



Clean Energy

An Untapped Source of Pollution Prevention

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Overview

- Clean Energy = Pollution Prevention
- Current Canadian Energy Mix
- Obstacles Impeding Growth
- The Huge Untapped Opportunity
- Tapping into the Pollution Prevention Potential of Clean Energy

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Complexity, Creativity, Change

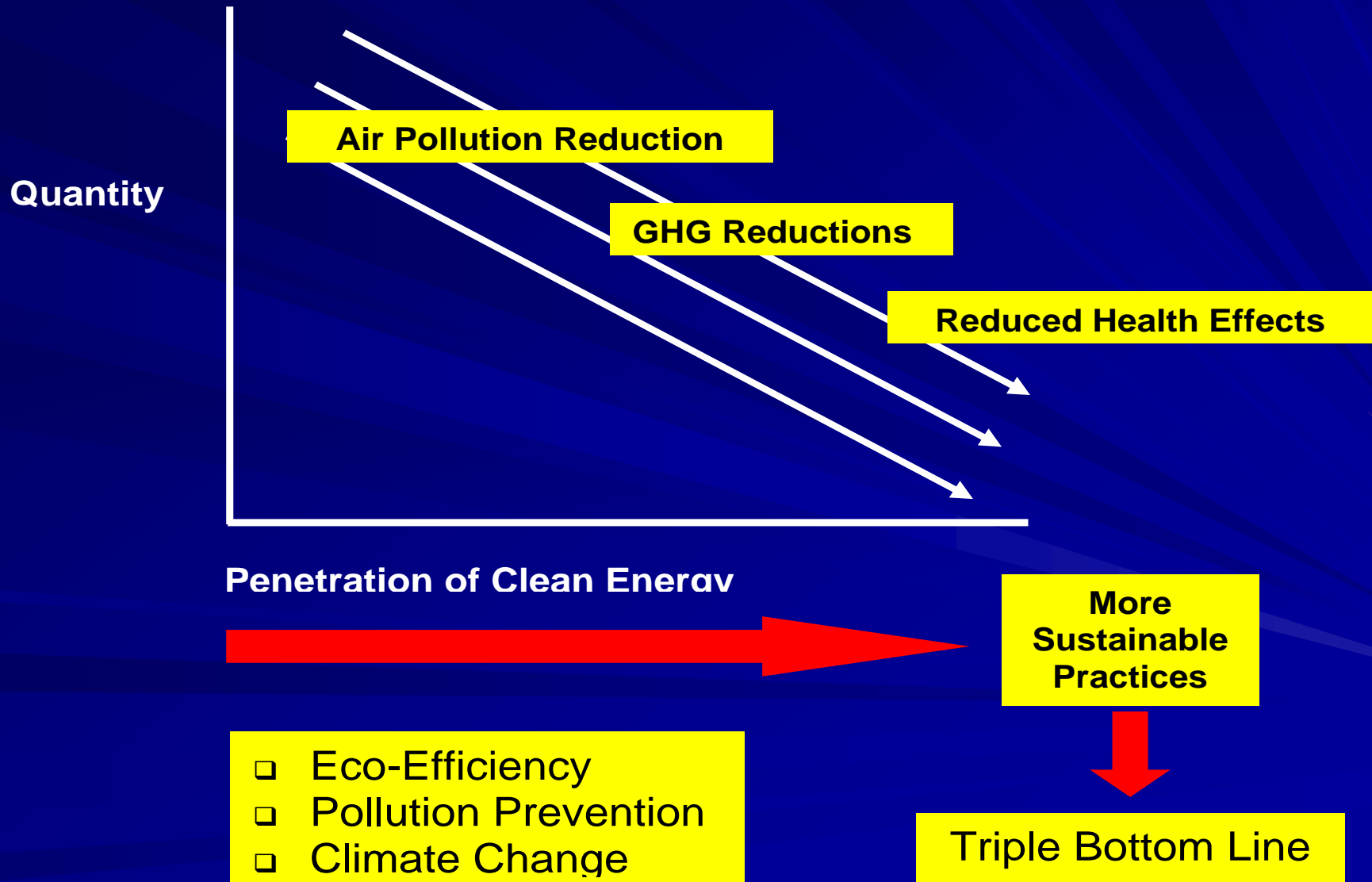


