

Ontario Sustainable Electricity Project

The Pembina Institute
and
The Canadian
Environmental Law
Association
March 2004

Ontario's Electricity Situation

- Demand-Supply Plan and Collapse of DSM efforts post-1995
- Ontario Hydro Restructuring and Market Experiments
- NAOP and reliance on coal
- Health and Environmental Impacts
- Difficulties bringing nuclear facilities back on-line
- August 2003 blackout and reliability/security of supply concerns

1993

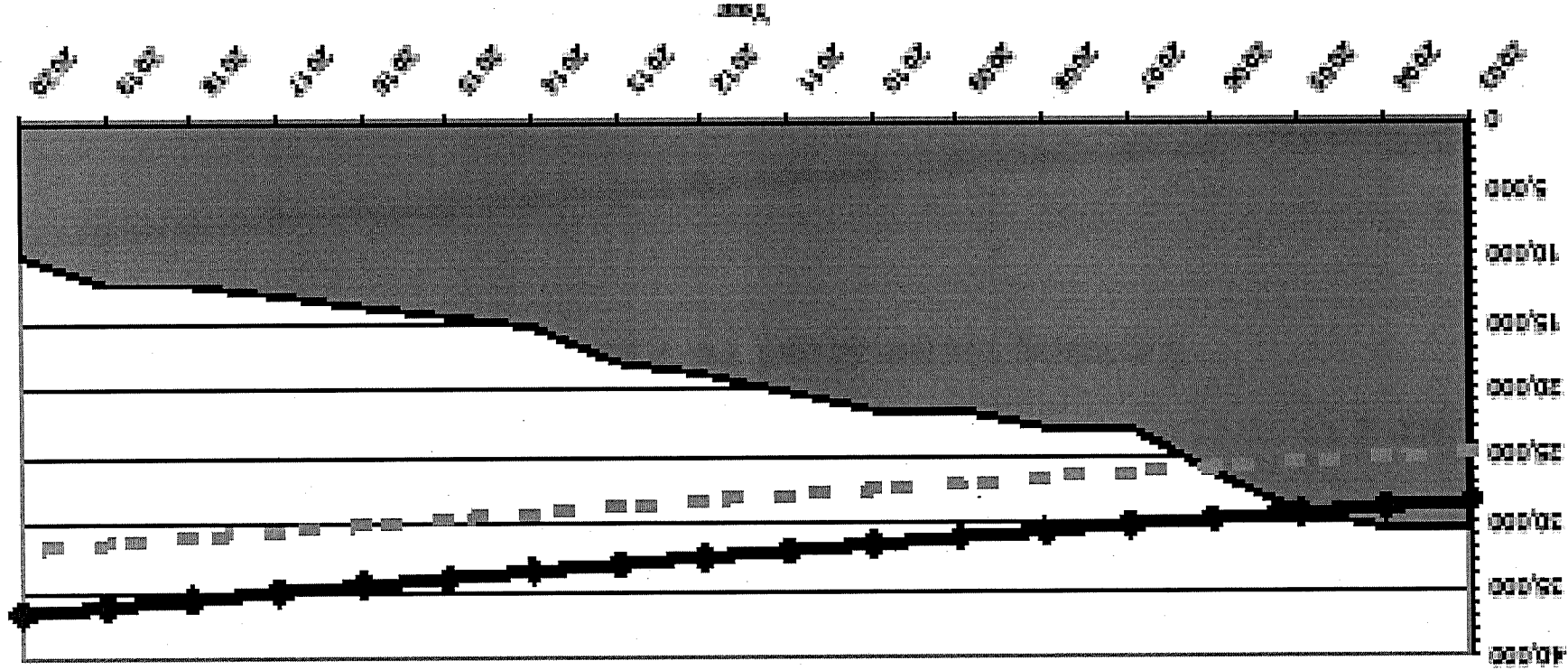
1 or fuel
Nuclear
Optimization
Plan

Ontario's Electricity Situation

■ Projected end-of-life for existing nuclear and coal facilities

■ Projected business as usual growth in demand

Capacity (MW)



