National Standards System Conference - 2004

3.2 Emerging Industries & Sector Applications – Employing Energy Alternatives

William Kemp

Overview

- Definition of Distributed Generation
- Factors Powering the Surge in Clean Energy Development
  - Market, Policy, Technology, Environment
  - Where Canada Stands and Why
- Why we need Distributed Generation
- Why is Canada Slow to React?
  - (Obstacles Impeding Growth)
- Examples of Market Success
- Canadian Industrial Impact
- Technology Trends to Watch
- Summary

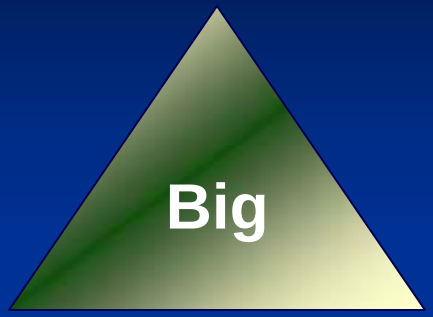
Definition of Distributed Generation

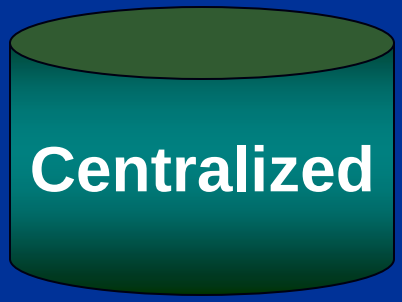
- Distributed Generation (DG) may be defined as small-scale generation facilities located near the point of energy consumption.
- DG may use fossil fuels or solar energy, wind, small hydro or bio-fuels as the primary energy sources. (Not necessarily “clean or renewable energy”).
- DG may use rotating generators or electronic power converters to supply electrical power to the distribution or high-voltage transmission grid.

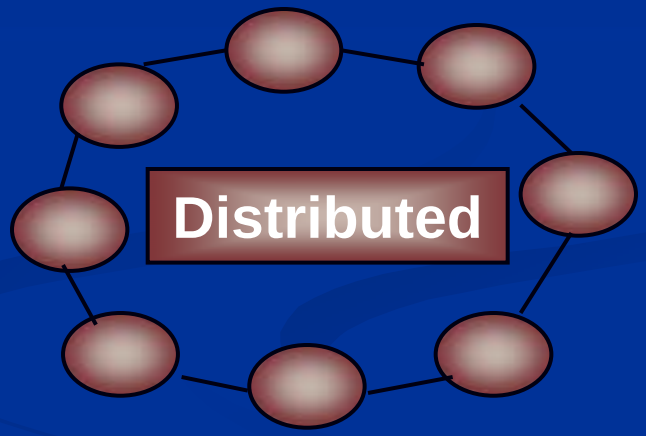
Definition of Distributed Generation

- DG systems may be located on either side of the customer revenue meter. (Becoming an energy efficiency device when located on the load side of the meter.)
- DG systems may produce electricity directly or offset electrical demand as is the case of combined heat and power systems or geoexchange technology (heat pump) and solar thermal water heating.

Fundamental Shift in World Markets







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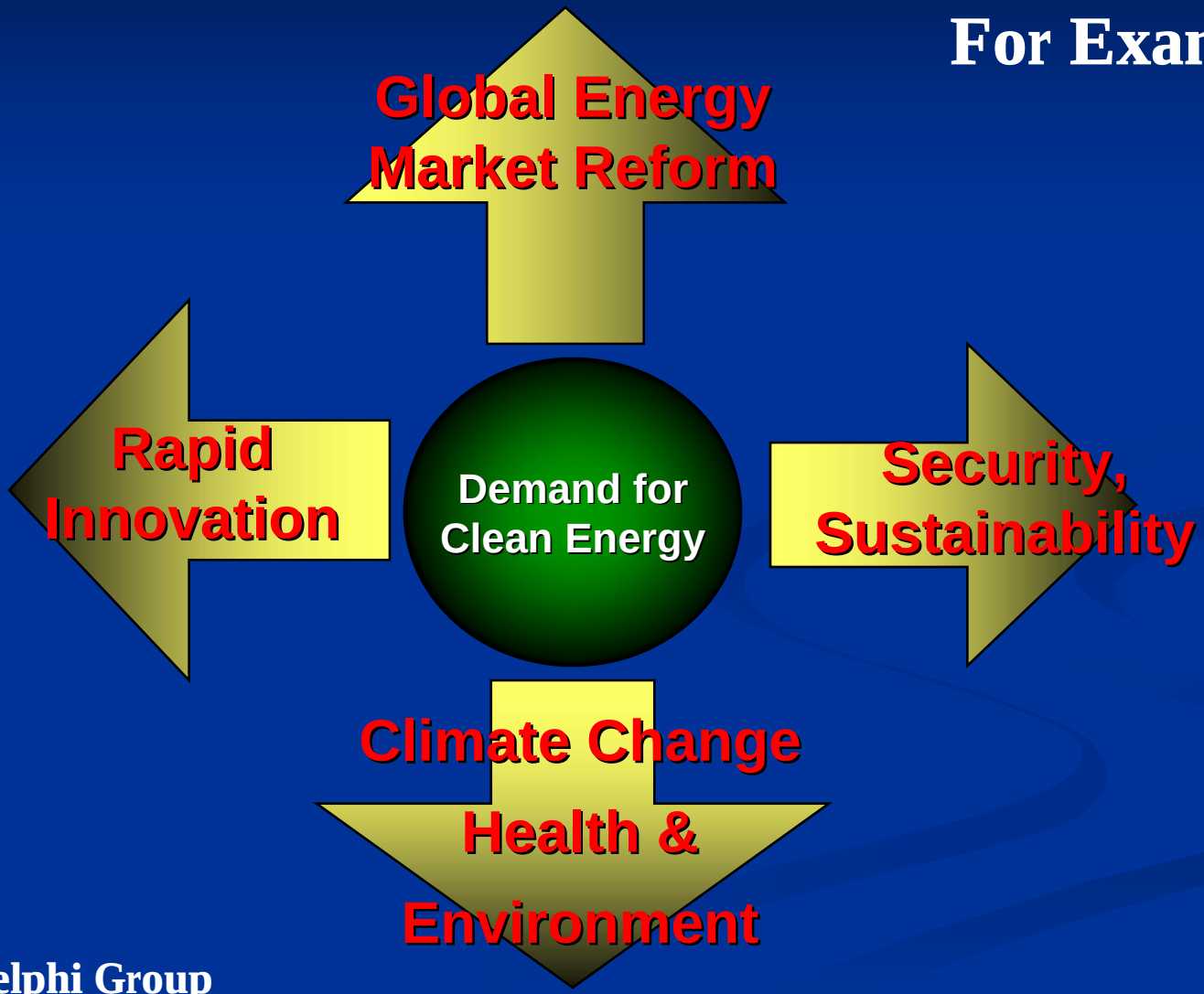
Courtesy Delphi Group

