. public policy and implementation
5. current status and lessons learned

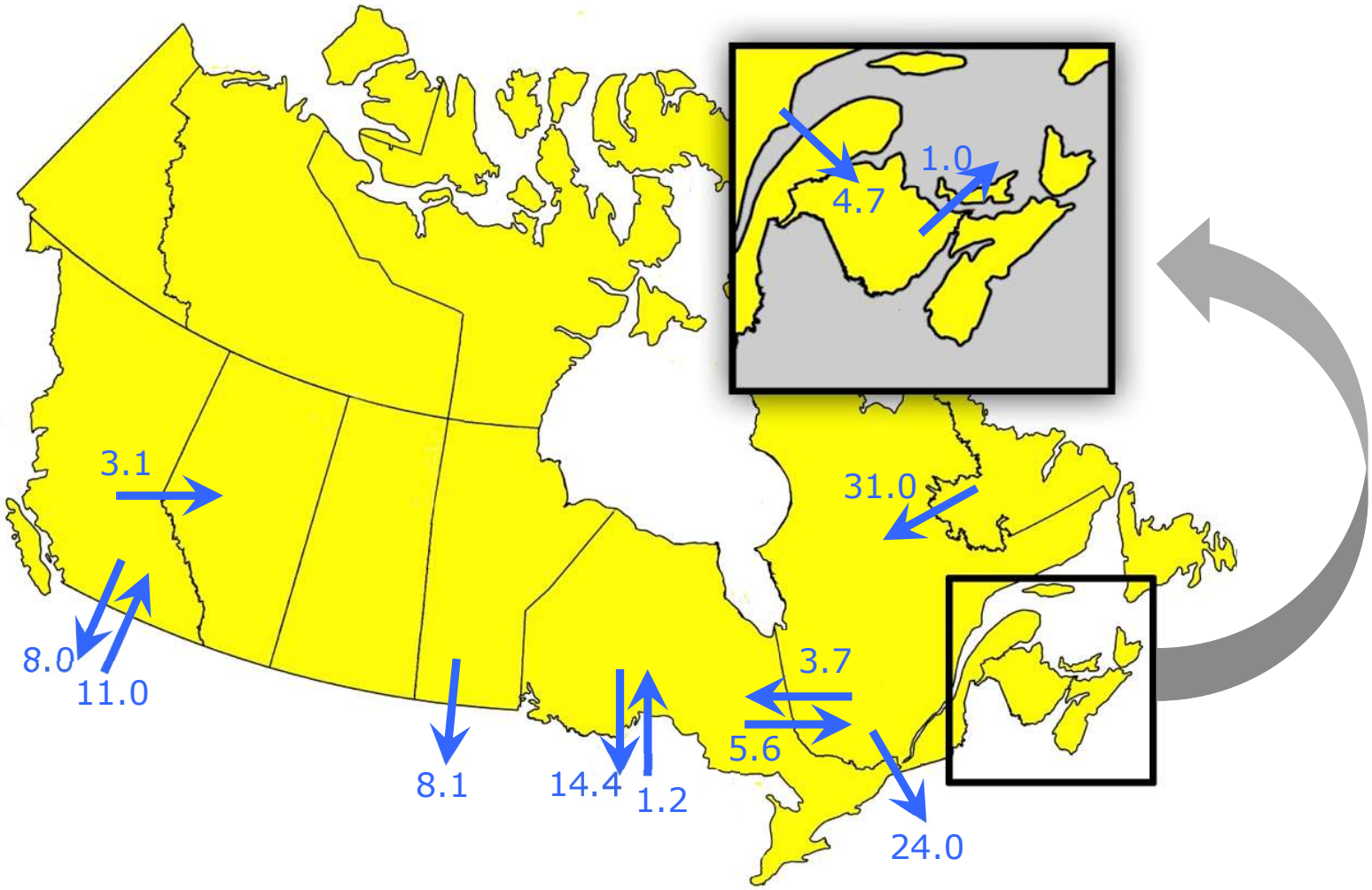
Ontario's Coal Phase-Out

Constitutional and Political Context

Federal/Provincial Jurisdiction in Canada

- energy is fundamentally a provincial reponsibility with federal involvement in interprovincial and international trade
  - oil and gas tend to be national in scope – significant federal involvement
  - electricity tends to be provincial in scope – limited federal involvement
- environment falls into both jurisdictions
  - leads to complex political and legal situations
- every Canadian province has indigenous energy resources which strongly influenced evolution of electricity sector
  - electricity has developed province-by-province as self-sufficient systems
    - trade with US 3-4 times higher than interprovincial trade
  - encourages a high proportion of public ownership by provincial government organizations