Market Valuation
Pricing & Positioning

GHG Reduction Strategies

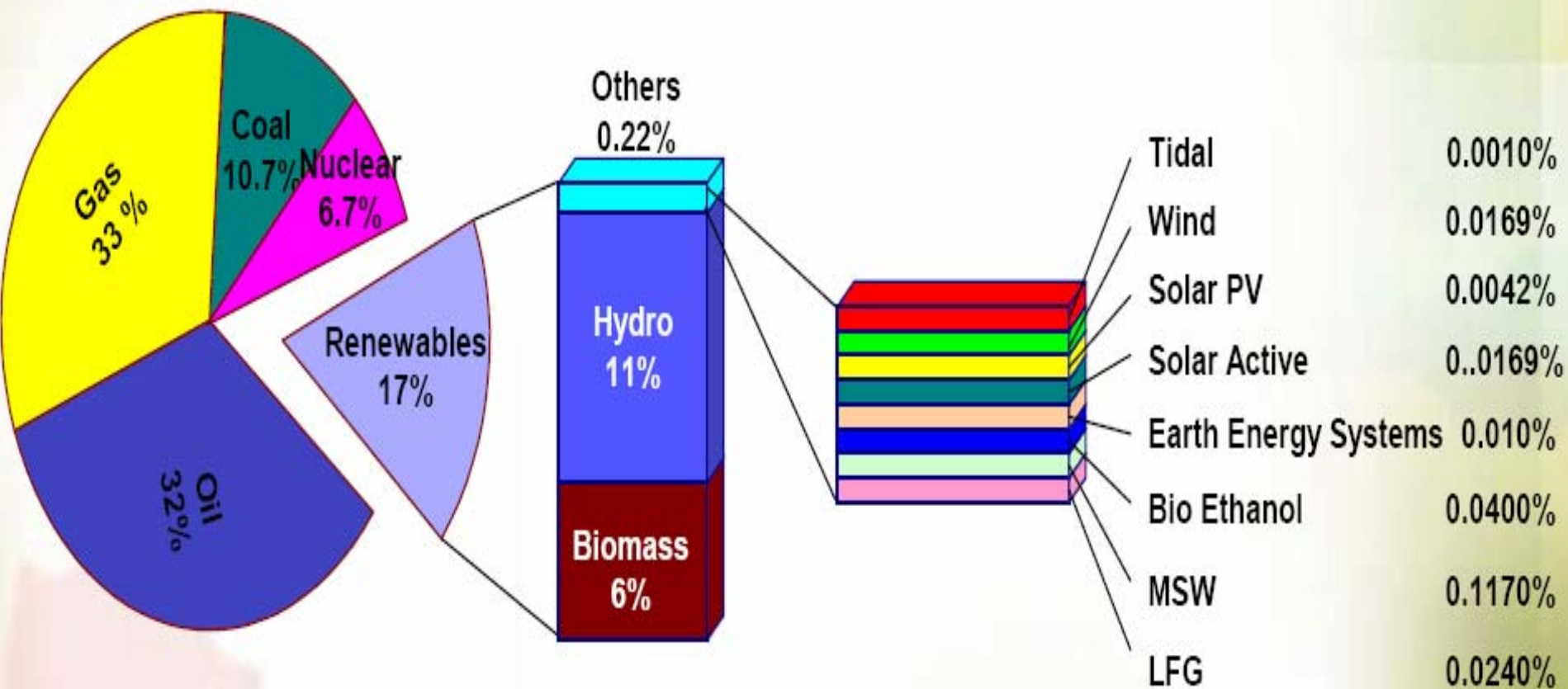
Business Planning & Project Structuring

Clean Energy = Pollution Prevention

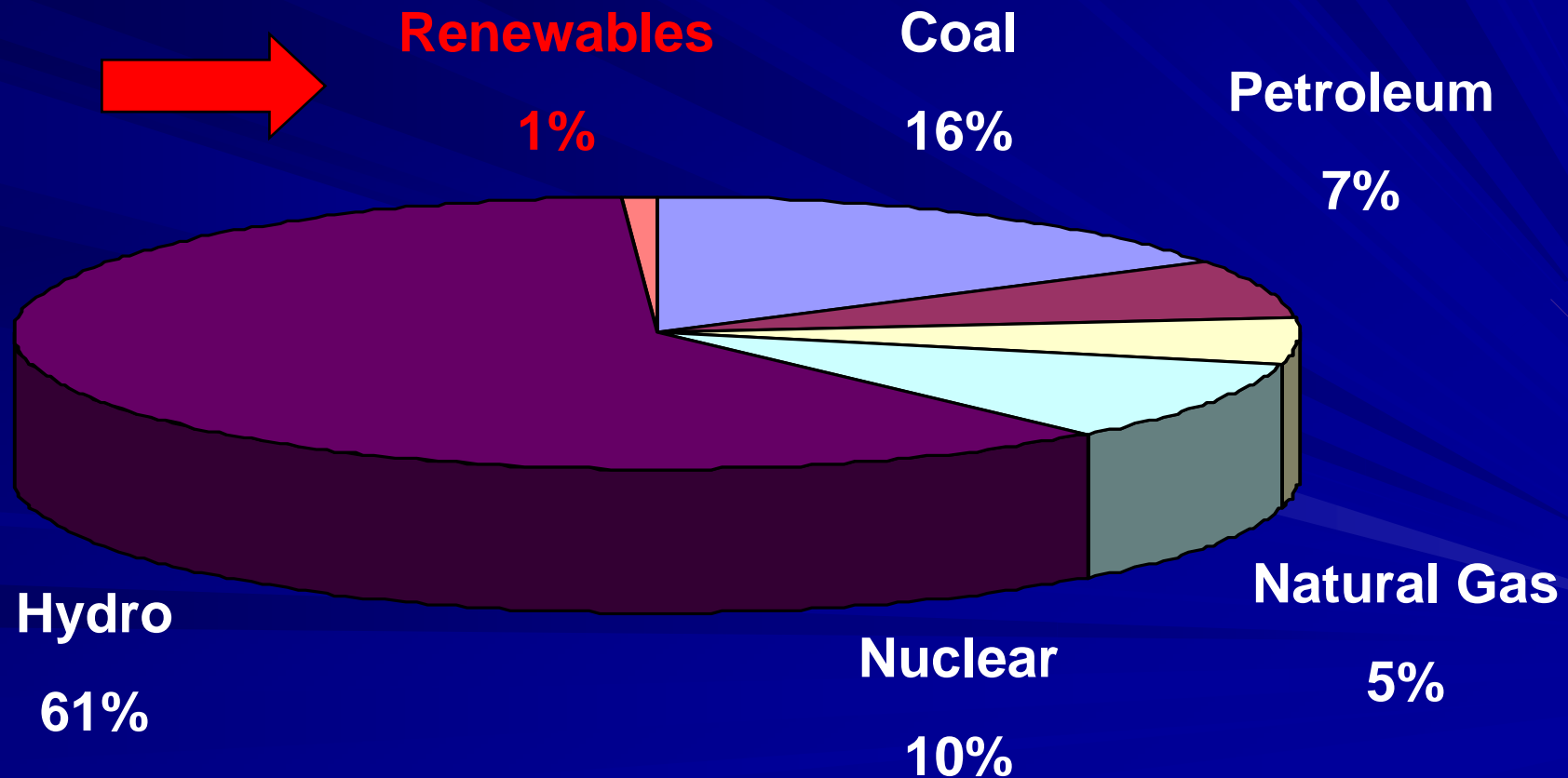


Current Canadian Energy Mix

2002 Fuel Shares of Canada Total Energy Supply



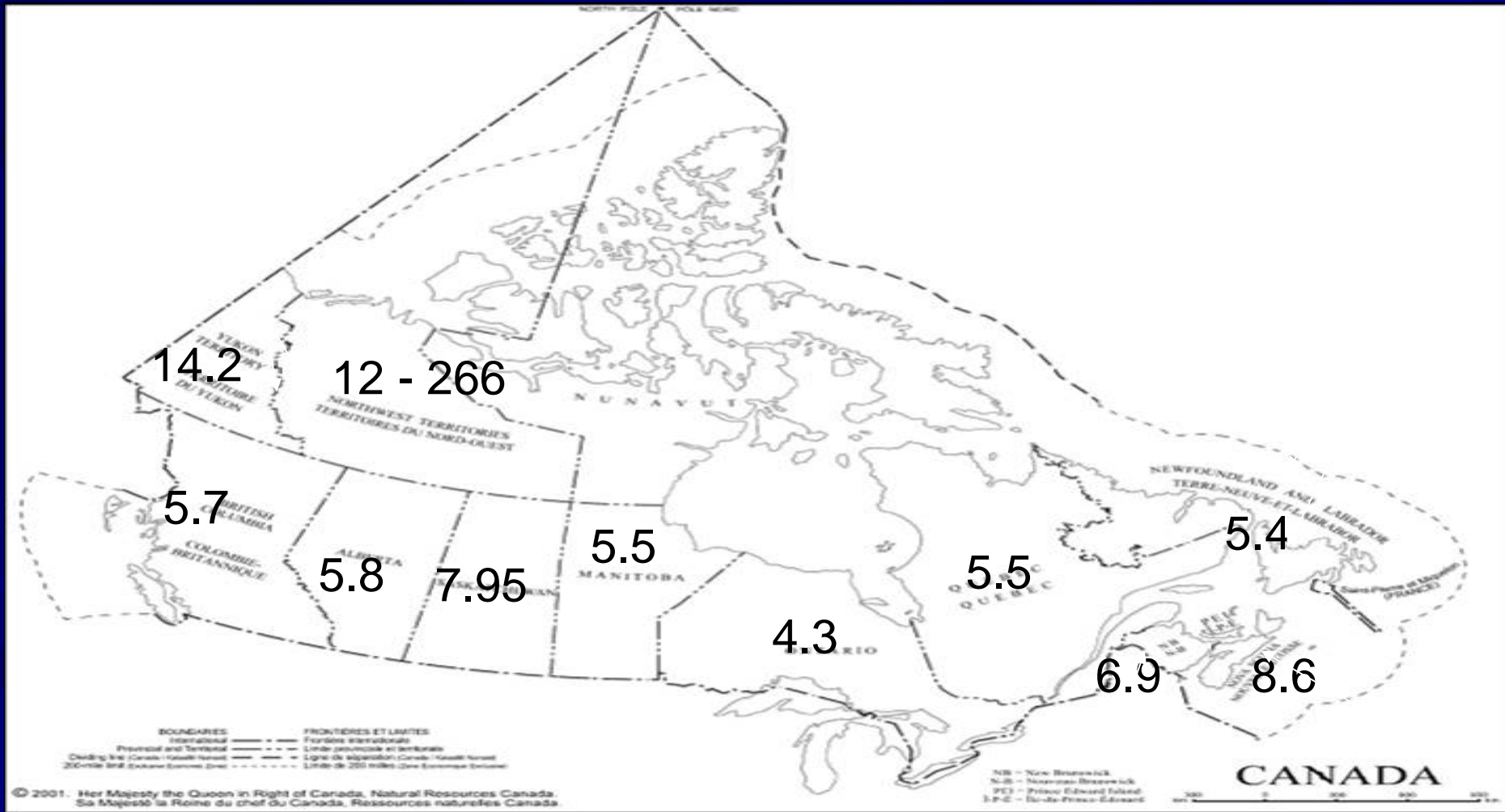
Canadian Electricity Capacity



Canadian Issues – Why Canada is Where it is

- Large Supplies of fossil and nuclear fuels – and large government incentives to promote these industries
- Low population density/ large land mass
- High per capita energy intensity
- Many external costs not factored into energy consumption charges
- Economic wealth built on low energy costs for long period of time...& low electricity costs continue
- Unfriendly policies to renewable technologies

Cost of Electricity in Canada - cents per kW/h (average residential)