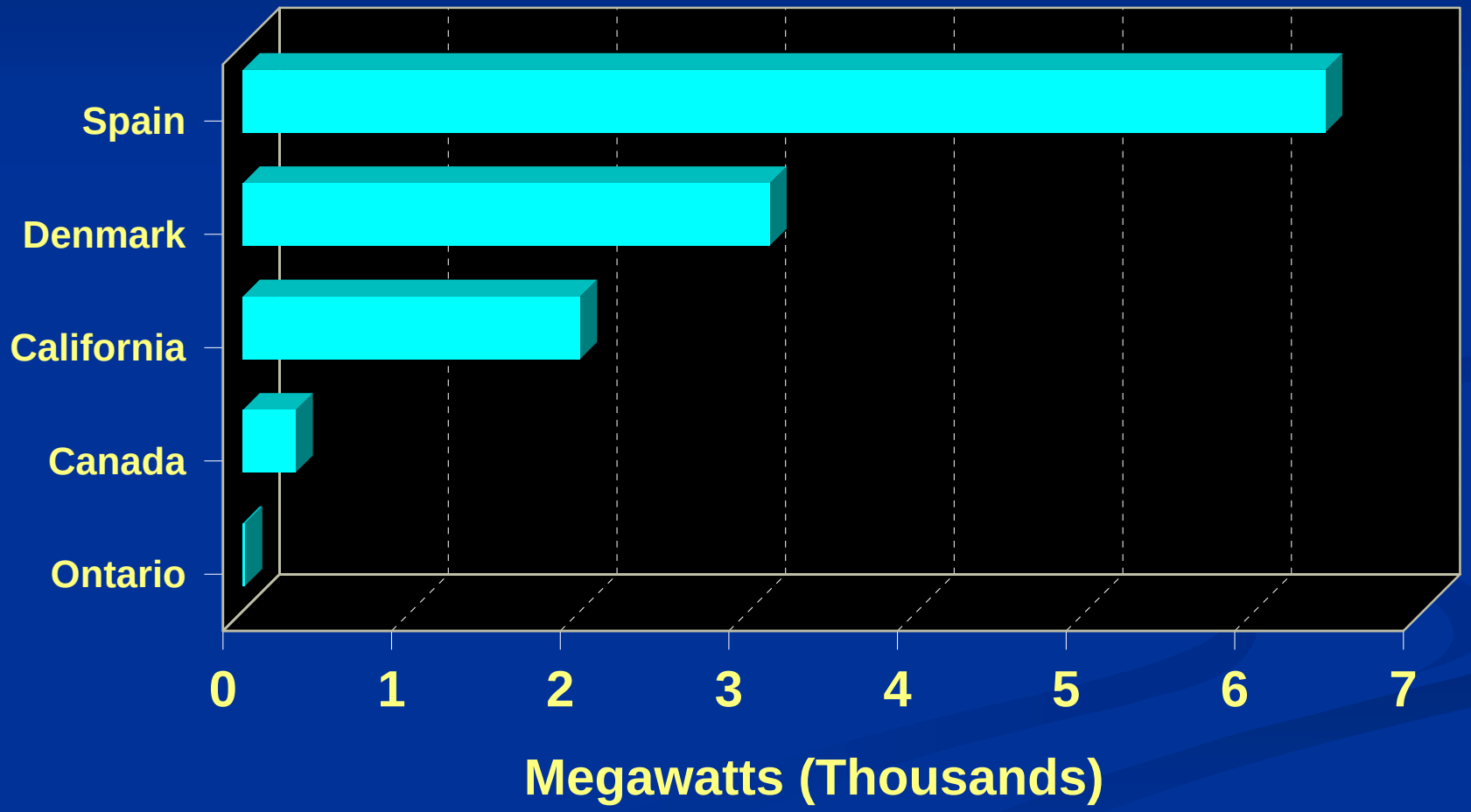
Multiple Forces are Causing this Change

For Example…



Courtesy Delphi Group

Installed Wind Capacity 2003