Significant Electricity Trade 2012



TWh in 2012

data compiled by National Energy Board from StatsCan (Catalogue no. 57-202-XIB)

2002-3 in Ontario Electricity

- May 2002: electricity sector deregulated
  - competition replaced regulated monopoly
- June 2002: Committee of the Ontario Legislature "Alternative Fuels" report recommends:
  - phase-out 5% of coal fired generation by 2005
  - phase-out of balance by 2015
- November 2002:
  - prices frozen resulting in large subsidy and zero new investment
- October 2003: election and change of government
  - new government promissed earlier phase-out 2007
    - post-election finds cost of subsidy from price freeze and supply unreliabiilty from under-investment hampers progress
  - phase-out deadline revised to 2010, 2012 and then 2014

Ontario's Coal Phase-Out

History and Status of Electricity System

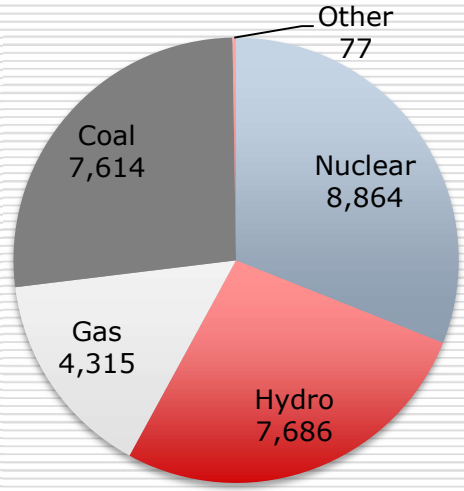
Development of Ontario's Electricity System

- 1890s - isolated systems based on localized water power or coal fired steam
- 1895 – US development of major generation and long distance transmission at Niagara Falls
  - Niagara Falls on US/Canada border
  - initial developments on both sides served US
- 1905 – Ontario local systems form a cooperative to build and operate major generation at Niagara Falls
  - world's largest hydroelectric project until 1960's
- 1950s – all economic hydroelectric sites developed, economy and electricity demand growing
  - partnered with federal government to develop CANDU nuclear
    - heavy water moderated reactor which does not require enriched fuel
  - coal fired generation added
    - known and reliable technology to backup new and untested nuclear and meet immediate load growth

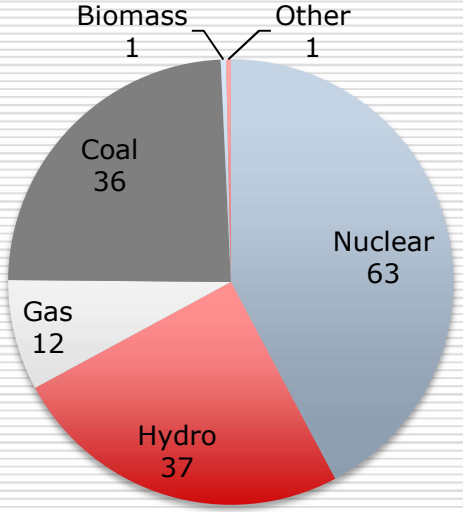
Status at Start of Coal Phase-Out

- new generation requirements increasingly driven by plant retirements rather than by growth of demand
- 25% of nuclear units decommissioned due to staffing and management inadequacies
  - restart equivalent cost and complexity of a new build
  - coal plants increasingly displacing nuclear for baseload supply
- supply margin critically small due to loss of investor confidence from freezing market prices and Enron collapse
- natural gas becoming the fuel of choice in NAmerica
  - low capital cost and short construction periods compared to alternatives – hydro, coal, nuclear

Electricity Mix 2002



Installed Capacity
28,556 MW



Energy Generated
149.1 TWh

Ontario's Coal Phase-Out

Economic and Commercial Factors

A History of Commercial Innovation

- Hydroelectric Power Commission of Ontario (HEPCO), 1906
- recognized Ontario's economic opportunity of developing electricity
  - electric utility a new concept; Edison, New York City, 1882; Ferranti, London, 1891
  - technology to use Niagara Falls first commercialized in 1895
- HEPCO combined new technology and new commercial arrangement
  - using public credit rating for commercial undertaking
  - massive increase in scale and economy of scale
  - public interest integral with commercial capability
- Ontario leapfrogged others in pace and cost effectiveness of electrification
  - widespread availability of economical energy
  - rapid growth to become Canada's economic heartland
- a commercial model copied around the world
  - Canada – most provinces
  - UK (CEGB), US (TVA), Australia, New Zealand, South Africa….