Source: Map - Atlas of Canada, Rates – Provincial Utilities

Existing Obstacles to CE

**Existing
Technology
Realities**

**High capital costs / Poor Rates of Return
Manufacturing, installation, BOS
Technological jump required**

**Current Market &
Legislative
Domain**

**Affinity towards centralized power
Cheap “established” power
Cumbersome rules, pricing, processes**

**Technical &
Administrative
Challenges**

**Inconsistent interconnection standards,
guidelines, product and safety codes
Contract terms and conditions**

**Lack of Skills,
Awareness, Educ.**

**Limited knowledge of RETs & benefits
(end-users, utilities, investors, gov'n't...)**

Canadian Renewables

A Huge Untapped Resource

The Solutions Will Be Varied

Landfill
Gas

Small
Hydro

Biomass

Geothermal

Fuel
Cells

Solar
Photovoltaics

CHP

Micro-
turbines

Wind

Wind

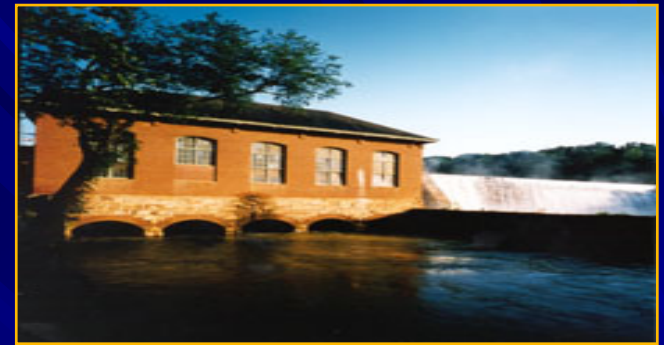
- At the end of 2002, Canada's installed capacity was about 237 megawatts (MW)
- Significant potential: CANWEA believes production of 10, 000 MW could be achieved by 2010
 - northern remote regions
 - west and east coasts
 - Great Lakes region
 - Prairies.
- Fastest growing in Canada
 - More than 20% in recent years



Source: CANWEA

Small Hydro

- Currently about 2000 MW.
- 3600+ sites (9000 MW) identified by NRCan as technically feasible
 - 1300 MW economical now
 - an additional 1800 MW economically exploitable if capital costs reduced by 10–15%.
 - Retrofits may significantly increase potential
- Capital cost (\$/kW): 1500 – 5000
- Cost (\$/kWh): 0.04 – 0.10



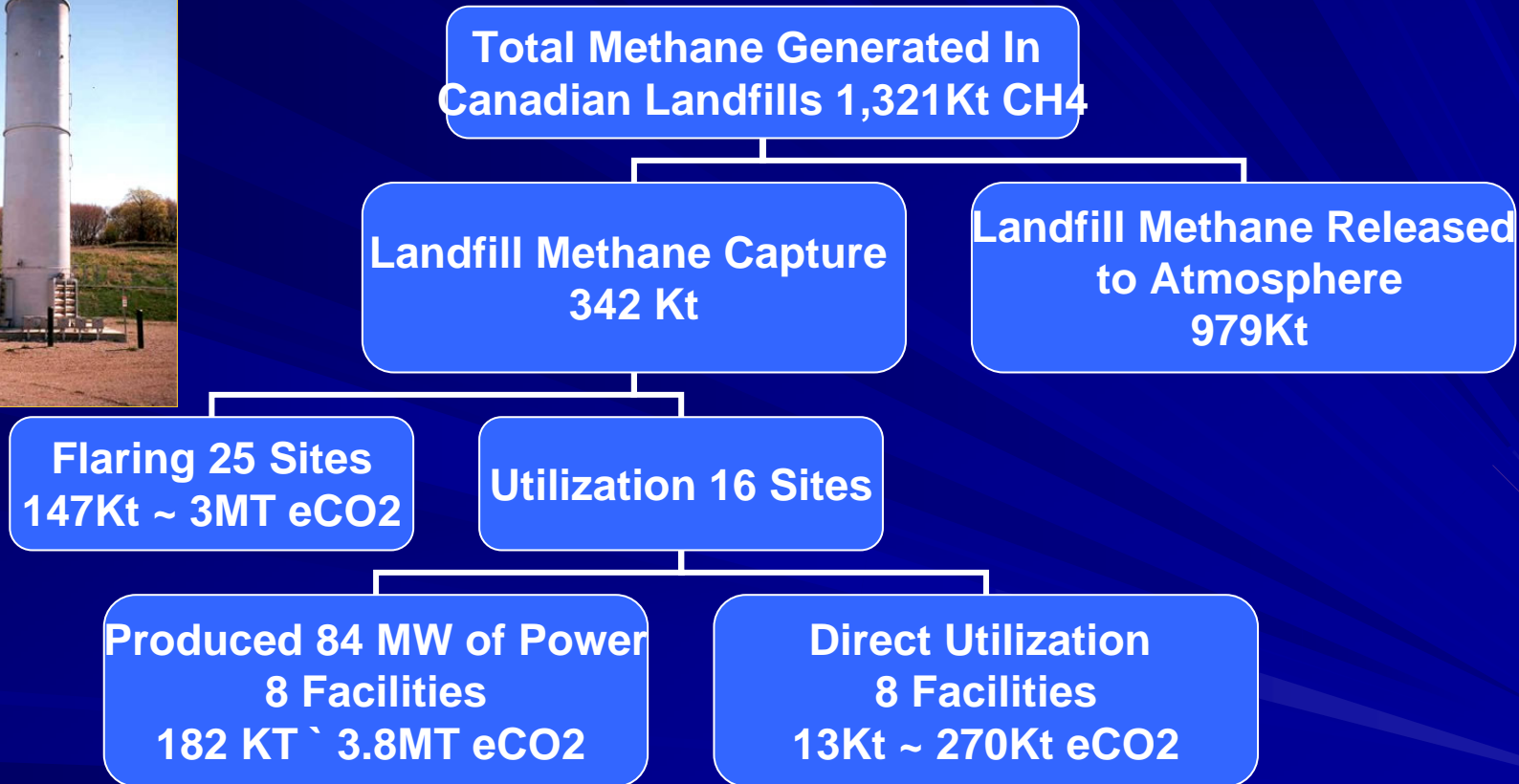
Replacement Francis Runners
Ottawa Hydro

