Energy, Politics and Sustainability:
Electricity Policy in Ontario

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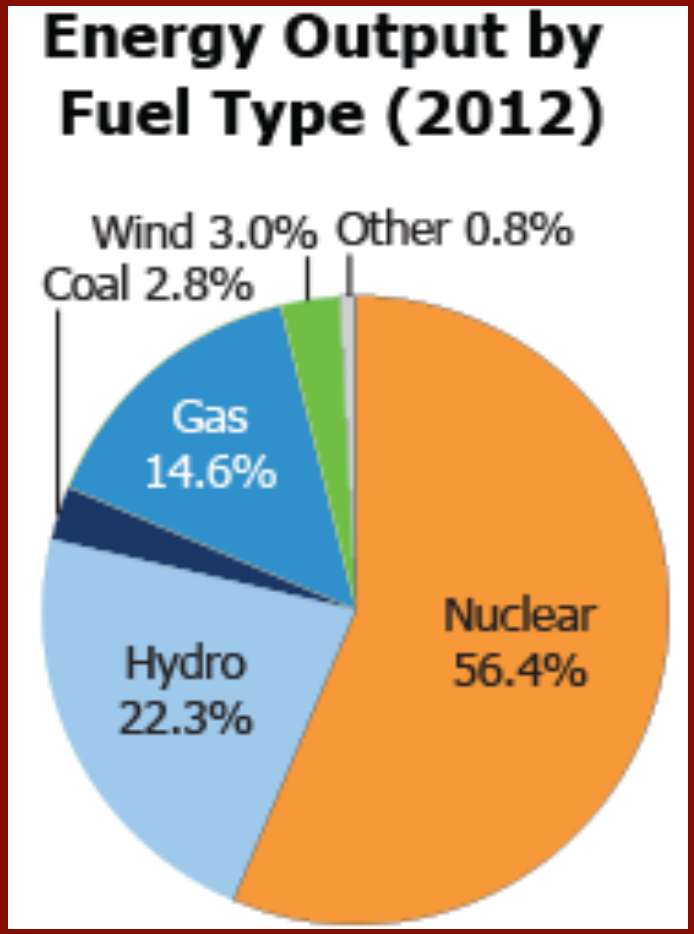
York University

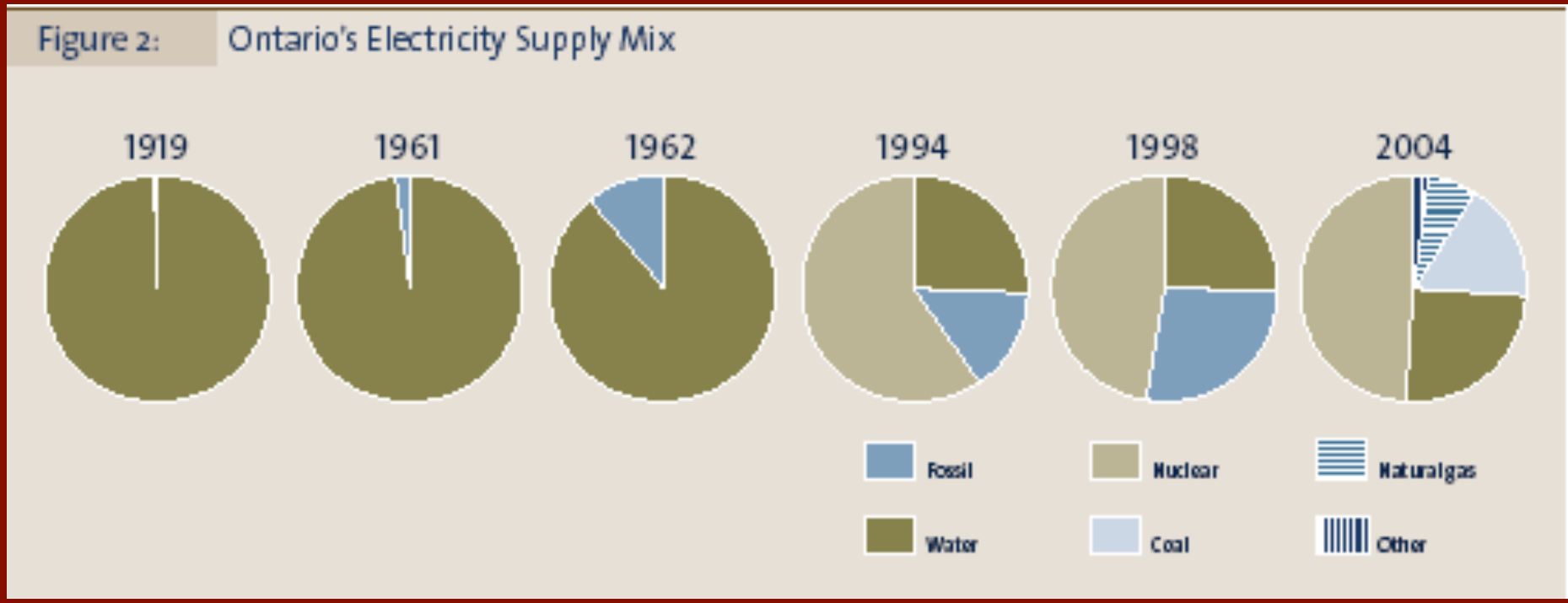
Ontario Electricity

- 'Hard' vs. 'soft' paths
- Markets vs. planning
- Transitions and Future roles of nuclear, coal, natural gas, renewables, conservation, smart grids and storage
- Relationships between energy, economy and