Where Canada Stands



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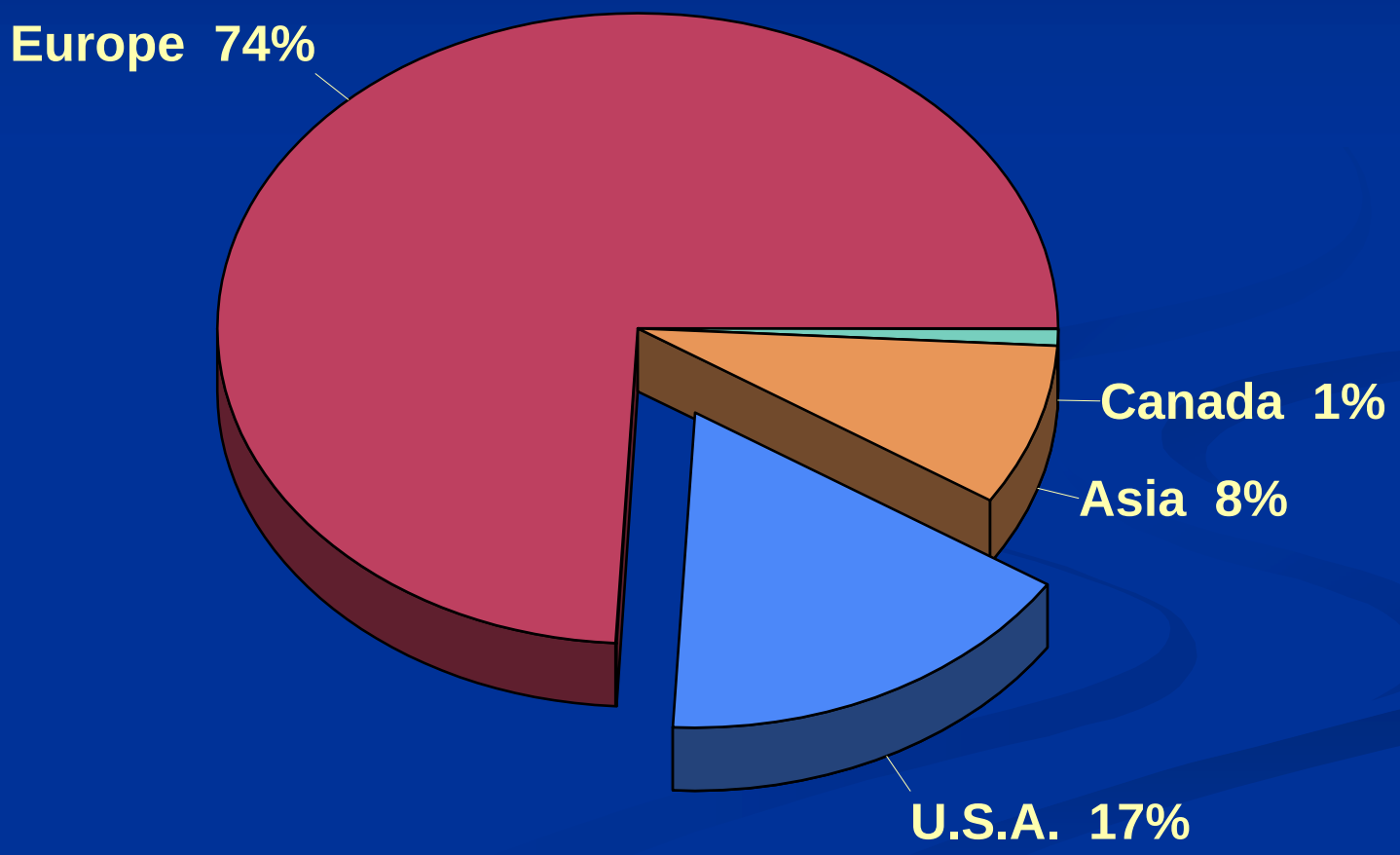
World Wind Capacity 2003
~40,000 MW