Biomass



- Forest biomass installed capacity in Canada: 1642 MW
- Demand increased 50% from 1990 – 2000
- Potential is another 20%
- It is projected that Canada will produce surplus wood residues in 2010 with an energy content of 57.6 petajoules (16,000,000 MWh)
- Capital cost (\$/kW): 2500 – 3500
- Cost of energy (¢/kWh): 0.04 – 0.07

LFG Management (2001)





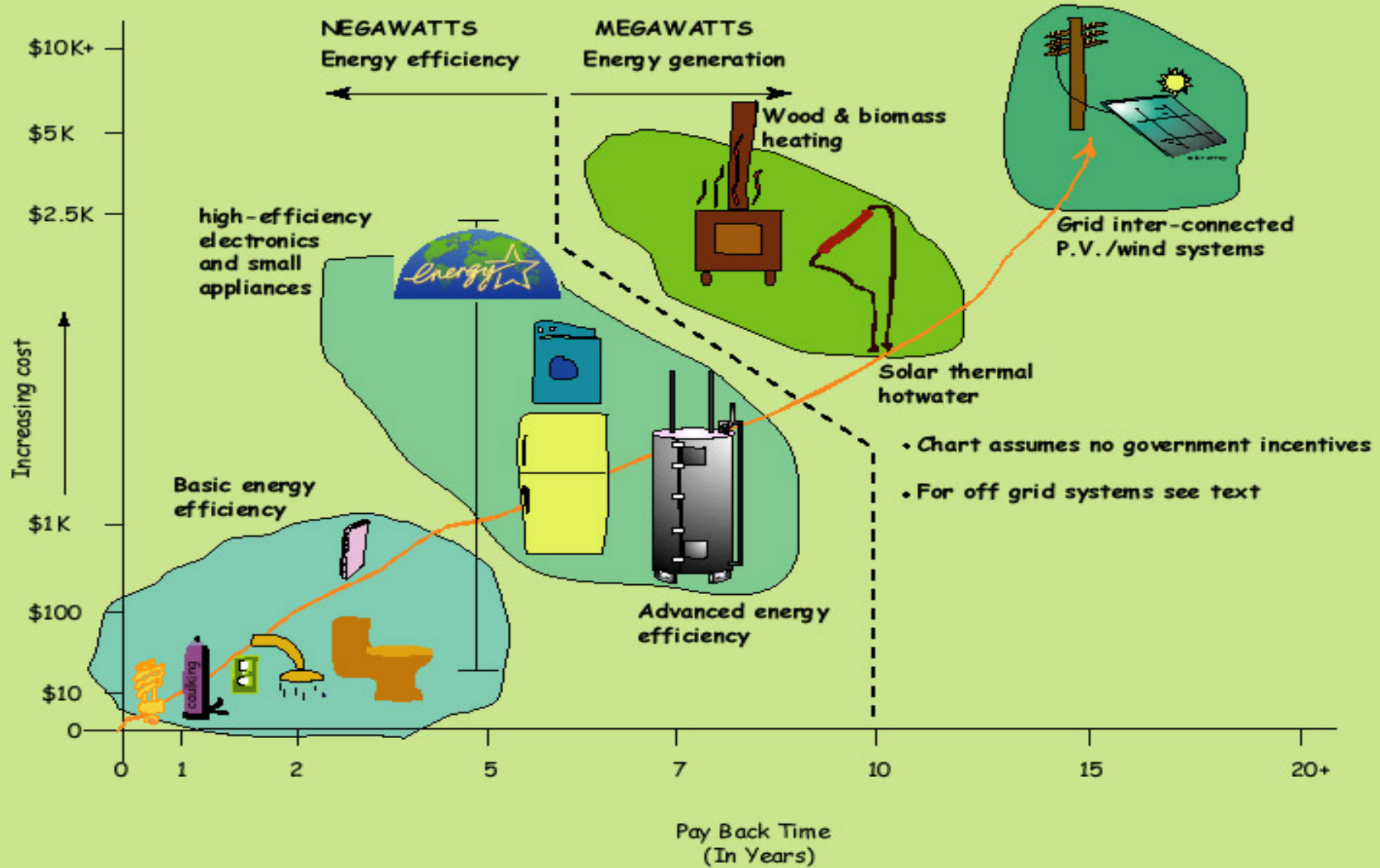
Solar PV & Thermal

- 10MW PV installed capacity in Canada
- Huge potential – Ontario gets more sunshine than Tokyo which is largest market in the world
- Capital for PV (\$/kW) \$5000 – 20000
- Cost of energy (\$/kWh):
 - 0.35-1.50 for solar PV
 - < \$0.08 per kWh. For solar thermal