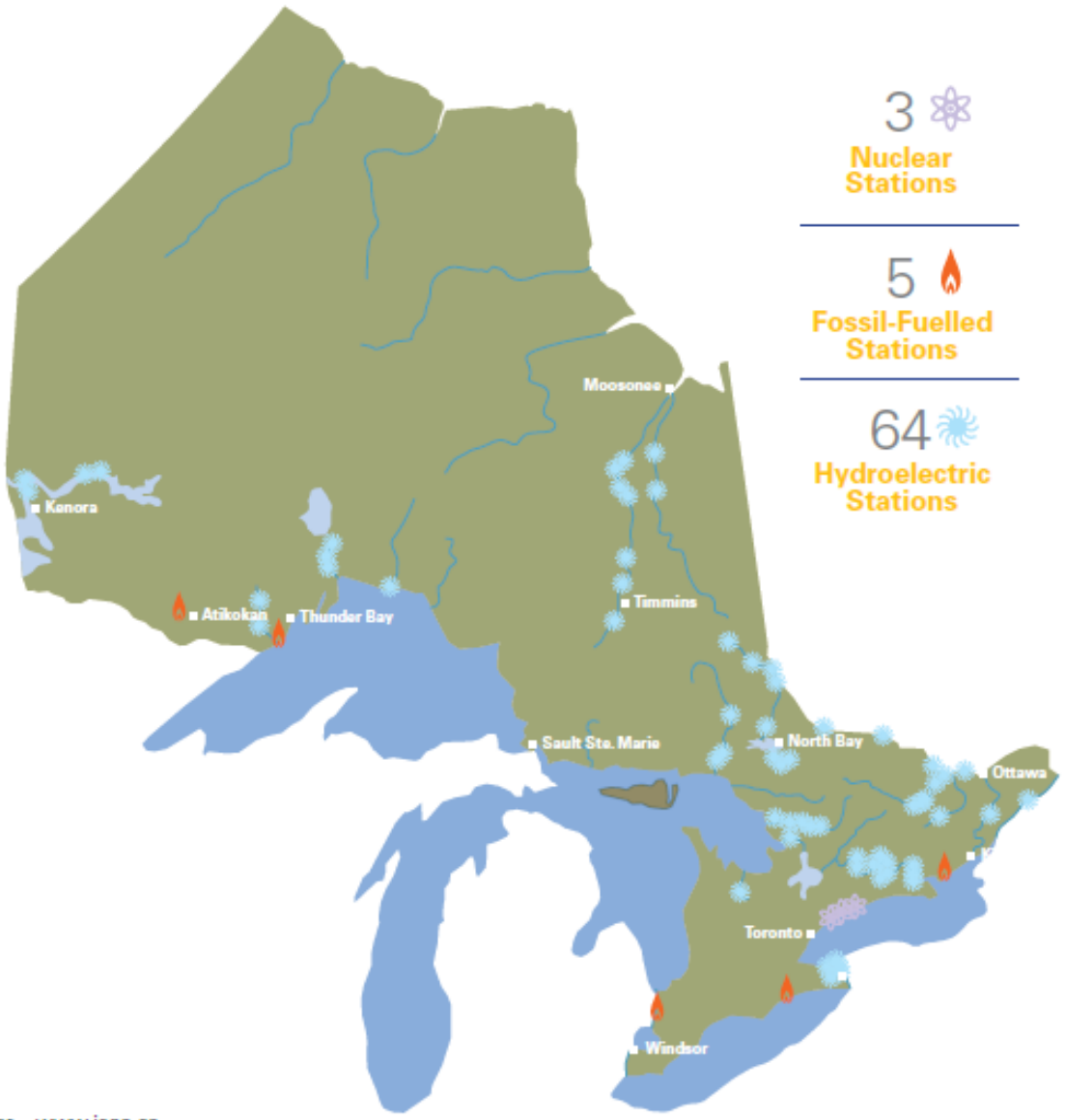
IESO

Ontario Electricity Supply Over 100 Years



2007 ONTARIO ELECTRICITY GENERATION MIX[1]

Most of Ontario's electricity generating stations are located in the southern half of the province close to where the demand for power is greatest. The majority of these power stations are owned and operated by Ontario Power Generation (OPG), a government owned company that generates 70% of Ontario's electricity. To the right is a map of the 72 generating stations operated by OPG across Ontario.



[1]Source: Independent Electricity System Operator – www.ieso.ca

Upheaval and Instability in Ontario's Electricity Sector

Vertically Integrated Monopoly

The Market Experiment

A 'Hybrid' System

ONTARIO POWER AUTHORITY

In the meantime....

NAOP Impacts

Appendix C

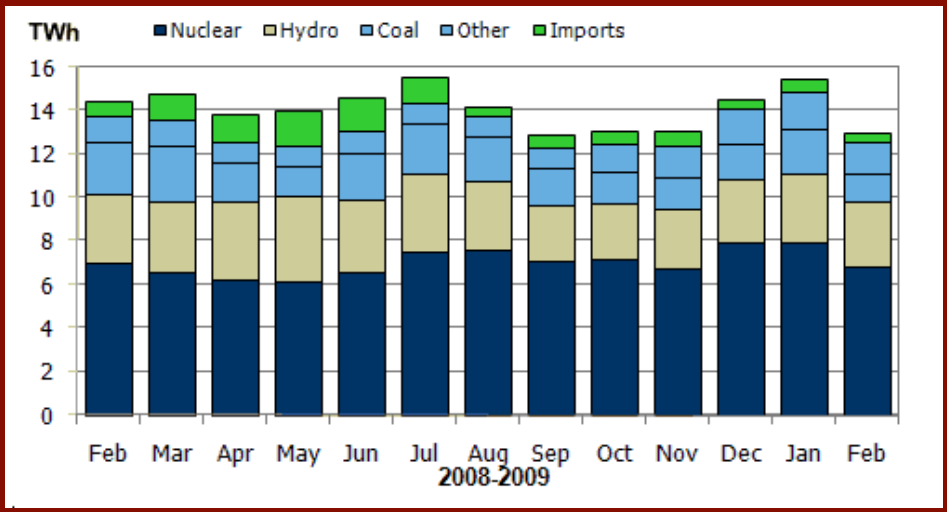
Ontario Power Generation's Coal Plants: Electricity Generation and Emissions, 1995 to 2001

	1995	1996	1997	1998	1999	2000	2001
Electricity Generation (Gwh)	16,699	18,915	24,523	33,275	34,068	41,446	37, 185
Greenhouse Gases (tonnes)	15,400,000	17,900,000	22,430,000	29,800,000	30,530,000	37,640,000	35,090,000
Sulphur Dioxide (tonnes)	74,100	84,500	123,150	140,810	140,580	163,510	147,090
Nitrogen Oxides (NO) (tonnes)	28,200	35,100	42,770	54,320	49,240	49,450	42,170

1 Gwh = 1,000,000 kilowatt-hours
Sources: Ontario Power Generation, *Towards Sustainable Development: 2001 Progress Report*, Appendix A; *Towards Sustainable Development: 1999 Progress Report*, Appendix A; Email from Bob Kozopas, Ontario Power Generation, August 22, 2000.