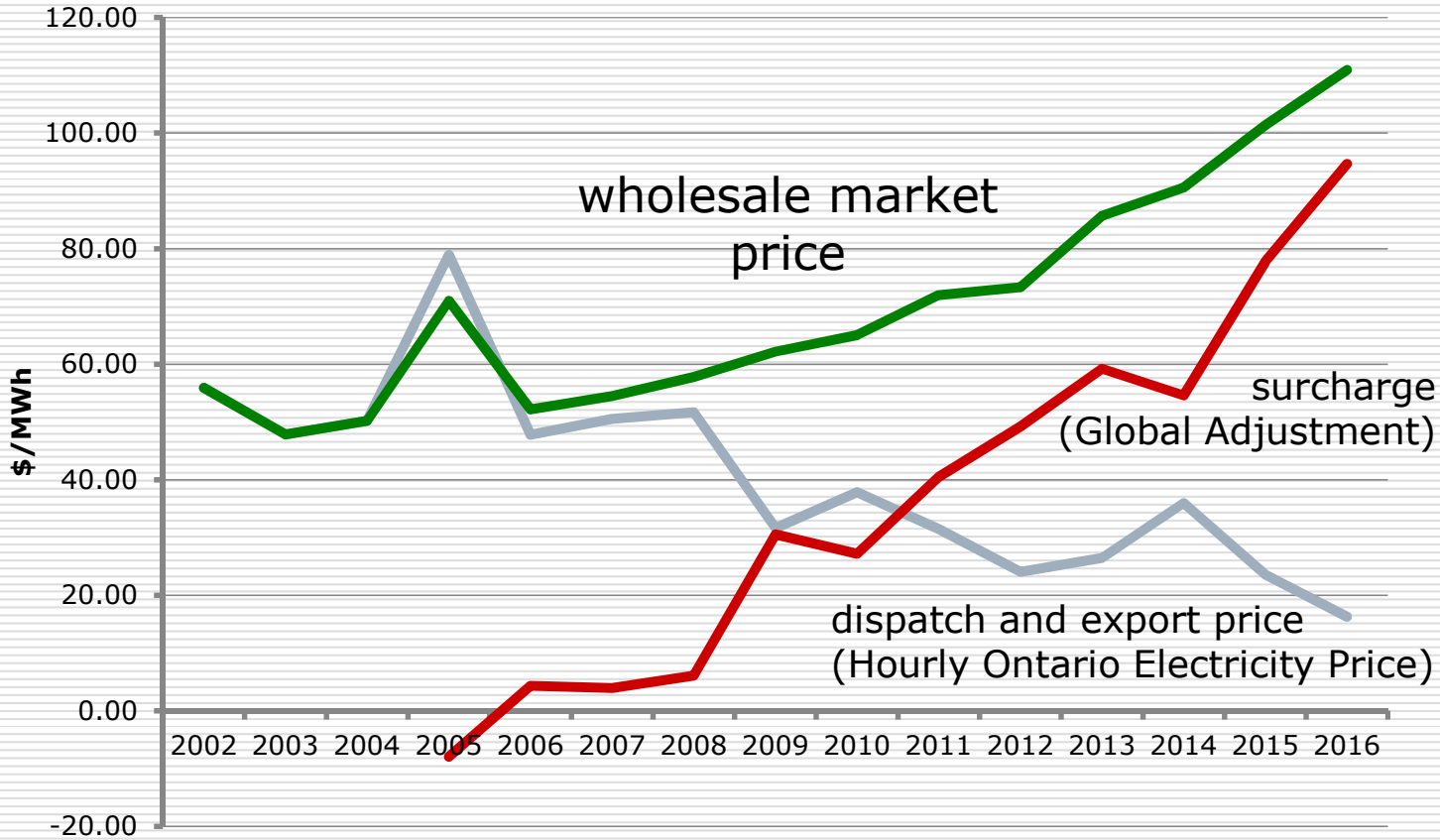
Ownership in Ontario Electricity Sector – 1990s