Existing Generation vs. Peak Demand

FIGURE 2.C

Total Installed Capacity (MW) Assuming Existing Generation Assets and Planned Plant Life
 Peak Demand (MW) Medium Growth Forecast (MW)
 Peak Demand + 15% Reserve (MW)

Debate re: Approaches to Future Demand/Supply

■ Potential contribution from DSM

■ Electricity Conservation and Supply Task Force (January 2004)

■ Torrie Smith (July 2003)

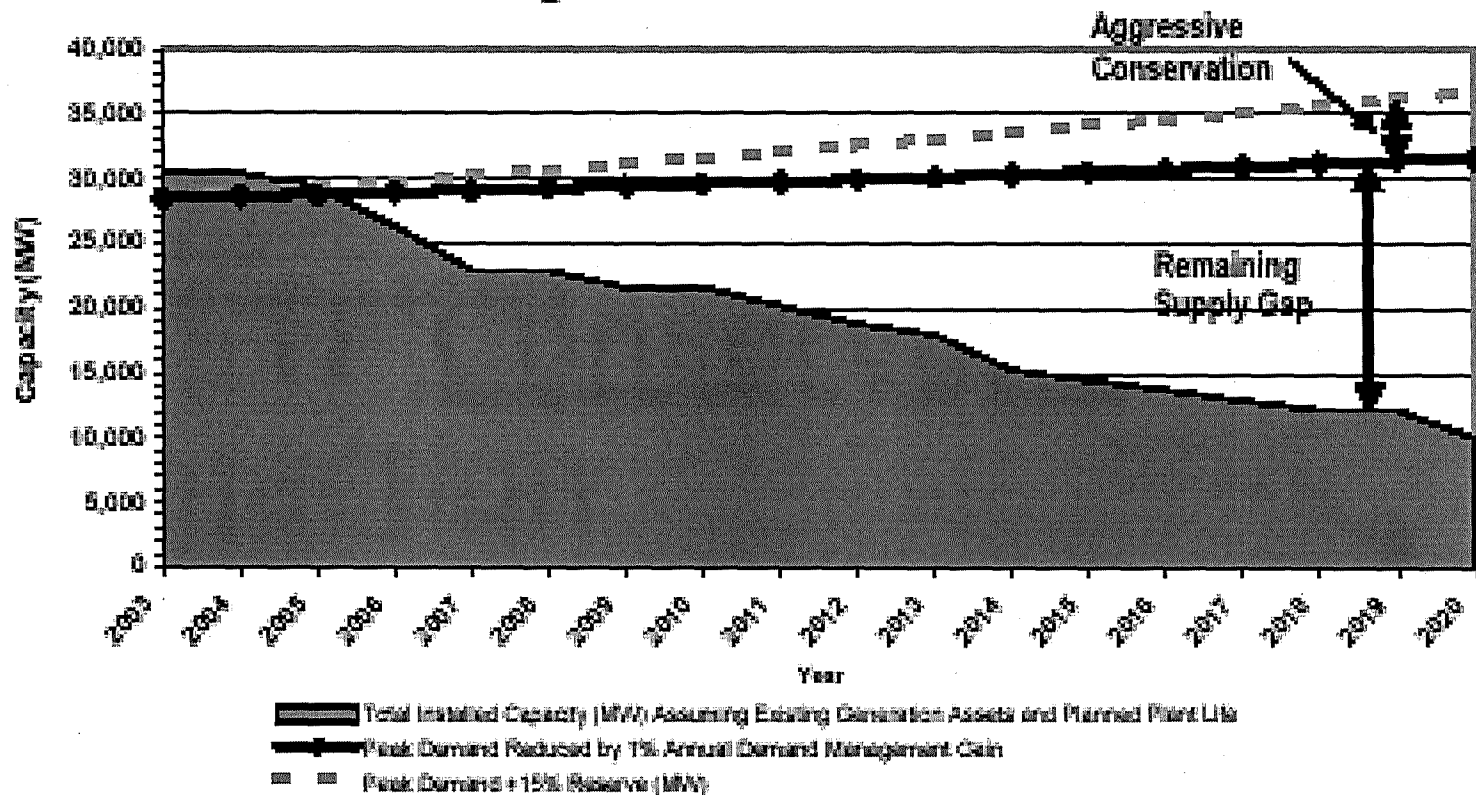
■ Future role of nuclear, gas and renewables