Home Plate

Homeowners can Contribute



Unleashing the Potential

- Work Together to Create Strong Industry Voice
- Streamline Procedures & Processes
 - Permitting, net metering, interconnection...
- Provide Industry/Government Leadership
 - Establish Flexible & More Certain Market for DG
 - Build on and Enhance Current Initiatives/Policies
 - Renewables Integral to Tackling Climate Change
 - Procure & Demonstrate Canadian Technologies
 - Align Initiatives and Enhance Coordination
- Enhance Awareness & Foster PP Partnerships

Watch the Players

- Federal Government
 - Climate Change Action Plan, Health & Air
 - New Incentives...or Regulations??
- Signals from Queens Park (& Other Prov)
 - Market overhaul & incentives...
- South of the Border
- Corporate Buyers and Large Suppliers
- Emerging Innovations & Opportunities

What Can't Be Ignored

- Clean Distributed Generated Energy is Poised for Significant Growth
- Not Just Small as Large Scale Projects Continue to be Developed
- When, How & Rate of Change is Unclear ...
- Success dependent on Policy, Electricity Market Reforms and Technology Breakthroughs
- The result will be significant decreases in GHGs and other air pollutants, increase employment, enhanced security, and better quality of life.

The Delphi Group

**For More Information & Creative
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Or

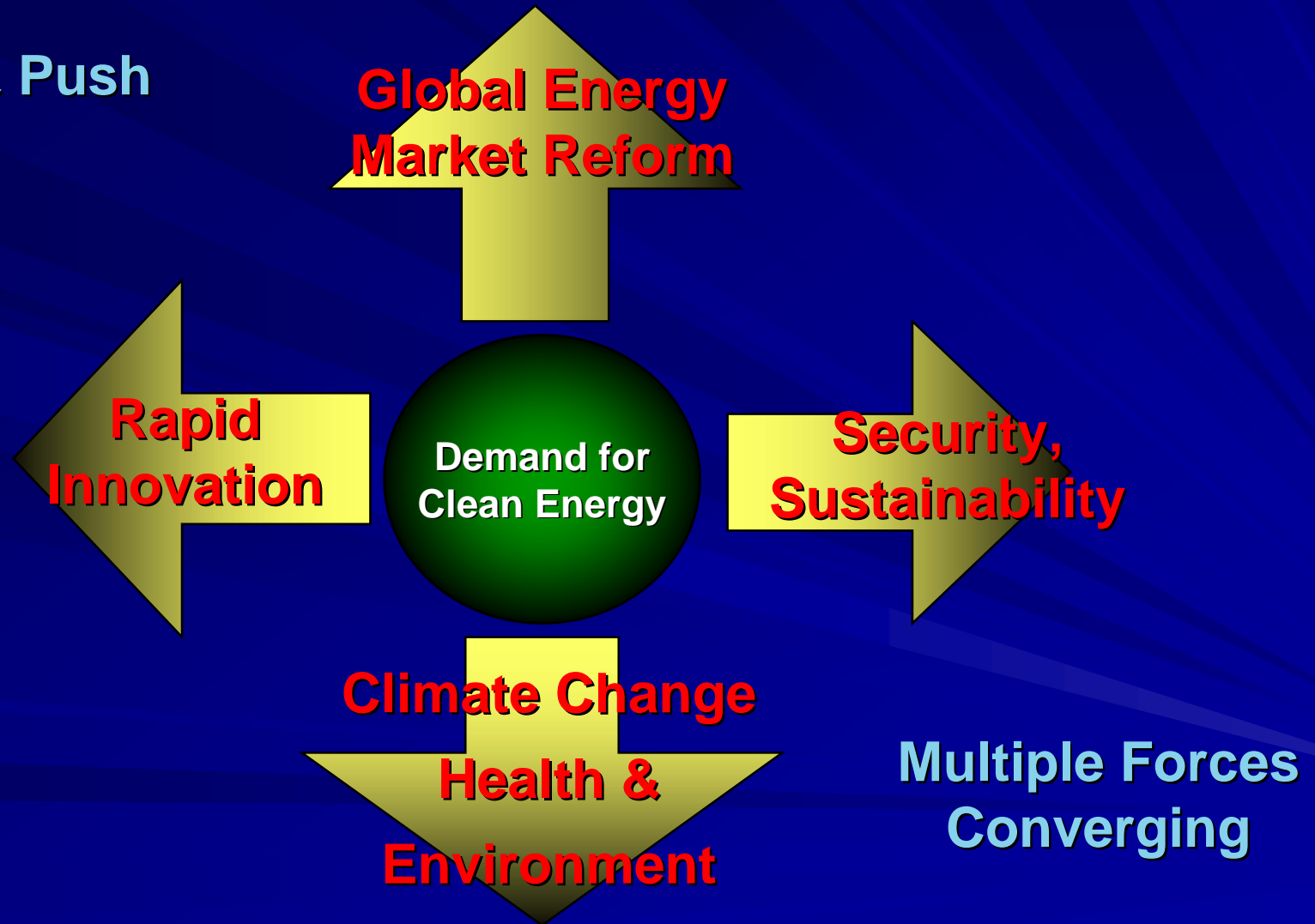
William Kemp

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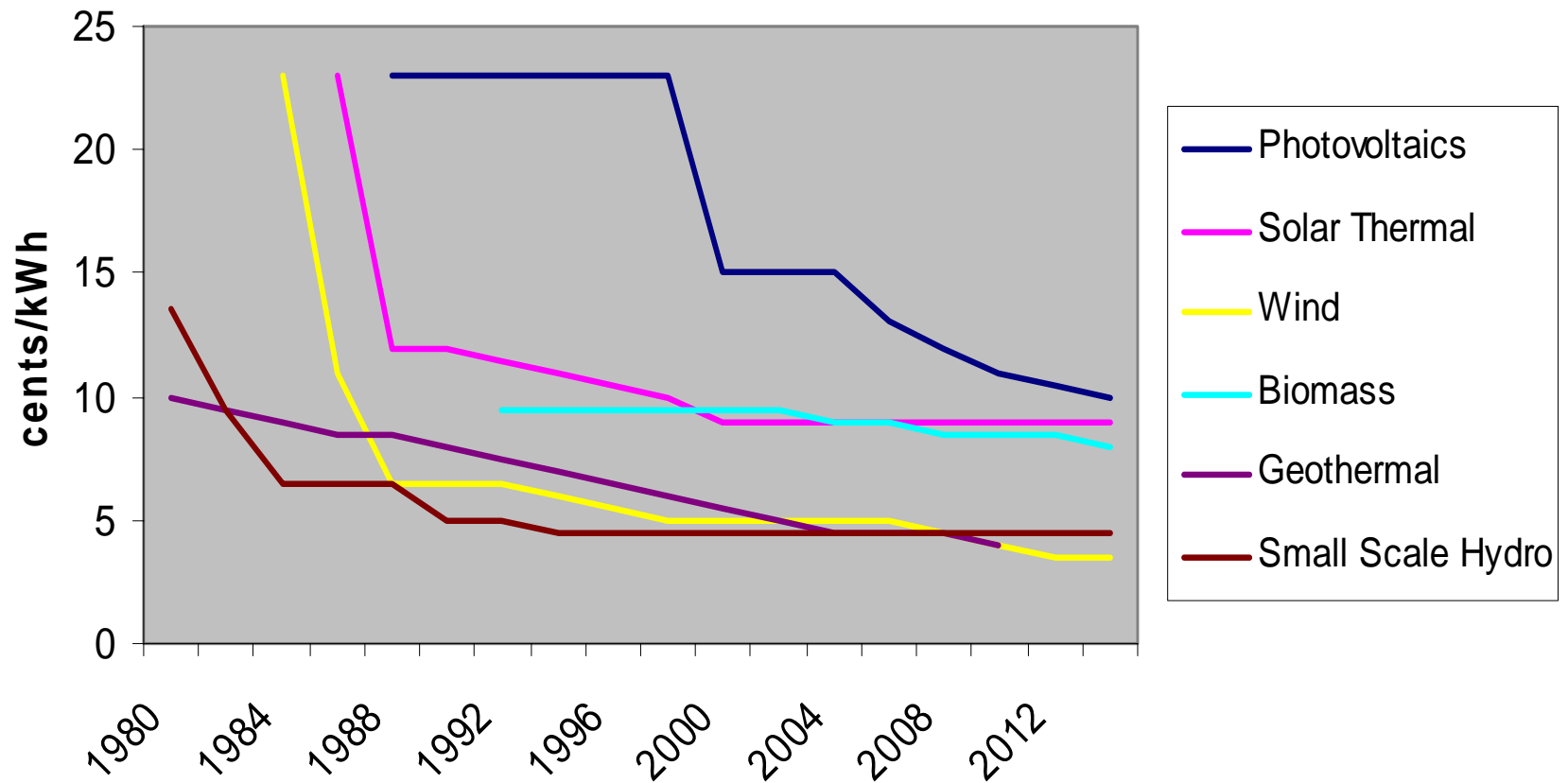
Tel (613) 253-9494 / email whkemp@magma.ca