More Challenges…

- August 2003 Blackout and Reliability/ Security of Supply Concerns



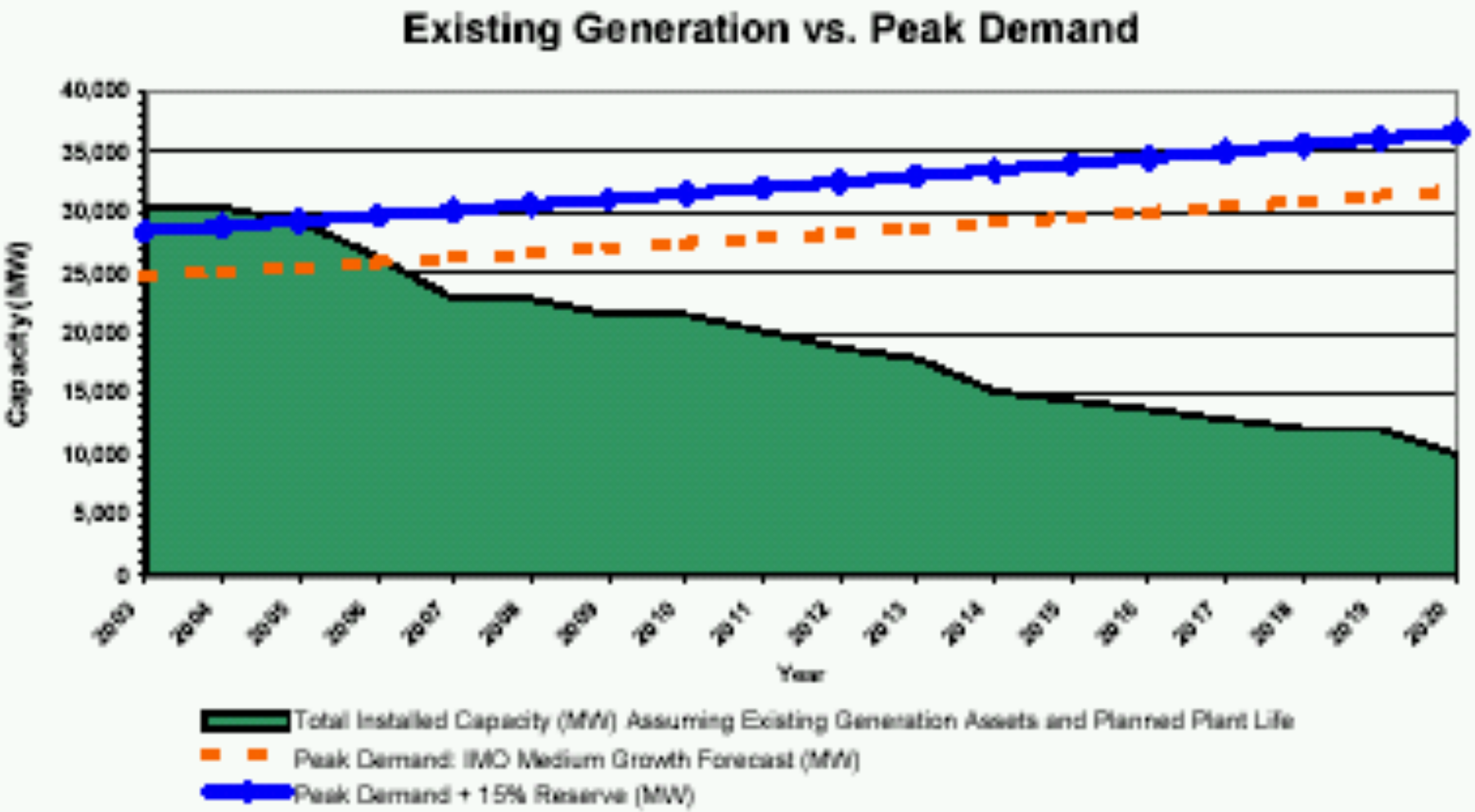
- Difficulties in meeting summer peaks

Ontario's Electricity Sector and Climate Change

- Electricity generation was responsible for 17% of Ontario's greenhouse gas emissions
  - Second only to transportation
- There is no viable means of reducing greenhouse gases emissions from Ontario' s existing coal plants

Anticipated retirement of 80% of existing generating assets over next 20-25 years

FIGURE 2.C



Electricity Restructuring Act 2004

- Creates Ontario Power Authority, including Conservation Bureau
- Mandates OPA to develop an 20-year Integrated Power System Plan (IPSP)

Supply Mix Directive I June 2006

- 14,000MW nuclear for baseload
- Reduce peak demand by 6300MW
- 7500MW new renewables
- High-value, high-efficiency uses of natural gas
- Coal Phase-out deferred

IPSP

- Review of IPSP required by Minister of Energy September 2008
  - Results postponed to March 2009
- …OEB Hearing Suspended September 2008

In the meantime….

- *The Green Energy and Green Economy Act, 2009*

Green Energy and Green Economy Act, 2009

- Feed-in Tariffs and Grid Integration for Renewables
- One-Window approvals system for renewables (REA)
- Restructures approach to conservation

Ontario Suspends Nuclear Procurement

June 29, 2009 11:20 AM

Queen's Park — The Government of Ontario today announced that it has suspended the competitive RFP to procure two replacement nuclear reactors planned for the Darlington site. Deputy Premier and Minister of Energy and Infrastructure George Smitherman indicated that the government remains committed to the modernization of Ontario's nuclear fleet.

"Emission-free nuclear power remains a crucial aspect of Ontario's supply mix," Smitherman said. "Unfortunately, the competitive bidding process has not provided Ontario with a suitable option at this time," he added.

Proposal submissions were received from AREVA NP, Atomic Energy of Canada Limited and Westinghouse Electric Company on February 27, 2009 and carefully evaluated. Only the submission from AECL was compliant with the terms of the RFP and the objectives of the Government. However, concern about pricing and uncertainty regarding the company's future prevented Ontario from continuing with the procurement at this time.

In March 2008, Ontario undertook a two phase competitive procurement process to select a nuclear vendor to build a two unit nuclear power plant at Darlington. The units are to replace older units as part of a strategy to renew Ontario's nuclear fleet. Nuclear power accounts for about 50 percent of Ontario's electricity needs and provides a reliable, stable and clean supply of base load electricity.