ECSTF Conservation Projection

Conservation Supply Take Force Report

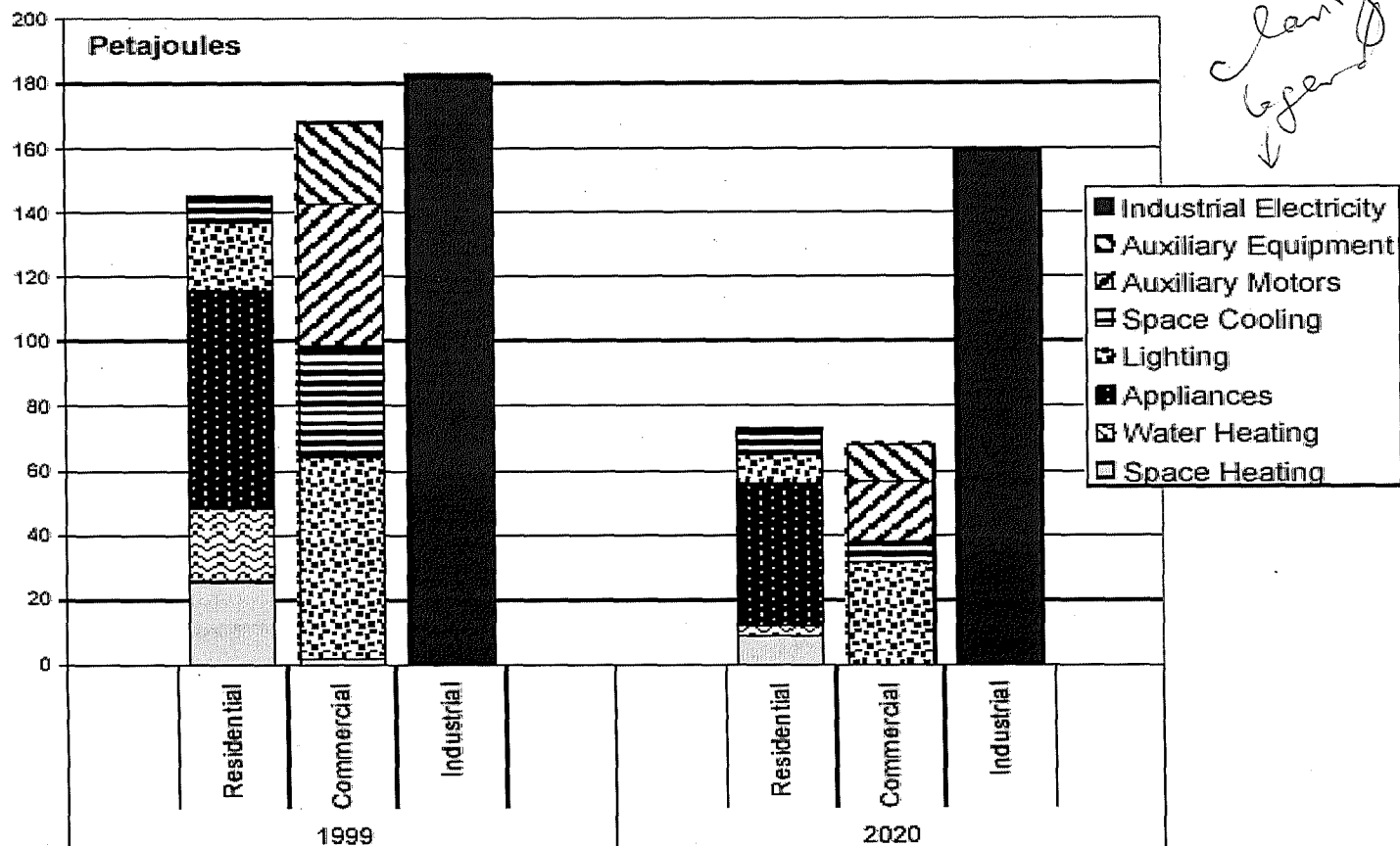
**FIGURE 2.D
DEMAND/SUPPLY BALANCE –**

Existing Generation vs. Peak Demand



Torrie Smith Conservation Projection

Figure 10 – Demand for Grid Electricity in Ontario by Sector and End Use in 1999 and in the Nuclear/Coal Phaseout Scenario for 2020