- provincial "crown corporation" Ontario Hydro vertically integrated monopoly
  - owned virtually all generation, transmission and rural distribution
  - 300+ municipally owned local distribution in urban areas
- several years of double-digit rate increases while inflation was modest and economy not growing raised concerns and triggered dismantling Ontario Hydro
  - Ontario Power Generation
    - owned all generating plants but sold a few hydro plants and leased one nuclear plant
    - not allowed to invest in new plants except in partnerships
    - required to rebate excess profits from market operations to electricity consumers
  - Hydro One
    - owned all transmission and rural distribution – rate regulated
  - Independent Electricity Market Operator
    - dispatched the system based on competitive market

Beginning the Phase-Out

- Ontario Power Authority established
  - provide financial guarantees for lenders to necessary new generation projects
  - design and fund conservation programs
  - undertake long-term planning to identify both generation and conservation needs
- funding raised by a surchage on electricity consumed in Ontario
  - initially, the surcharge was actually a rebate because market prices were high, few supported projects were in service and contracts required plant owners rebate excess earnings
  - as dispatch/export prices declined (falling price of natural gas, surplus of generation and contract price more important to generators than market price), the number and price of projects rose, the surcharge rose and today is 200-300% bigger than the market price – effectively making market price irrelevant

Wholesale Electricity Price



Planning Cost Assumptions

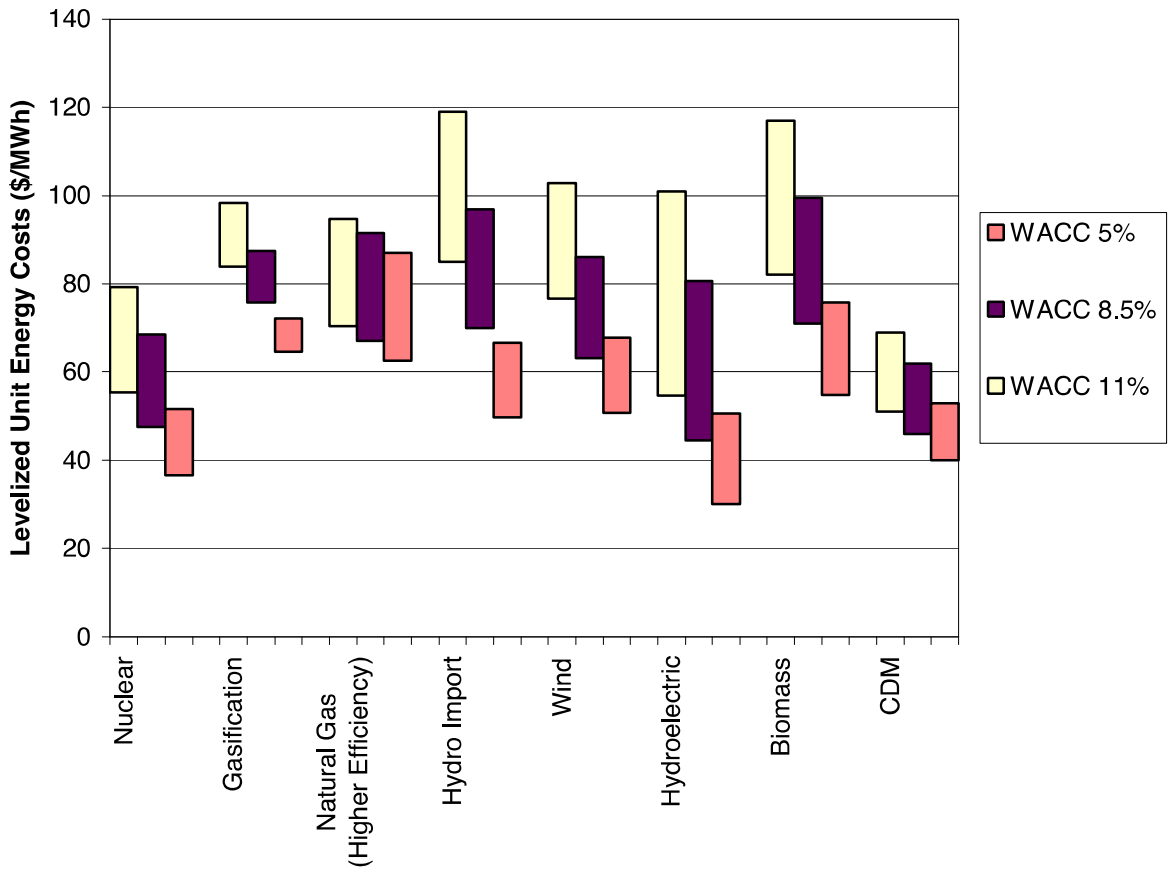


Figure 2.7.10 – LUECs: Base-load and Rewable Generation Options

Ontario Power Authority "Supply Mix Advice" December 2005

nuclear includes both refurbishment of existing plants and new build

Write Downs on Coal Stations

station	capacity (MW)	end of life	undepreciated value 2002 ($M)	write downs for early retirement ($M)				
				2002 Committee Recommendations	2014	2012	2010	2007
Nanticoke	3920	2015	755	0	58	174	290	465
Lambton 1-2	988	2010	117	0	0	0	0	44
Lambton 3-4	988	2020	264	73	88	117	146	190
Thunder Bay	310	2021	87	73	32	41	51	64
Atikokan	215	2025	73	64	35	41	48	57
Lakeview	1140	2005	51	0	0	0	0	0
Lennox*	2140	2016	444	0	0	0	0	0
total	**9701**		**1791**	**210**	**213**	**374**	**535**	**821**