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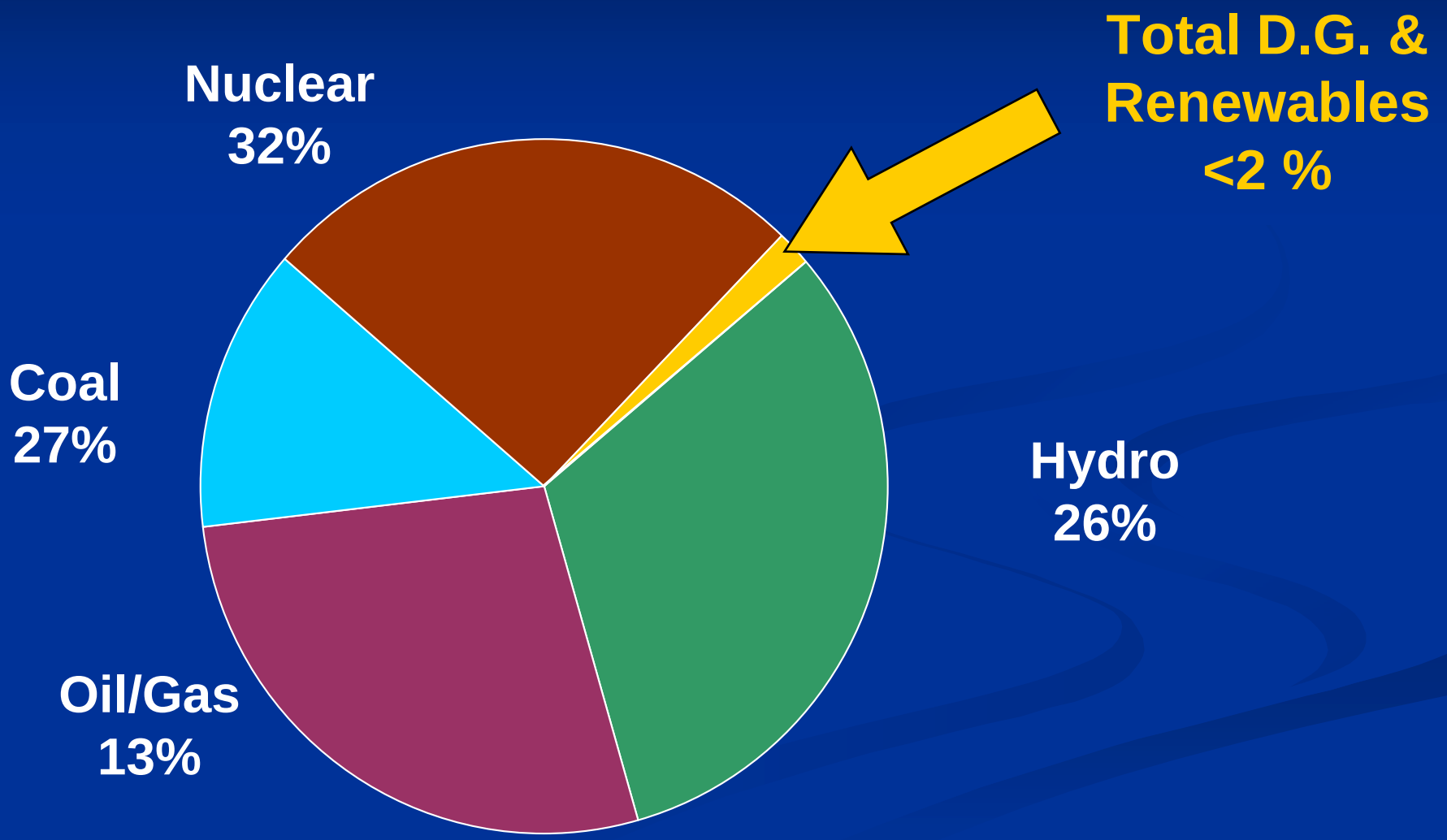
“Current Status”
Ontario Generation 2002



Even though Canada has huge potential resources for D.G. -- 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-Varennes,NRCan , private communications

… and Distributed Green Heat

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

Source: Natural Resources Canada, Presentation by Andre Filion

Energy Issues – Why We Are Where We Are

- Large Supplies of fossil and nuclear fuels
- Low population density/ large land mass
- High per capita energy intensity
- Economic wealth built on low energy costs for long period of time
- Many external costs not factored into energy consumption charges
- Unfriendly policies to renewable and decentralized technologies

Energy Issues – Why We Need Distributed Generation

- Clean and (Mostly) Green for Renewable DG
  - No Sox, NOx or CO_2
- Renewable in Nature
  - Net Positive Energy Balance
- Domestic Energy Source Not Subject to Embargo
- Does not Consume Water
- Modular, Flexible and can be Sized to Meet Local Loads
- Diversifies and Distributes Wealth Democratically

Why is Canada Slow to React?

- DG and Renewable Technologies seen as “too expensive” compared to traditional energy sources.
- Government self interest keeps energy prices artificially low; “don’t upset the electorate”.
- Ontario tender for 300 MW of renewable DG is too modest, indicating government does not believe technology can make a difference.
- Government has a parochial attitude when reviewing successful programs around the world. “That only works in California…”

Why is Ontario Slow to React?

- Bill 100 allows for long-term price contracts for renewables but does not accept “Advanced Tariff Laws” used successfully around the world.
- Hidden concerns that corporations will flee Ontario to other jurisdictions with lower energy costs.
- Private investors in generation cannot operate under economic and regulatory uncertainties dictated by current government regulations.
- Past spending patterns show lobbying efforts…

Why is Canada Slow to React?
Past Government Spending on Energy

- **$40.4 billion** Direct federal spending on fossil fuels between 1970 and 1999.
- **$16.6 billion** Total subsidies to the nuclear energy industry by the Government of Canada since 1953.
- **$2.8 billion** Loans to fossil fuel industry written off by the federal government since 1970, over and above direct spending.
- **$850 million** Federal cost of cleaning up radioactive waste in Port Hope and decommissioning uranium tailings sites. Historical waste practices in the refining and processing of uranium and radium resulted in contaminated sediment on the harbor of this Ontario municipality.
- **$156 million** Federal subsidy to the Canadian nuclear industry in 2000.
- **$12 million** Total average yearly funding for renewable energy by the Canadian government

Source: Low-Impact Renewable Energy Policy in Canada: Strengths, Gaps and a Path Forward, Pembina Institute, February 2003

Why is Canada Slow to React?