Pembina/CELA Project

- Gaps in ECSTF and Torrie analyses

- Collaboration with EMRG at SFU to use CIMS to investigate potential contribution from DSM and cogeneration

- Investigation of supply options to meet remaining future demand

- Identification of key policy measures to implement

Energy Materials Research Group

CIMS DSM/Efficiency/Cogen Analysis

■ Four Runs:

- Removed constraints in CIMS on cogeneration
- Provided financial incentives equivalent to removal of PST
- Innovative financing measures to reduce payback time on efficiency investments via reduction of CIMS discount rates
- Combined run
- Used NRCan forecasts for future Ontario electricity and gas prices

CIMS Results

Simulation

Electricity Demand (PJ)

	2000	2005	2010	2015	2020
Baseline	490.26	500.00	531.94	587.18	650.79
1. Unconstrained Cogeneration Competition	490.26	500.00	520.52	562.12	612.76
2. Unconstrained Cogeneration Competition + Discount Rate Reduction	490.26	500.00	437.51	400.69	391.88
3. Unconstrained Cogeneration Competition + Capital Cost Reduction	490.26	500.00	511.94	546.06	591.62
4. Unconstrained Cogeneration Competition + Discount Rate Reduction + Capital Cost Reduction	490.26	500.00	435.22	396.37	386.20

CIMS Results

Electricity consumption with the policy simulating changes in place is forecast by CIMS to be as follows:

Sector	GWh/Year – Policies Applied			
	2005	2010	2015	2020
Residential	37,926	30,542	27,277	26,494
Commercial/Institutional	55,279	47,623	40,874	39,201
Industrial	12,709	11,952	10,863	10,058
Process	33,440	32,060	33,263	34,570
Auxiliary	(464)	(1,282)	(2,173)	(3,047)
Cogeneration				
Total	138,890	120,895	110,104	107,276

CIMS Results

- 73,499 GWh/Year reduction against BAU
 - 41% reduction in demand against BAU
 - Results reflect:
 - Adoption of most efficient technologies *Sign*
 - Cogeneration *High level*
 - Shift from electric to natural gas heating *large*
- business as usual - full?*
- already existing by 2010*

Impact on Natural Gas Consumption

Sector	Increases in Natural Gas Use – PJ			
	2005	2010	2015	2020
Residential	-	(23)	(38)	(45)
Commercial /Institutional *	-	52	118	176
Industrial	-	2	4	6
Process	-	0	0	1
Auxiliary	-	(3)	(5)	(8)
Cogeneration	-	28	79	130
Total	-			

Impact on Natural Gas Consumption

■ 130PJ over BAU for total of 1200PJ

■ Total consumption 42% increase over 2001 consumption

■ 15% accounted for by cogen and other measures

Societal Costs of Cogen/Efficiency/DSM

Sector	Incremental Costs Associated with Achieving 2020 Savings			
	Investment	O/M	Energy	Total
Industry	829	273	(1,255)	(153)
Residential	7,220	(45)	(6,174)	1,001
Commercial	10,211	1,345	(11,782)	(225)
Total	18,260	1,573	(19,211)	622

18 billion
invested over
15 yr period

in
Savings

Range
low to
high

622 million
over
15 yr

Societal Costs

- Net cost \$622 million over 15 years
 - < \$60 per resident
 - < \$4 per resident per year
- Does not include health and environmental co-benefits *which add*

efficiency reduce costs?

[Handwritten notes:]

1/5000 > 15 yrs
16/10000 ~ 1 yr

[Faint handwritten notes:]

1/5000
16/10000
~ 1 yr

Estimating Peak Demand Reduction

- Estimate demand reduction from CIMS results (using IMO load factors)
- Estimate impact of demand response measures
- Impact of demonstration projects to reduce peak demand

Peak Load Reduction

Sector	Peak Reduction MW		
	2010	2015	2020
Residential	1400	2546	3206
Commercial /Institutional	3032	6209	8832
Industrial	Process	113	293
	Auxiliary	270	401
	Cogeneration	112	234
Total	4,927	9,682	13,346

avoided
Served
Spent

Demand Response

■ Potential shift of 10% Peak
(Navigant consulting study for IMO)

■ 10% of 16,650 MW = 1665MW

Peak Load Shaving

■ 1000 MW solar roof program to reduce peak demand 750 MW.