Ontario's Long-Term Energy Plan

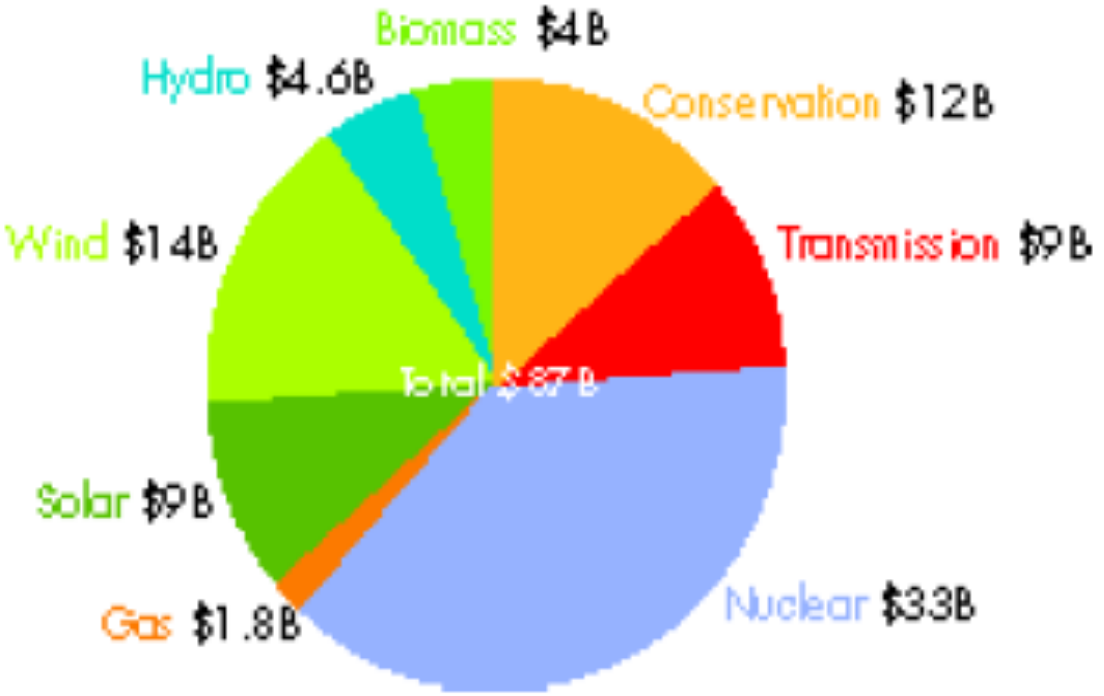
Building Our Clean Energy Future

Ontario

Long-Term Energy Plan and 2011 Supply Mix Directive

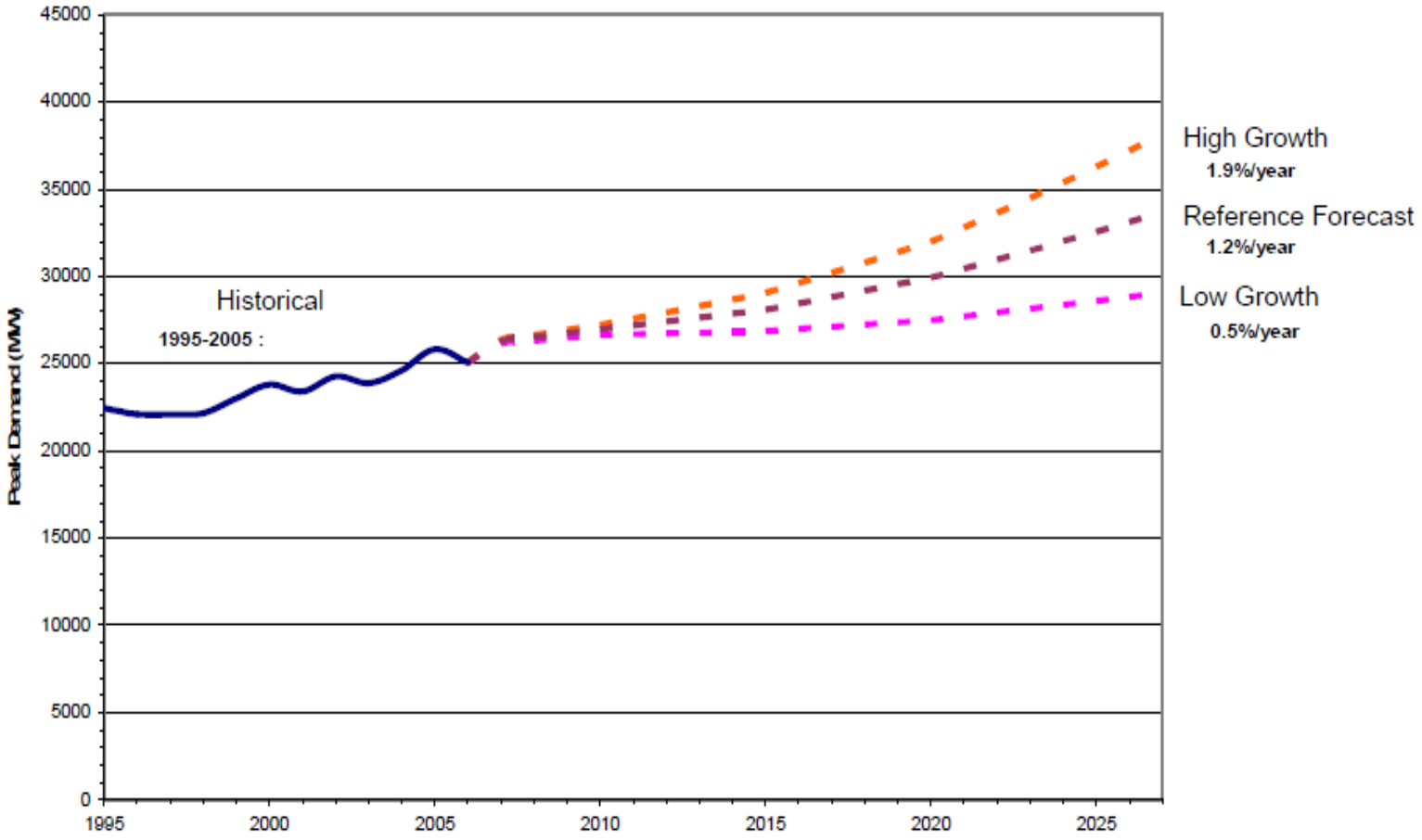
Installed Capacity	2003	2010 (Projected)	2030 (Projected)
Nuclear	10,061	11,446	12,000
Renewables – Hydroelectric	7,880	8,127	9,000
Renewables – Wind, Solar, Bioenergy	155	1,657	10,700
Gas	4,364	9,424	9,200
Coal	7,546	4,484	0
Conservation	0	1,837	7,100
Total	30,006	36,975	48,000

FIGURE 13: ESTIMATED CAPITAL COST OF LONG-TERM ENERGY PLAN: 2010 TO 2030 ($ BILLIONS)



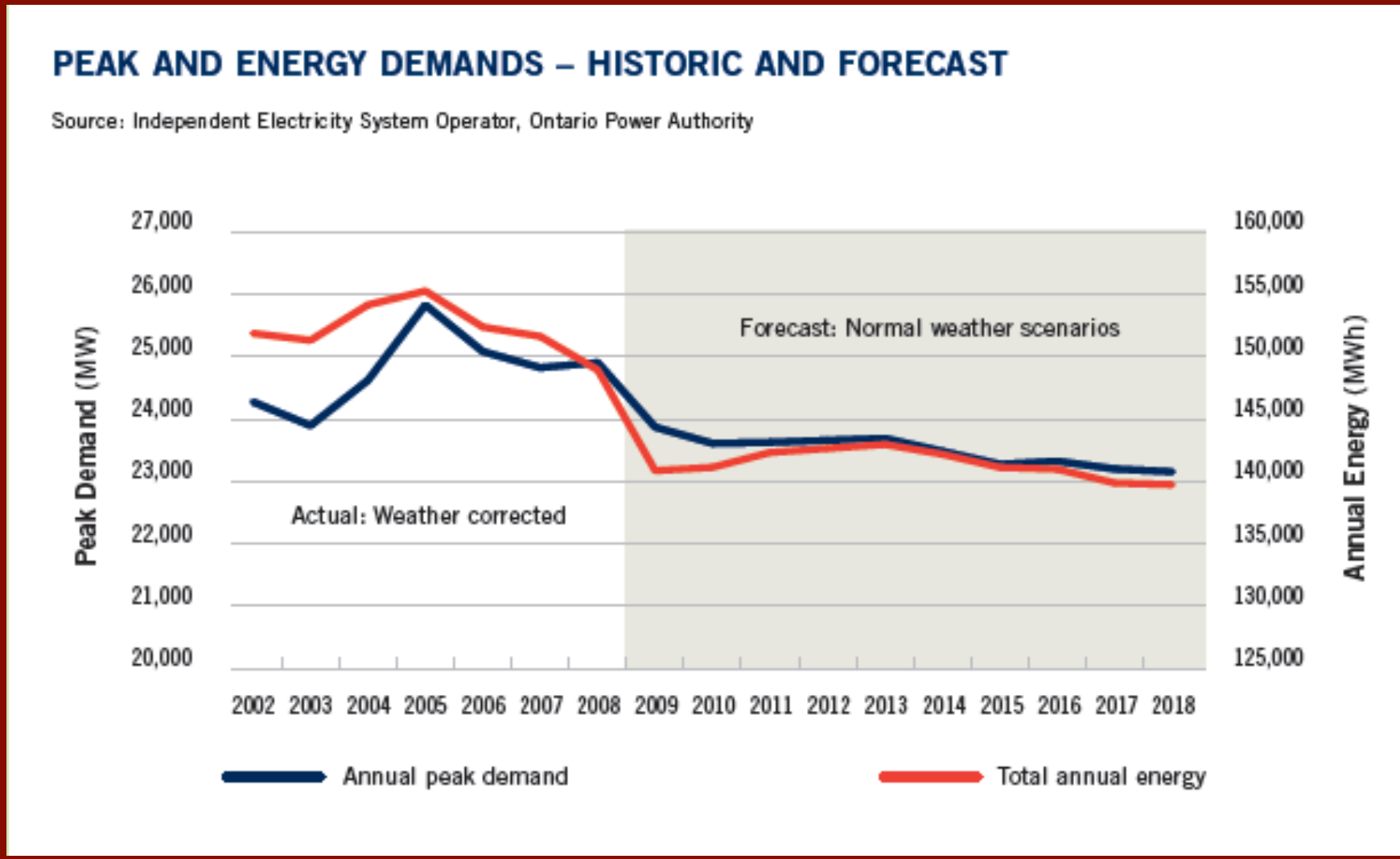
Complications….