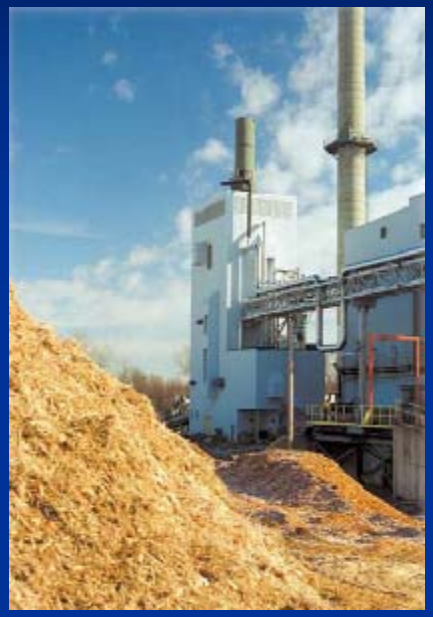
Casting a Shadow on D.G.

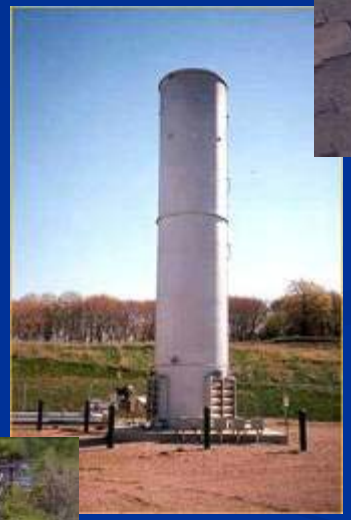
Existing Technology Realities	**High capital costs / Poor Rates of Return** **Manufacturing, installation, BOS** **Technological jump required**
Current Market & Legislative Domain	**Affinity towards centralized power** **“Cheap” established power** **Cumbersome rules, pricing, processes**
Technical & 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, govn’t...)**

Courtesy Delphi Group

Market Success – It Does Work

D.G. in World Markets





Wind Works

Large Networks	Percent Wind
Denmark	17%
Germany	4%
Ireland	2%
Spain	2%
California	1%

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World Wind Industry 2003 Revenues

	Billion $CAD
Project Development	~12
Electricity Sales	~14
Operation & Maintenance	~1.5

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World Market

- Germany
  - 2,600 MW in 2003
  - 20,000 MW Total on Land by 2010
- Spain = 1,000 MW/year
- France = 20,000 MW Filed
- USA 500-2,000 MW/year
- Growth 20%-40%/year
- Small Turbines
  - $25-50CAD million/year

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Danish Co-ops (*Vindmølleaug or Fællesmølle*)

- 1/4 Capacity Nationwide
- ~ $1.7CAD Billion
- 100,000 Households Own Shares
- 5% of Population

Velling Mærsk-Tændpibe

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Canadian Market Success

Private Distributed Generation is Already Here:

- Publicly Traded Canadian Hydro Developers (TSE Symbol “KHD”) has 82.9 MW of Ecologo™ certified green power generation.
  - Gross sales of: $16M in fiscal 2001.
  - Net earnings of: $3.7 M
  - Cash flow return on equity: 12%

  - According to President Ross Keating, “Our compounded average growth over the last 5 years has been 30% per year. As the market continues to shift towards renewables, we expect this growth rate to continue.”

World Industrial Impact

Jobs in the Wind Industry

Europe	Direct	Indirect	Total
Germany	7,500	37,500	45,000
Denmark	8,600	4,300	13,000
Spain	7,000	15,000	22,000
Total			80,000

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Canadian Industrial Impact
Issues and Concerns

- Canada risks becoming a net importer of foreign DG technology and labour (an exporter of Canadian money) if we don't accept the realities of the new energy market.

- Universities and colleges must place more emphasis on power technology development.

- Governments need to level the playing field between central and decentralized technologies and understand that the technologies are cooperative and not mutually exclusive.

Canadian Industrial Impact
Building a Sustainable Industry

- What Works
  - Advanced Renewable Tariffs (ARTs)
    - . . . Electricity Feed Laws
- What Does Not Work
  - Direct Subsidies & Tax Credits
  - Quota/RPS Systems
- Proof is in the Market
  - ART Markets = Many Manufacturers
  - Quota Markets = Few Manufacturers

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Canadian Industrial Impact

Advanced Renewable Tariffs

- What Are They?
  - Political Price, Not Political Quota
  - Fixed Price/kWh
  - Fixed Period
  - Simple Contracts
- How Do They Work?
  - Simple & Comprehensible
  - Little or No Administration
- Where?
  - Germany, France, Spain, Austria, Netherlands, Portugal . . . Maybe within Canada?