* Lennox is a dual fueled oil/gas plant and not subject to coal phase-out policy but included for consistency with data sources

- values are estimates based on disaggregating consolidated information in OPG 2002 Annual Report and Annual Information Form

Ontario's Coal Phase-Out

Public Policy and Implementation

Clash of Cultures

- evident from the all-party roots of Ontario's coal phase-out that it had strong public support
  - electricity industry failed to understand that and treated energy policy as a partisan political issue
- complexity of electricity system requires
  - central coordination of its just-in-time real-time operations
  - long range perspective due to its large investments and the catastrophic effects of under-investment
- democratic governments are not well suited to either just-in-time operations or long-range perspectives, but
  - inherent public distrust of monopolies means that electricity industry is untrusted
  - unpopularity of electric industry allows politicians to adopt policies on basis of popularity rather than soundness

Interests in Coal

- all coal-fired generating stations owned by OPG which is 100% owned by Government of Ontario
  - write-down of undepreciated assets is a political decision that does not require negotiation
- all coal imported so mining interests and communities are outside Ontario
  - repurcussions on coal supply industry and mining communities are not a concern
- Power Workers Union (PWU) involved in both coal and nuclear plants
  - a shareholder of Bruce Power, the biggest nuclear plant and operated by private sector
  - seats on boards of both OPG and Bruce Power
  - PWU expecting job growth and financial gains

Selling the Policy

- justification for Ontario coal phase-out has changed over time
  - before about 2000
    - air quality in wilderness areas – i.e. aesthetic
  - around 2000-2010
    - smog abatement in cities – i.e. health care costs
  - since about 2010
    - GHG abatement – i.e. climate change
- reflects the public's changing interests
  - but changing justification breeds public skepticism
  - undermines public support for worthwhile initiatives

Popular Programs

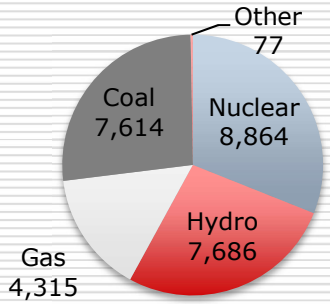
- conservation programs can be designed and funded on the basis of
  - economics – $/MW or $/MWh displaced
  - political attractiveness – distributing money, advertizing exposure
- contracts for new generation can be awarded to
  - minimize cost – commercial competition to find lowest bidder
  - maximize number of projects – standing offer to purchase at premium prices