■ Addresses summer peaks

Peak Demand Reduction Summary

	2010 Peak MW		2015 Peak MW		2020 Peak MW	
	Winter	Summer	Winter	Summer	Winter	Summer
IMO Forecast	26,000	27,800	26,500	28,700	28,000	30,000
Efficiency/Fuel Switching and Cogeneration	-5000	-5000	-9700	-9700	-13,400	-13,400
Demand Response	-2300	-2300	-1900	-1900	-1650	-1650
On-Site Generation		-250		-500		-750
Net Grid Demand	18,800	20,300	14,900	16,600	13,000	14,300

Remaining Grid Demand

	GWh/yr	Winter Peak MW	Summer Peak MW
2005	153,000	25,500	26,300
2010	136,000	18,800	20,300
2015	117,000	14,900	16,600
2020	104,000	13,000	14,300

Renewable Supply Options

■ Wind

■ OWPTF estimate of 3000 to 7000MW
excluding offshore

■ Match between wind generation and
peak demand

■ Assumed 6000MW capacity by 2020

Renewable Supply Options

■ Hydro

- Current Capacity 7600MW

- Assume 1400MW new capacity including 600MW Niagara Expansion

- Total 9000MW

■ Biomass

- Landfill gas and biogas recovery, industrial energy recovery

- Assumed 1500MW

Demand/Supply Summary

	2010			2015			2020		
	GWh	MW	MW	GWh	MW	MW	GWh	MW	MW
		Peak	Capacity		Peak	Capacity		Peak	Capacity
Revised Grid Demand	136,257	20336		117,246	16654		103,873	14309	
Existing Nuclear	45,552	5328	8000	22,776	2,664	4,000			
Existing Hydro	33,572	6375	7665	33,572	6,375	7,665	33,572	6375	7665
Existing Peaking Gas and replaced Oil	12,208	3060	4645	12,208	3,060	4,645	12,208	3060	4645
Wind	7,884	1317	3000	11,826	1,976	4,500	15,768	2635	6000
New Hydro	4,380	600	7665	4,380	600	1,000	6,570	900	1500
Biomass	7,008	468	1000	10,512	703	1,500	10,512	703	1500
Baseload Requirement	25,623	3825	4500	12,208	3,825	4,500	25,623	3825	4500
Total Supply	136,227	20,974	36,475	107,482	19,203	27,810	104,253	17,498	25,810
Contingency	-30	638		-9,764	2,549		380	3,189	

↑ Next as all

Demand/Supply Summary

- 25,633GWh/4500MW baseload need
- Less than full replacement of existing coal generation (36,946GWh in 2003)

Baseload Need Options

■ Imports

- Quebec/Manitoba

*which one
what*

■ Integrated gasification combined cycle

- Reduced smog precursors and heavy metals, but not GHGs relative to conventional coal

in fuel

■ Combined Cycle Natural Gas

- Highest efficiency
- Large reductions in smog and acid rain precursors, heavy metals and GHGs
- May imply need to expand pipeline capacity or LNG
- Long-term supply issues

Policy Implications

- Efficiency/DSM/Cogeneration
- Net metering and power purchasing agreements for cogeneration
- Minimum efficiency standards and building codes
- Financial incentives and innovative financing tools funded through system benefits charge
- Mandate utility role in DSM targets and delivery
- Ontario Energy Board regulation of performance based rate setting so that electrical utilities share in the benefits of DSM

Policy Implications

- Demand response
- Time of use, time of day, critical peak pricing
- Interruptible or ripple supply rates
- Solar roofs program

Policy Implications

■ Renewables/Supply

In final ■ RPS for wind, hydro and biomass

■ Renewable power source tax credits to match federal WPPI *in final*

■ Analysis of renewable potential

■ Land-use guidelines re: wind

■ Long-term supply contracts for needed baseload