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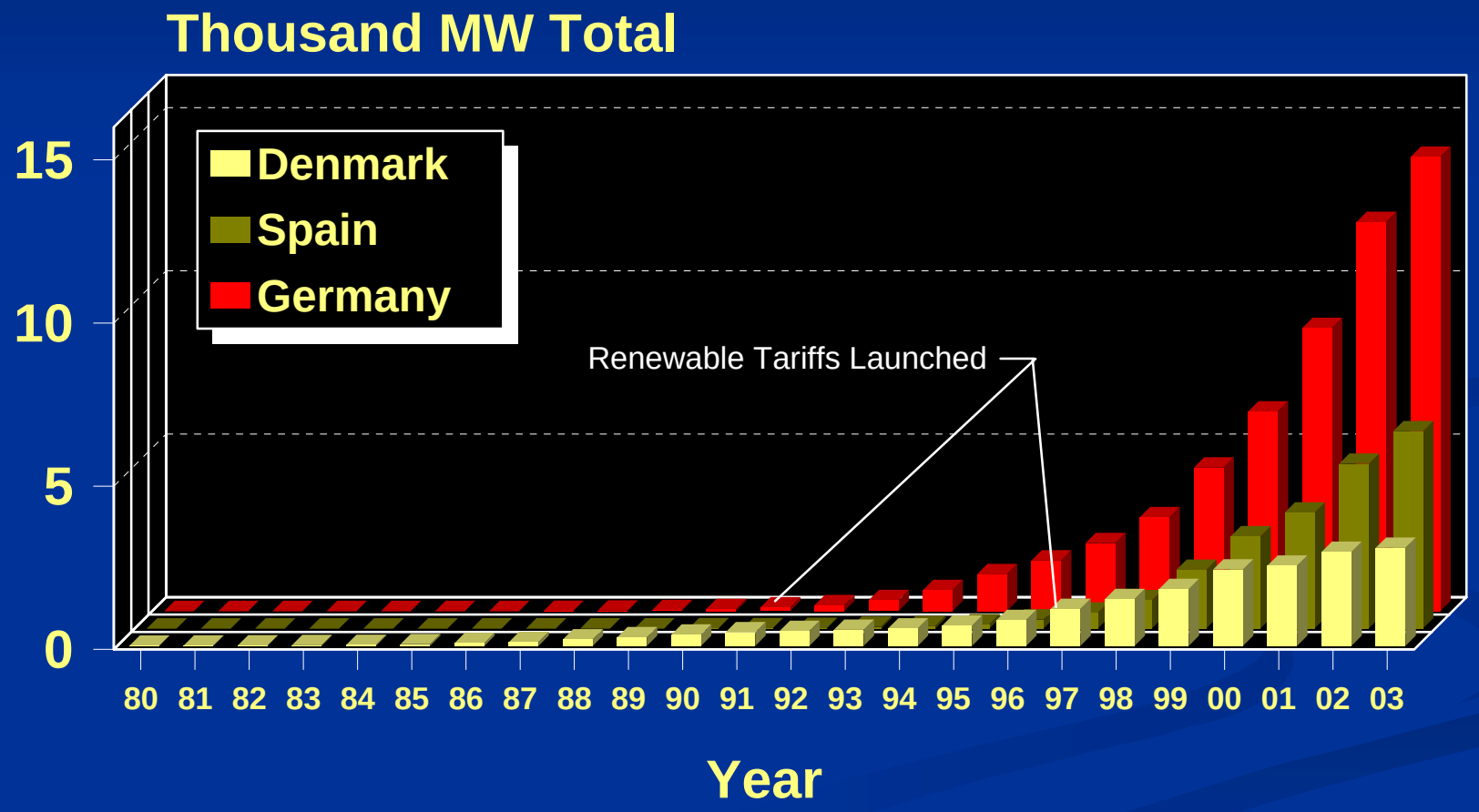
European Wind Market Comparison



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Advanced Renewable Tariffs
(for wind technology)

- Germany
  - $0.15CAD/kWh first 5 years
  - $0.14CAD/kWh years 5-20, Interior Sites
  - $0.10CAD/kWh years 5-20, Coastal Sites
- Spain <50 MW
  - $0.10CAD/kWh
- France <12 MW
  - $0.14CAD/kWh first 5 years
  - $0.14CAD/kWh years 5-15, Low Wind Sites
  - $0.05CAD/kWh years 5-15, High Wind Sites
- Austria
  - $0.13CAD/kWh for 13 years

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DG Tariff Structure for Ontario

- 20 Year Fixed-Price Contract
- $0.10/kWh for wind
- Years 1-10: $0.10/kWh
- Years 10-20
  - High Productivity: $0.08CAD/kWh
  - Low Productivity: $0.10CAD/kWh
- $0.08/kWh small hydro; $0.30/kWh for photovoltaic systems
- Streamlined Interconnection Regulations
  - i.e. Net metering, MicroConnect, etc.
- For all Projects <10 MW