1 **Figure 18: Reference Forecast Growth Scenarios – Peak Demand**



Source: IESO/OPA

Economic Downturn and Declining Demand (IESO December 2009)



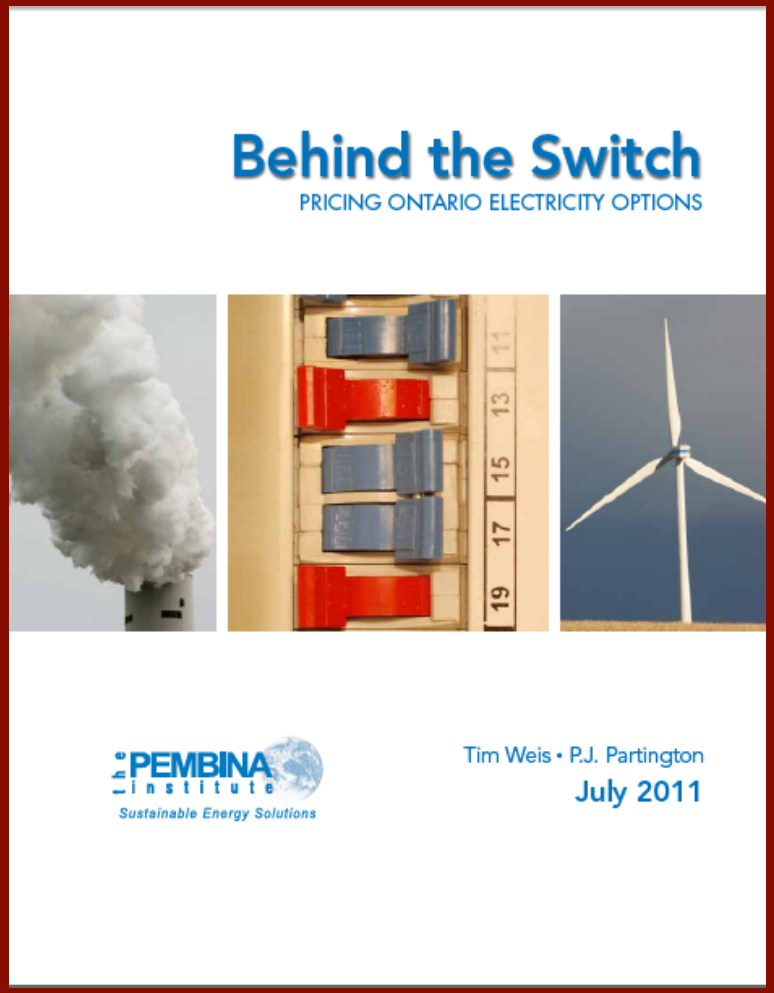
Fukushima

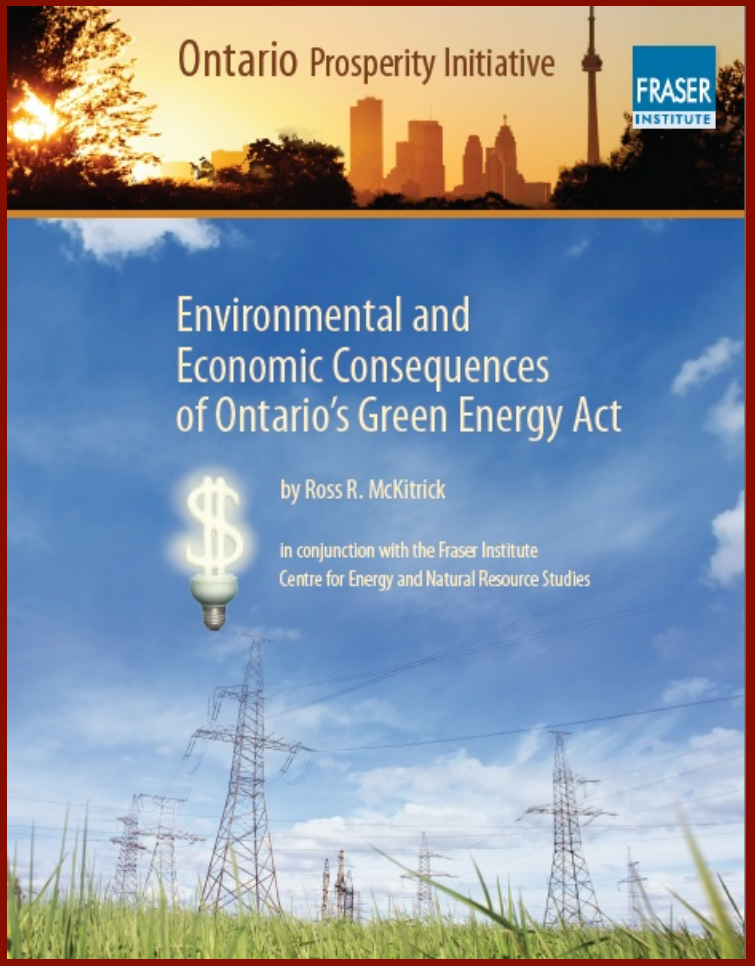
Green Energy Challenges

- Local Opposition to wind energy and impact on 2011 Election

Lynne DiCocco (holding GEA Green Fascism sign), is surrounded by neighbours protesting the Armow Wind Farm

The Cost Debate





Green Energy as Industrial Strategy

FP COMMENT

TRENDING RBC | Earnings | Porter Airlines | Tax Season | BlackBerry

Ontario's Power Trip: Discounts and windmills

FP TOM ADAMS, SPECIAL TO FINANCIAL POST | 12/06/27 | Last Updated: 12/06/27 8:55 PM ET
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Ontario Premier Dalton McGuinty works a solar panel assembly line during last year's election campaign. National Post

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Granting discounts to industry while spending on wind means chaos

Studies in Ontario Electricity Policy Series | Paper No. 5

Understanding the Economic Impact of Renewable Energy Initiatives:

Assessing Ontario's Experience in a Comparative Context

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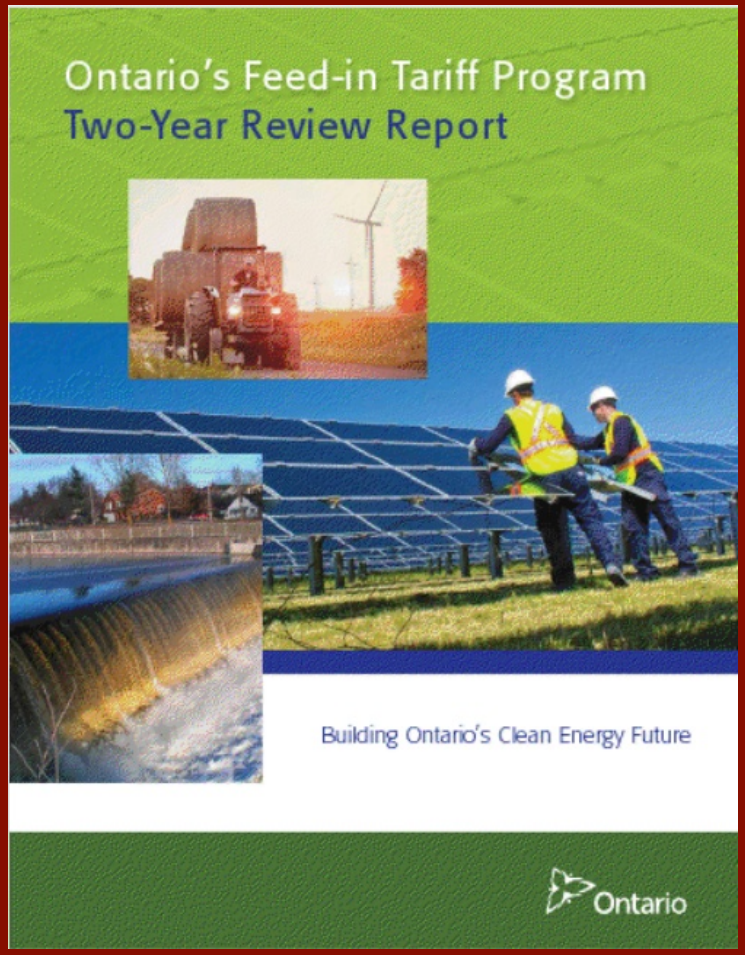
Co-Chair, Sustainable Energy Initiative
York University

with contributions from
Nageen Rehman, Mariana Eret, Dawn Strifler and Paul Cockburn

YORK UNIVERSITÉ UNIVERSITY
redefine THE POSSIBLE.

Green Energy Withdrawal

- Off-shore wind moratorium February 2011
- Fit Review and moratorium October 2011
- FIT rates reduced April 2012



Green Energy Withdrawal

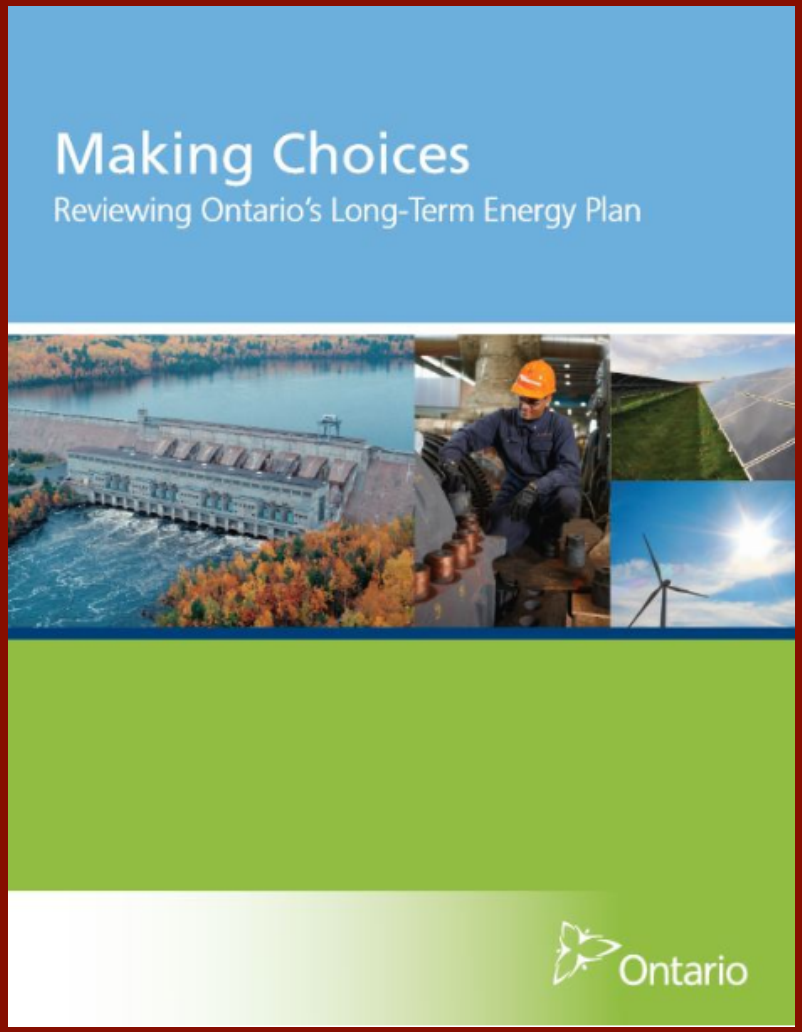
- May/June 2013
  - FIT Program terminated for projects >500kw
  - Samsung agreement targets reduced by 45%
  - Domestic content requirements reduced in face of WTO decision
  - No commitment on renewables beyond 2018

No Nuclear New Build – October 2013

AECON

Where Now?

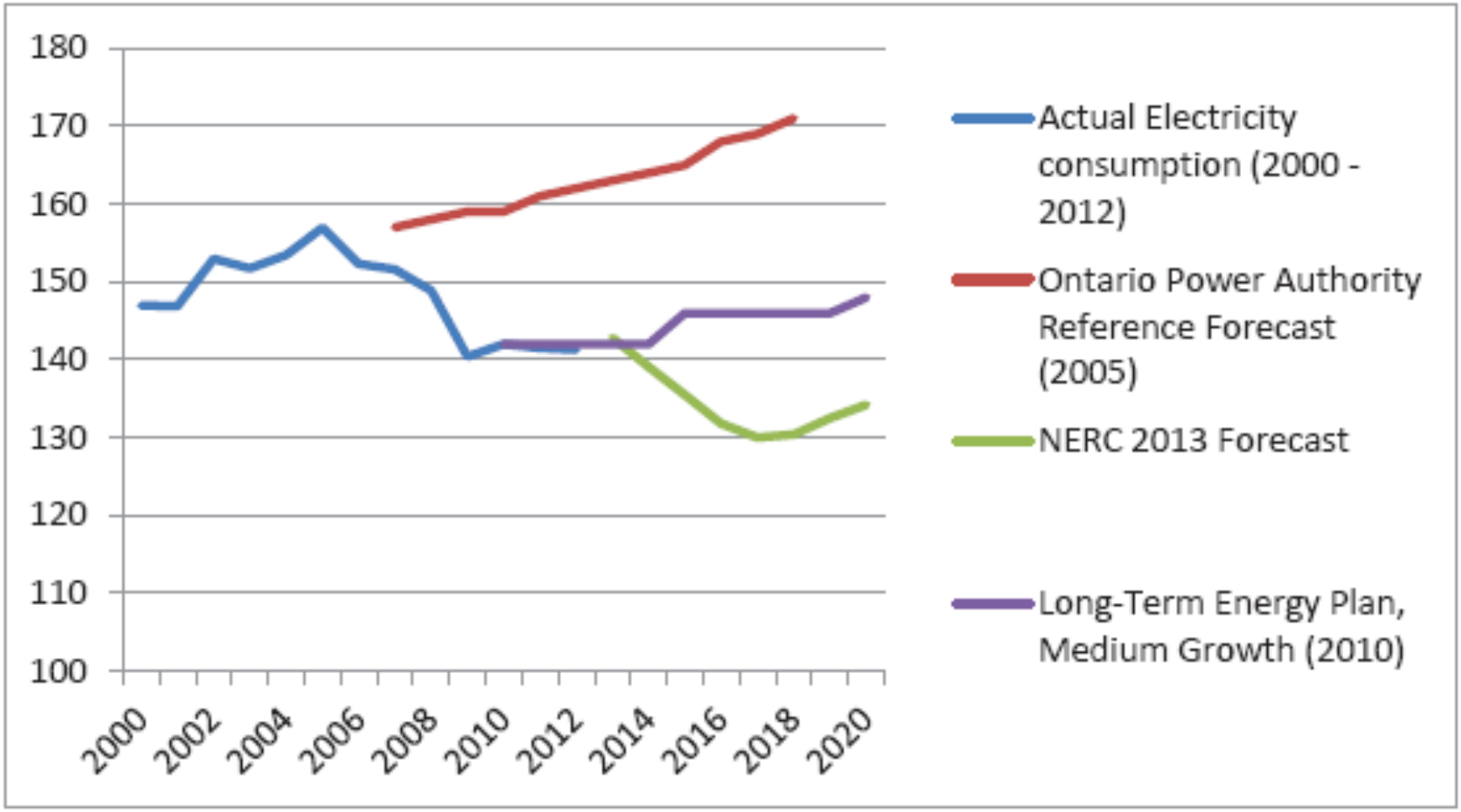
- Gas plant cancellation saga continues
- Declining Demand
- Conservation
- Nuclear Refurbishments?
- Renewables Future?
- Smart Grids and Storage?
- Quebec relationship
- Bill 75 and Abandonment of Planning concept