Ontario's Coal Phase-Out

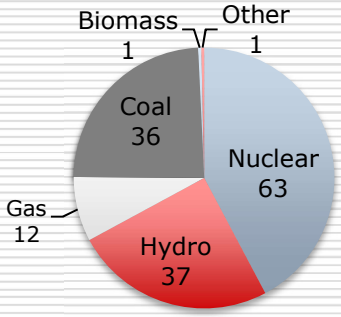
Current Status and Lessons Learned

Supply Mix Then and Now

2002

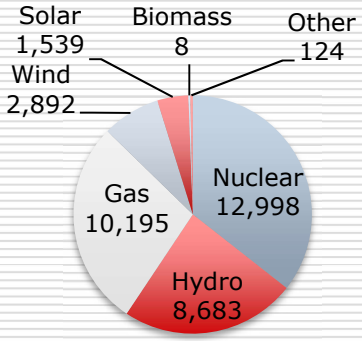


Installed Capacity 28,556 MW

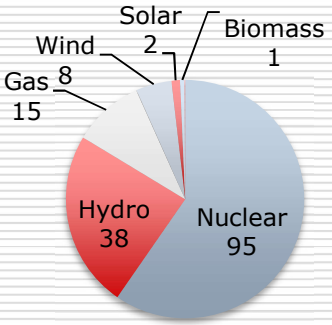


Energy Generated 149.1 TWh

2014

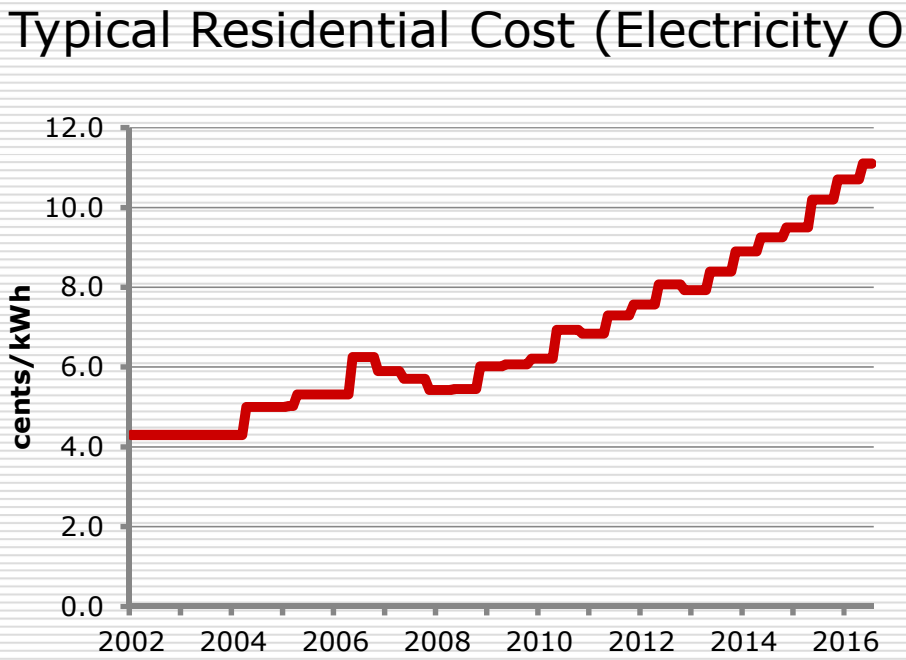


Installed Capacity 36,519 MW



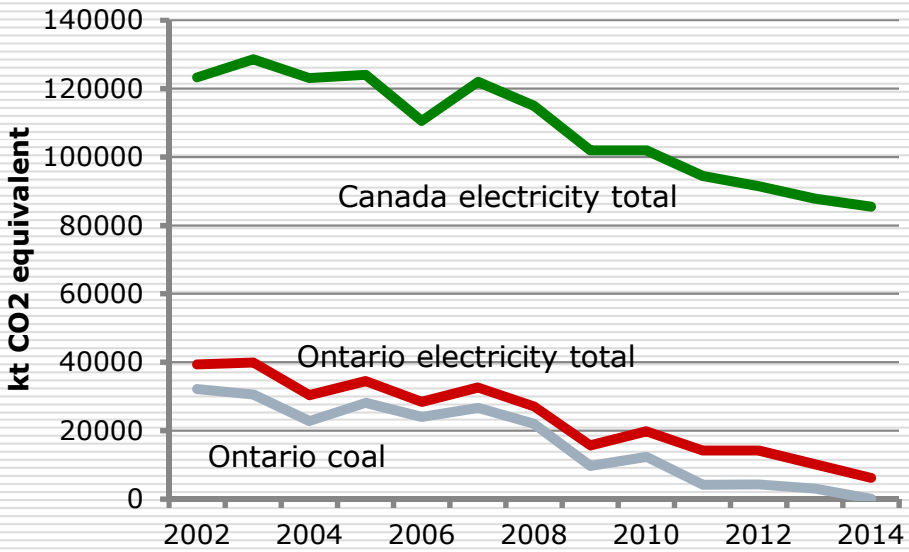
Energy Generated 159.1 TWh

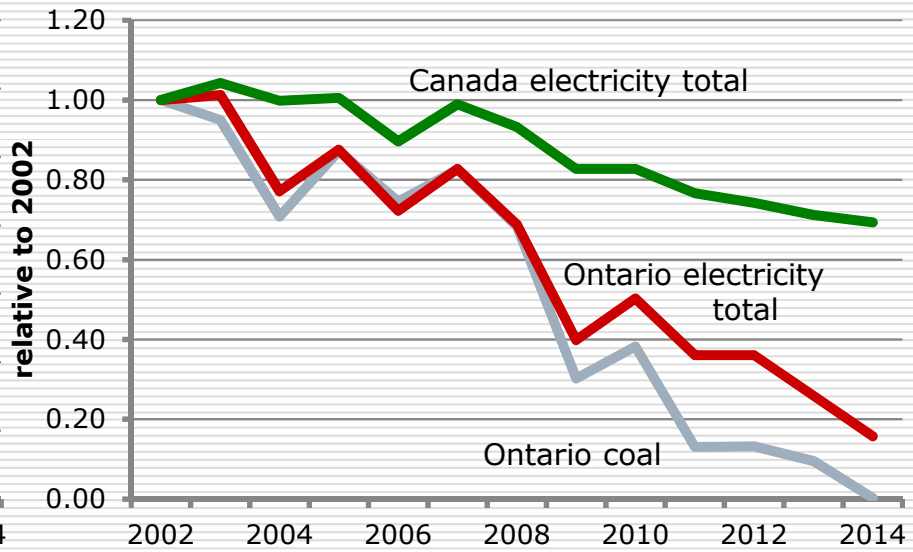
Electricity Prices



- rate structure varies including introduction of time-of-use rates in 2005
- delivery, regulatory, account fee and taxes extra

GHG Emissions Then and Now





Lessons Learned

- politics are inevitable but very dangerous to success
  - recognize the difference between real consensus and political spin
- the design of subsidies and the details of how they are paid are important to not undermining the existing commercial structure and public confidence
- setting phase-out deadlines instead of emissions targets results in over-investment
  - emissions targets provide flexibility in managing supply adequacy through phase-out period
  - unforgiving phase-out deadlines with unforgiving reliability standards requires new capacity to cover inherent forecasting uncertainty
    - ultimately leads to excess capacity and higher costs to customers

Lessons Learned (cont'd)

- projects and programs move more slowly than public and political expectations
  - beware of creeping bureaucracy and resulting costs
  - expect public disenchantment
- decide what will replace coal-fired capacity and determine the implementation cost before promissing results to the public
  - there will be enough setbacks to explain without basing expectations on unrealizable outcomes