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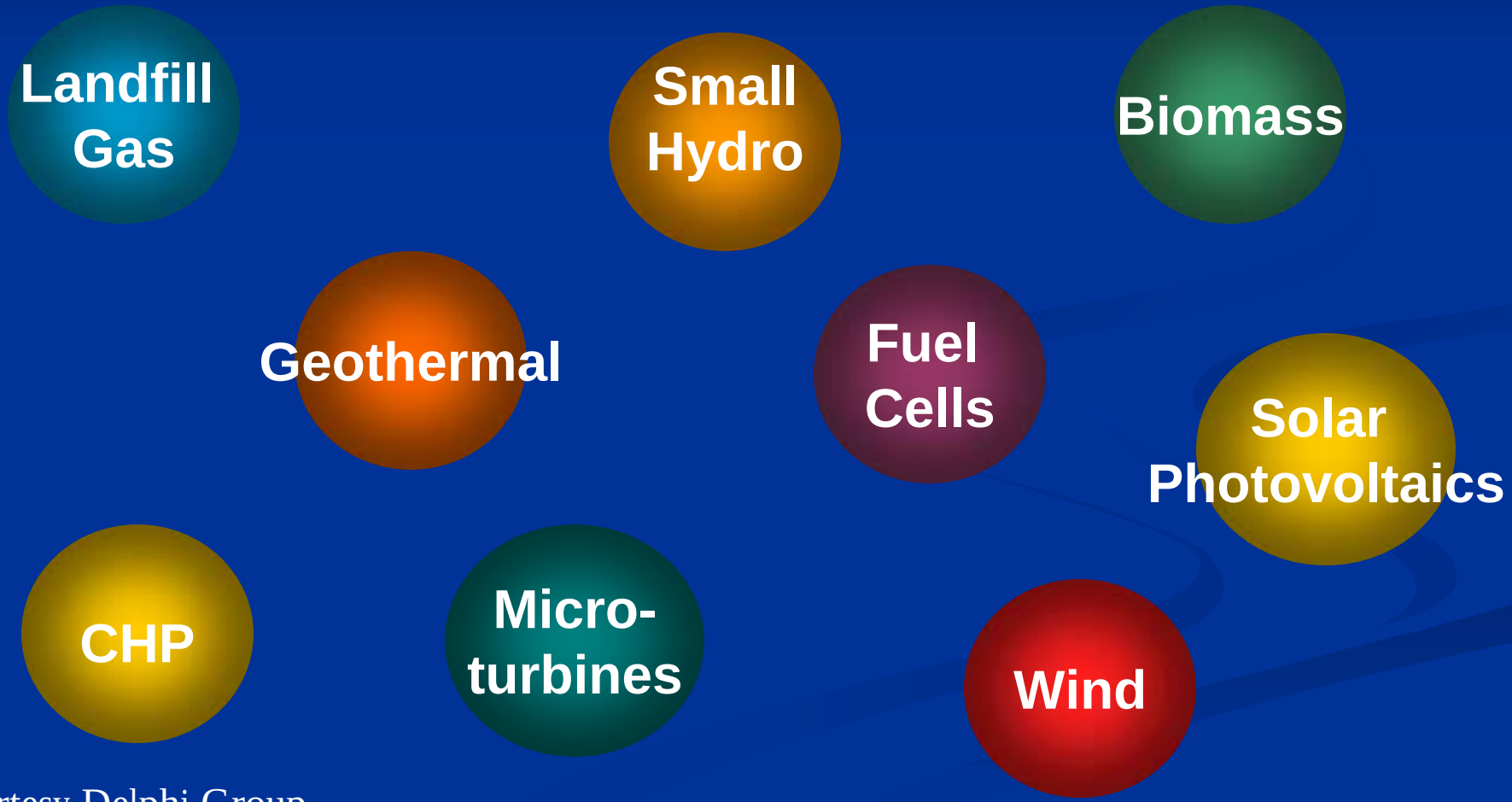
Technology Overview

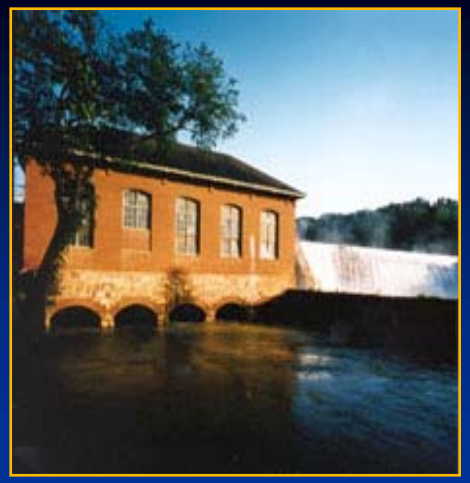
The Solutions will be varied



Courtesy Delphi Group

Combined Heat & Power

- Potential in commercial sector in Ontario ~ 2,500 MW.
- Existing CHP ~ 1% of potential
- Least cost after Hydro
- Small, low risk, short lead-time
- Clean, efficient
- Improves local reliability



Small Hydro
(Co-op Friendly)

- Well established, low cost, flexible, strong capacity
- ~ 80+ sites => 400+ MW
- Potential: >12,000 MW
- 6% - 20% viable
  - Far from grid
  - Retrofits may be the way to go

LFG Management (2001)

(Possibly Co-op Friendly)

Total Methane Generated In Canadian Landfills 1,321Kt CH4

Landfill Methane Capture 342 Kt

Landfill Methane Released to Atmosphere 979Kt

Flaring 25 Sites 147Kt ~ 3MT eCO2

Utilization 16 Sites

Produced 84 MW of Power 8 Facilities 182 KT ` 3.8MT eCO2

Direct Utilization 8 Facilities 13Kt ~ 270Kt eCO2

Biomass
(Co-op Friendly)

- Demand increased 50% from 1990 – 2000
- 2nd most deployed renewable next to hydro
- New & proven technologies
- Costs $0.05 / KWh & Up
- Security & supply location?
- Financial/Political Support?

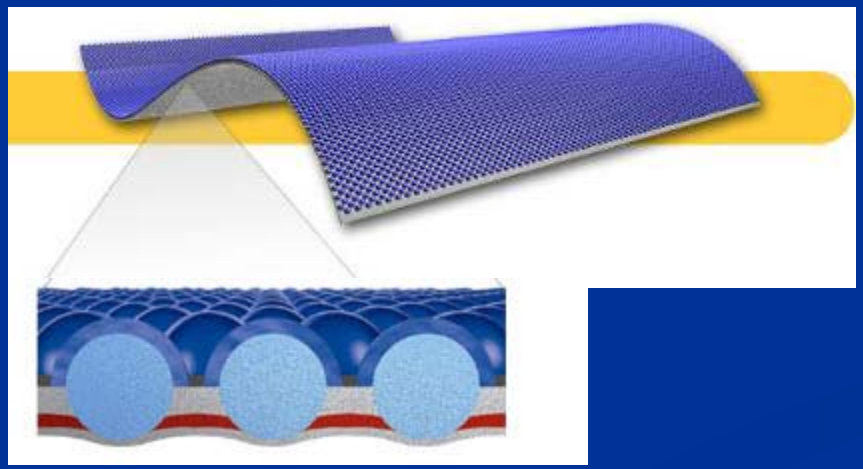
Wind
(Co-op Friendly)