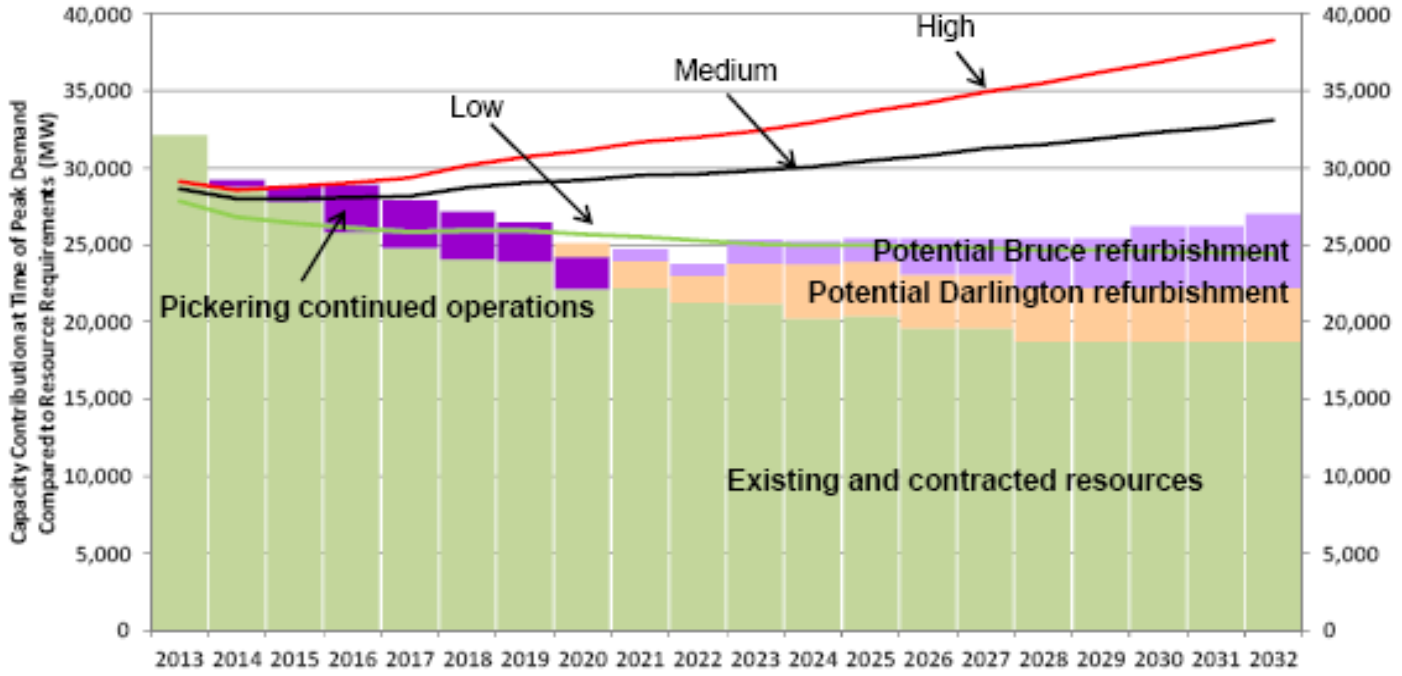
Planning Implications

- Need for more flexible and adaptive approach to planning
- Incorporate insights from complex systems, socio-ecological resilience and socio-technological transitions perspectives
- Comparative policy analysis
  - Germany, California, BC, UK.

Figure 6: Ontario Electricity Consumption 1975-2013 (Forecast 2013-2018) tWh/yr[103]



Different scenarios may unfold that result in different electricity demands and consequent infrastructure needs



Notes:
Resource requirements under low, medium and high scenarios are comprised of demand plus planning reserve as required by reliability standards.
Contracted resources include contracted renewables and contracted natural gas.
Values are presented in Appendix B.

ONTARIO POWER AUTHORITY

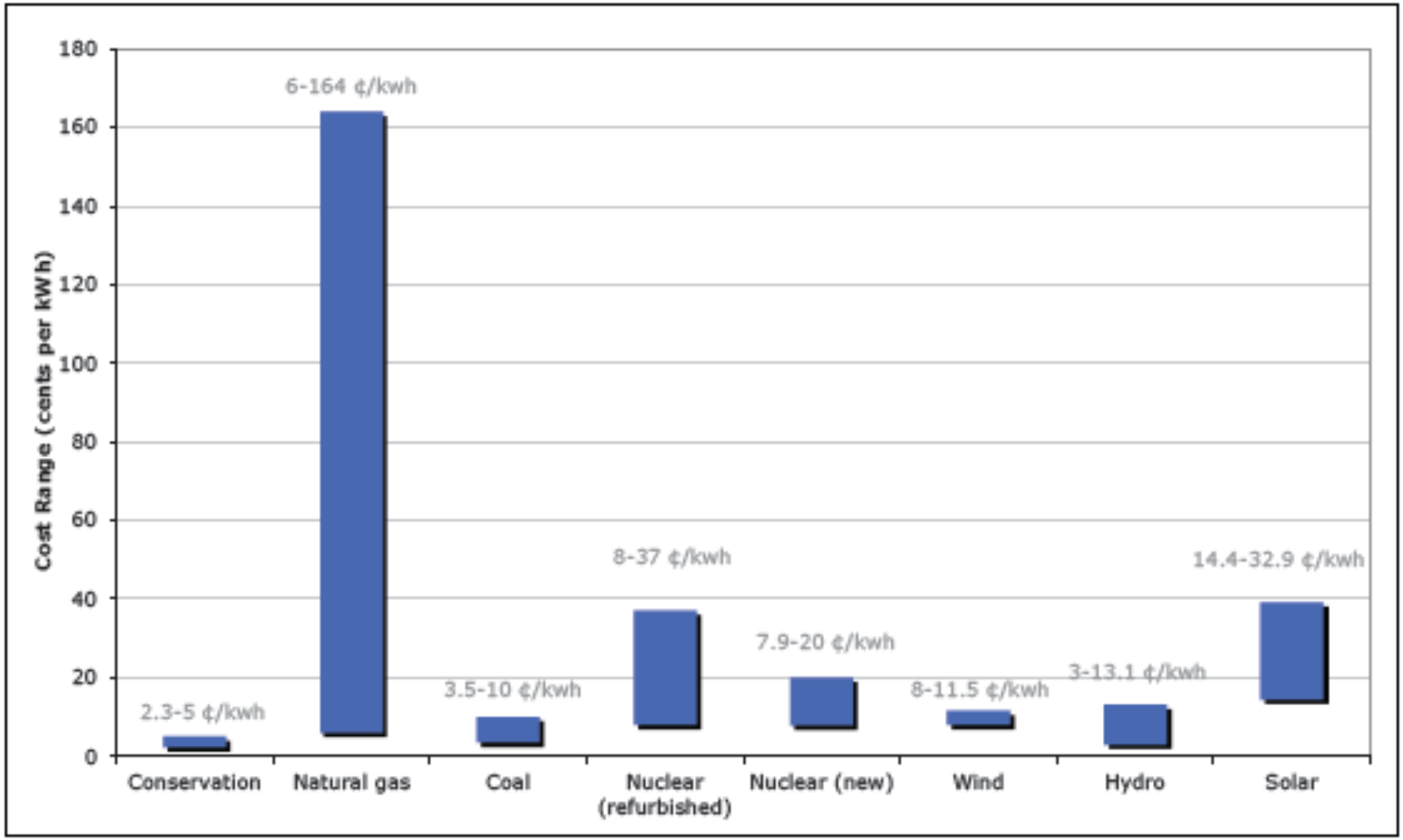
3.5 Hydro-Quebec Export Prices of Interruptible Electricity, 2006 to 2012