    - setback example: widespread installation of new air conditioning shifted annual peak from winter to summer which reduced effective capacity of both existing and new generation
    - expectation example: "moving to renewable energy will increase your bill by 1%", Ontario Energy Minister

Information Sources

slide no.

5. National Energy Board, https://www.neb-one.gc.ca/nrg/sttstc/lctrct/stt/lctrctysmmr/lctrctysmmr-eng.html

6. Ontario Select Committee on Alternative Fuels, final report, http://govdocs.ourontario.ca/node/17622

10. Independent Electricity System Operator, http://www.ieso.ca/Pages/Power-Data/Data-Directory.aspx; and

    Canadian National Inventory Submissions to United Nations Framework Convention on Climate Change http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/9492.php

15. Independent Electricity System Operator, weighted average figures from December monthly market reports, http://www.ieso.ca/Pages/Power-Data/Market-Summaries-Archive.aspx

16. Supply Mix Advice Report, Ontario Power Authority heritage website at www.ieso.ca http://www.powerauthority.on.ca/integrated-power-system-plan/supply-mix-advice

17. Ontario Power Generation Inc. 2002 Annual Report and Annual Information Form http://www.opg.com/about/finance/pages/financial-reports.aspx#05

23. Independent Electricity System Operator, http://www.ieso.ca/Pages/Power-Data/Data-Directory.aspx

24. Ontario Energy Board Historial Prices, http://www.ontarioenergyboard.ca/OEB/Consumers/Electricity/Electricity+Prices/Historical+Electricity+Prices

25. Canadian National Inventory Submissions to United Nations Framework Convention on Climate Change http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/9492.php