Trend or Fad?...Definite Trend

Pull & Push

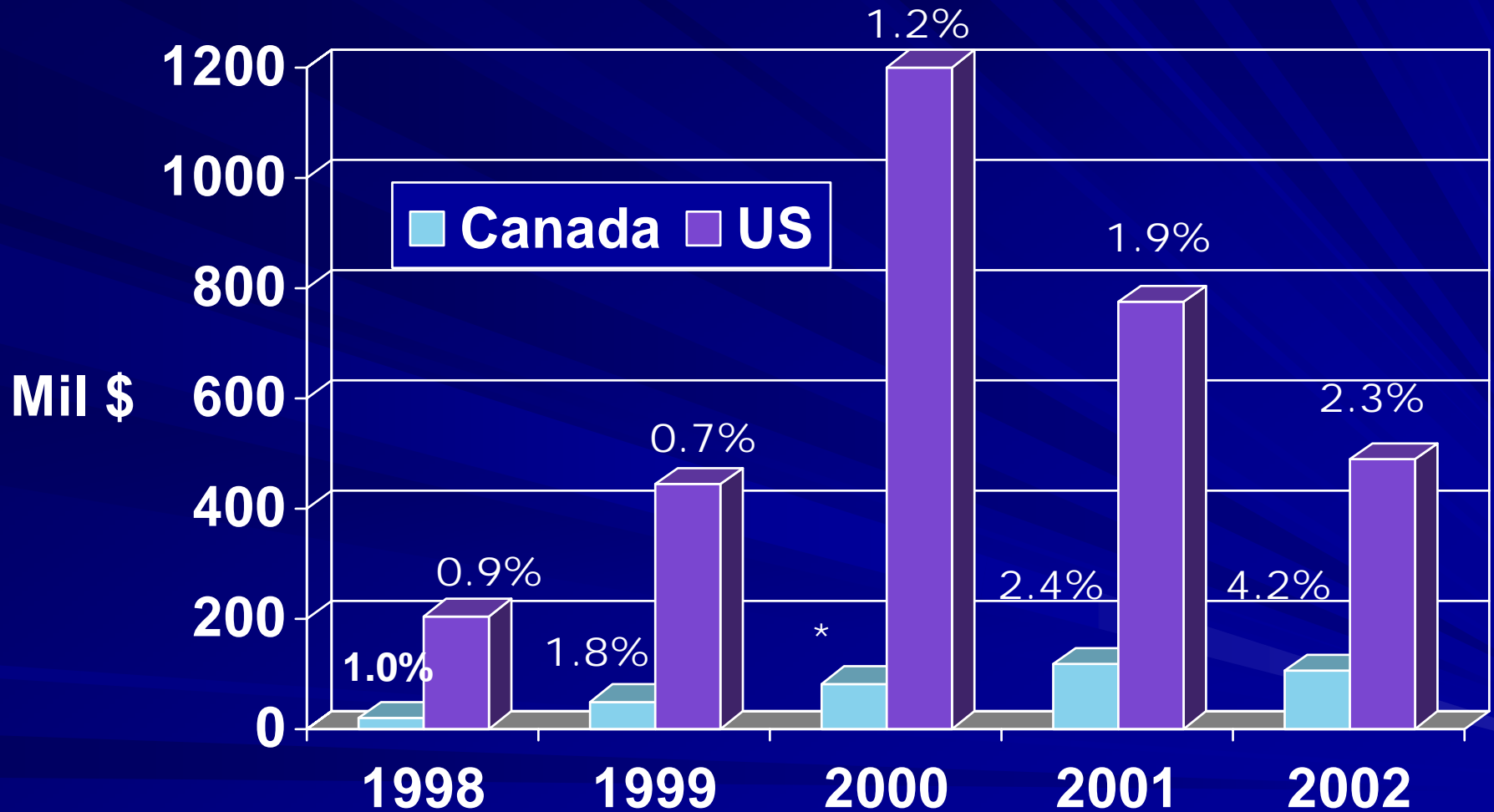


Cost Competitiveness of Renewables



Source: US Department of Energy Website, 1998

CE Investment Trends in NA



* Interpolated - figures not available

Source: Canadian Venture Capital Association and Clean Edge

Large Players are Engaged

■ Solar

- ATS Automation, Shell, BP

■ Small Hydro

- GE, ABB, VA Tech

■ Wind

- Vestas, NEG Micon, GE, Shell, Enercon, Transalta

■ Biomass

- Foster Wheeler, DTE, Caterpillar, Weyerhaeuser, Canadian Forest Products, Domtar...

Government, Utility & Corporate Signals

Federal

- MicroPower Connect Initiative
- Climate Change Plan for Canada (\$ 2 B)
- Green Electricity Purchase
- Canadian Renewable and Conservation Expenses (CRCE)
- SDTC & TEAM

Provincial

- Tax incentives for corporations and residents
- Purchase 20% Renewables
- Net Metering...?
- Green Power Standard...?
- Coal Plant shut downs...?

Corporate

- Suncor Energy
- Dupont
- Inerface
- The Body Shop
- MEC
- RBC Dominion

Canadian Electricity - 2002

Technology	Installed Capacity in Canada (MW)	Additional Potential in Canada	Capital Cost (\$/kW)	Cost of Energy (\$/kWh)	Eg. of investors or developers
Large Hydro	67,000	X2	1,000-2,000	0.03-0.08	Utilities SNC, ACRES
Small Hydro	1,500	2,000	1,500-5,000	0.04-0.10	See ref.4
Wind	230	Larger than 28,000MW	1,000-4,000	0.05-0.20	OMERS, Trans Alta, Axor
Photovoltaic	10	Very Large	5,000-20,000	0.35-1.50	ATS, XANTREX, ICP, Newsun
Forest biomass (hog fuel and spent pulp liquor)	1,642	+20%	2,500-3,500	0.04-0,07	Most Pulp and Paper Co.
Electricity from Waste		X2	2,500-4,000	0.05-0.08	Ref. 4
Land fill gas	87	X5	1,300-2,000	0.06-0.09	
Tidal	20	8,500 MW	High	0.08-0.20	

Sources include the following : ref. 6, Les Énergies Renouvelables au Québec, Ressources naturelles Québec, août 2002.

RETScreen.gc.ca, CETC-Varenes, NRCan, private communications

Heat from renewable sources

Source/Technology	Primary Energy Supply (PJ)	Additional Potential in Canada	Capital Cost	Energy Cost
Industrial Pulp and Paper	513	+20%		2.20-5.00 \$/MBTU
Residential Heating	95	Large		
Landfill gas	2.4	X2		0.75 \$/MBTU
Municipal Solid Waste (MSW)	12	X2		
GSHP	1.0	Large	900 \$/kW	0.03-0.075 \$/kWh
Active Solar (Water and Air)	1.1	Large	125-1, 100 \$/m ²	Savings of 10-60 \$/square metres
Passive Solar		Large	500-10,000 \$/residence	Savings of 5 to 20% of heating bill

Installed Wind Capacity 2003 Where Canada Stands