(₵/kWh)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2006	9.99	9.14	7.09	6.01	7.36	6.54	7.12	10.36	6.31	6.66	6.01	7.61
2007	6.61	9.88	7.82	7.13	6.90	8.57	8.01	8.67	6.90	5.37	6.48	8.75
2008	8.69	6.68	6.67	6.05	6.74	8.00	14.04	11.26	7.59	9.62	7.46	6.58
2009	11.95	8.59	5.98	10.40	4.48	4.46	4.88	4.33	3.41	4.21	4.71	5.01
2010	5.16	4.70	4.06	4.09	4.29	5.27	5.90	5.94	6.64	11.83	6.83	6.02
2011	5.08	4.48	3.84	3.69	3.69	3.76	4.50	4.43	3.52	4.15	3.85	3.52
2012	4.29	3.51	3.00	2.85	3.13	3.10	3.62	3.54	2.71	3.28	3.77	-

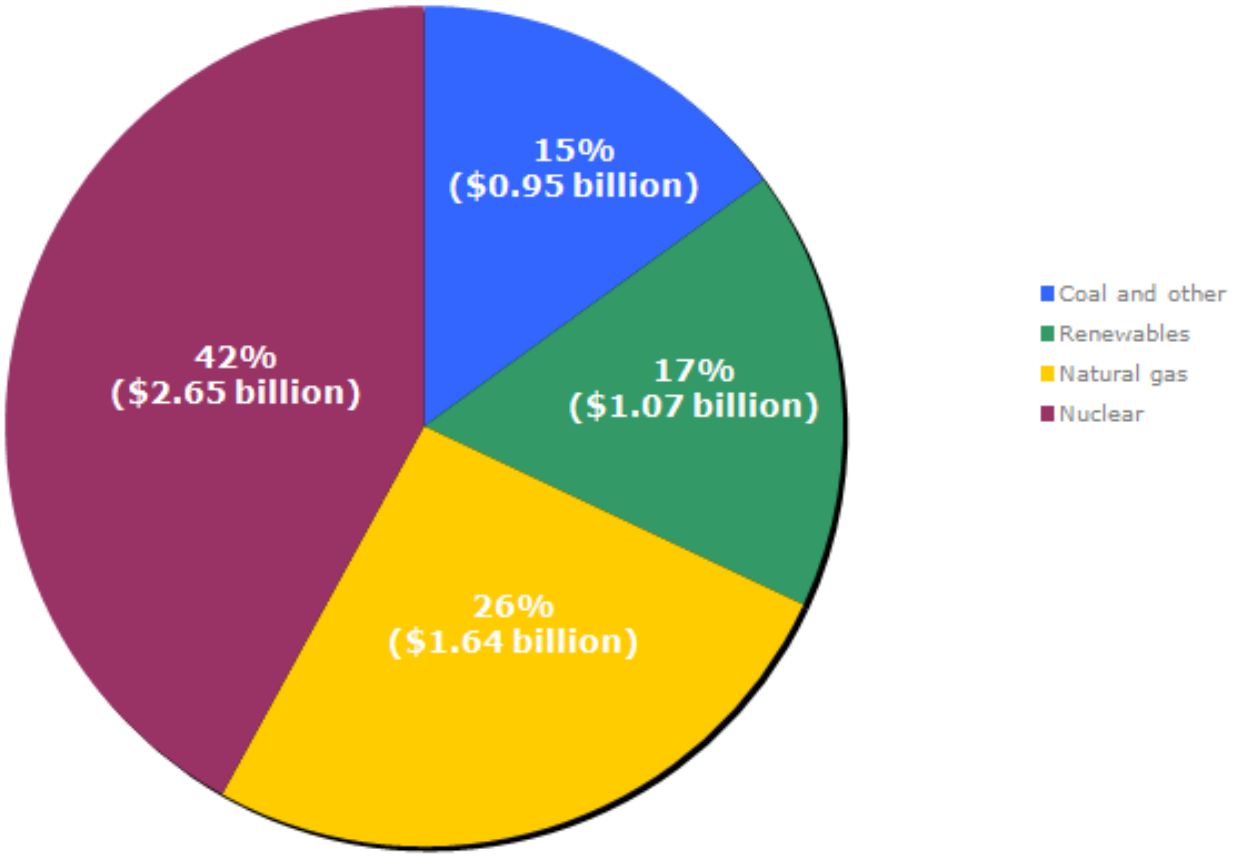
Source : National Energy Board

Figure 4: Economic Costs of New Energy Conservation and Supply Technologies: Ontario[65]



FIT rates: The original FIT rates and the rates as updated April 5, 2012 and August 26, 2013 are as follows:[18]

Renewable Fuel	Project Size Tranche	Original FIT Price (¢/kWh)	FIT Price (¢/kWh) April 5, 2012	FIT Price (¢/kWh) August 26, 2013
Solar (PV) Rooftop	≤ 10 kW	80.2	54.9	39.6
	> 10 ≤ 100 kW	71.3	54.8	34.5
	> 100 ≤ 500 kW	63.5	53.9	32.9
	> 500 kW	53.9	48.7	N/A
Solar (PV) Non-Rooftop	≤ 10 kW	64.2	44.5	29.1
	> 10 ≤ 500 kW	44.3	38.8	28.8
	> 500 kW ≤ 5MW	44.3	35.0	N/A
	> 5 MW	44.3	34.7	N/A
On-Shore Wind	All Sizes	13.5	11.5	11.5
Waterpower	≤ 10 MW	13.1	13.1	14.8
	> 10MW≤ 50MW	12.2	12.2	14.8
Renewable Biomass	≤ 10 MW	13.8	13.8	15.6
	> 10 MW	13	13	15.6


15%
($0.95 billion)
17%
($1.07 billion)
26%
($1.64 billion)
42%
($2.65 billion)
Coal and other
Renewables
Natural gas
Nuclear