- ~ 35 sites > 10 MW in 2003
- Fastest growing in Canada
- Significant potential (but only a few key areas in Ontario)
- Political backing & incentives
- Competitive $0.06 – $0.12/KWh
- Possibly localized areas of opportunity but…need > 15 km/h

Source: CANWEA

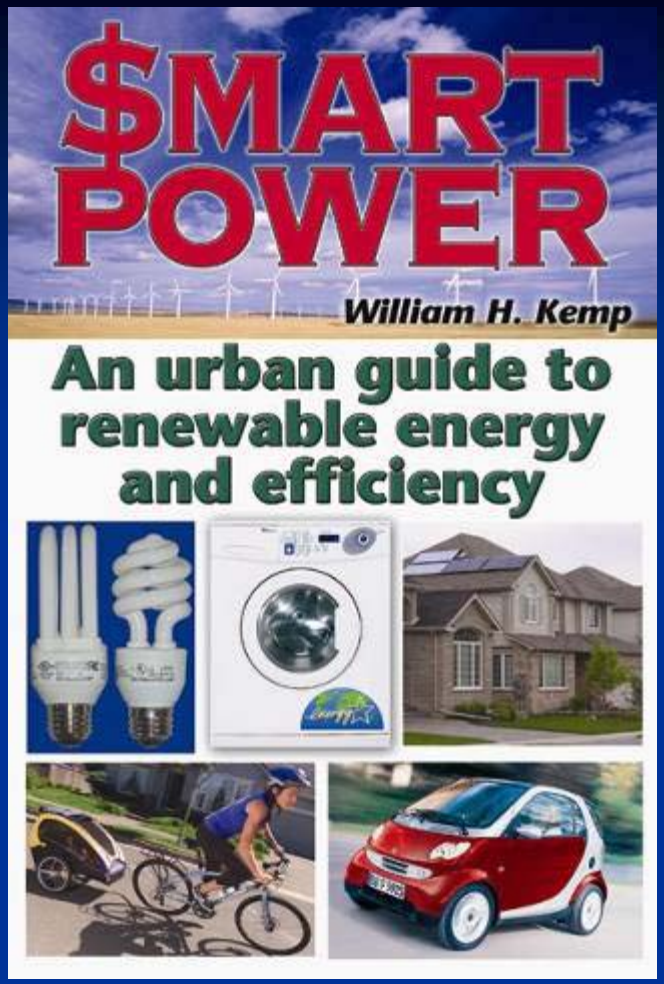
Solar PV

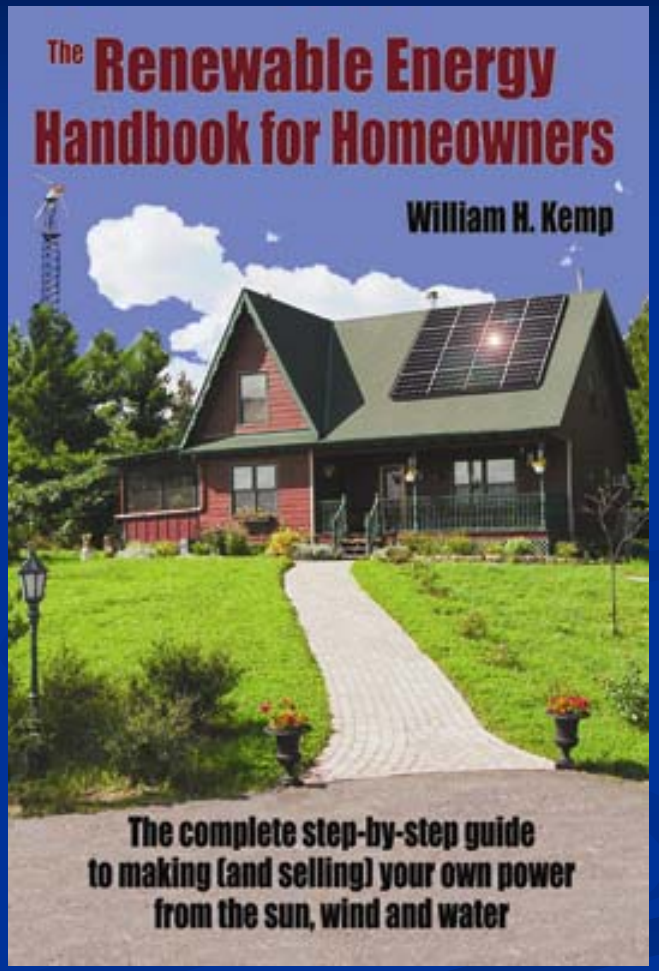
- 10 MW in all of Canada
- Much of S&E Ontario has better sunlight than World's largest market – Japan
- Not currently competitive >$0.25 KWh
- Peak shaving potential
- BIPV offers interesting opportunity



What Can't Be Ignored

- Clean Distributed Generation is Poised for Significant Growth
- Distributed Generation and Centralized systems are complementary, not mutually exclusive
- When, How & Rate of Change is Unclear …
- Large scale success dependent on Policy and Electricity Market Reforms (Open Market with Real Competition)
- Canada represents significant opportunity…but Caution Warranted





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