



Reducing the Demand for Energy Using Solar Hot Water

Overcoming the First Cost Barrier

Presentation at the Developing a Renewable
Energy & Energy Efficiency Strategy for Ontario
Workshop, November 15, 2005

The Canadian Solar Industries Association

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A Roadmap...

at least for the next 20 minutes

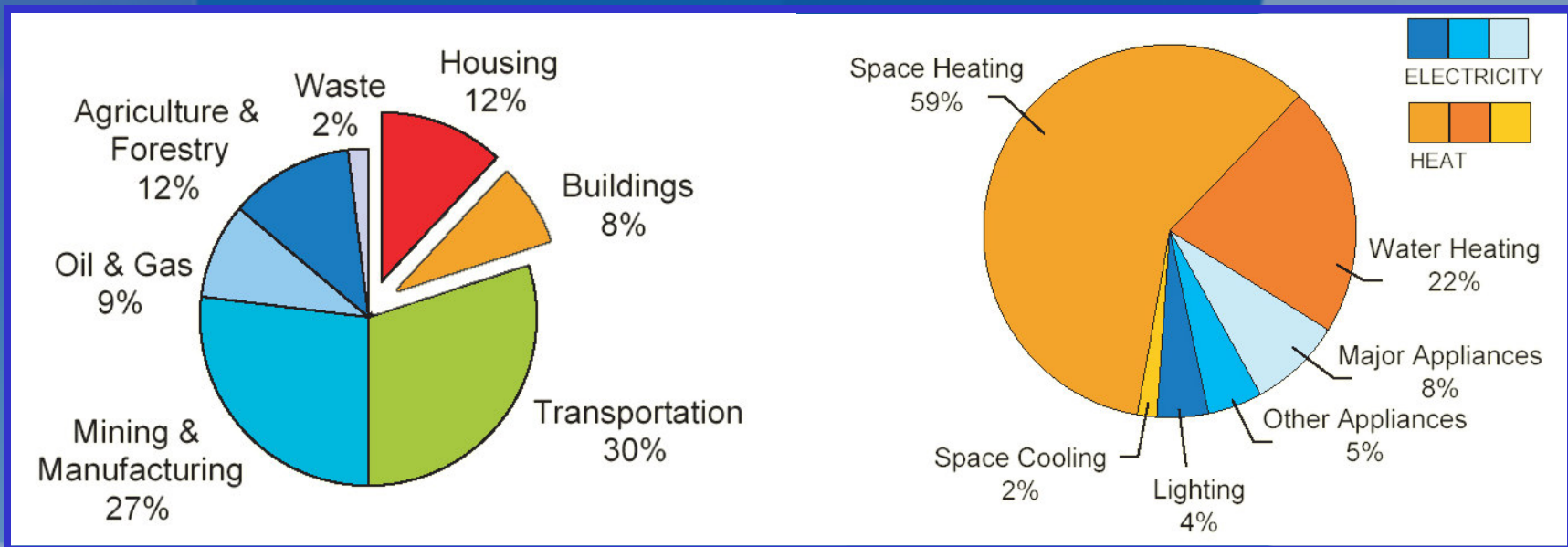
- Energy in Ontario
- Understanding Solar Heat
- Solar in Ontario
- Understanding Energy Prices
- Accounting for the Cost of Solar
- The Future of Solar in Ontario
- Financing Solar
- Lunch

Energy in Ontario



More than just electricity...

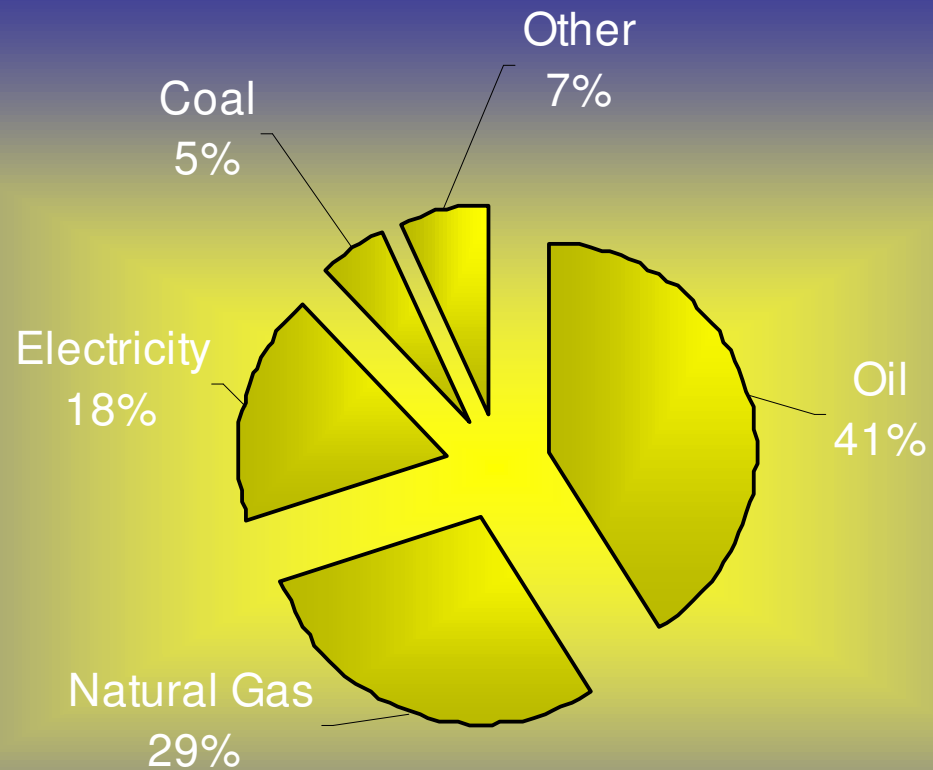
Ontario's Homes & Buildings: *A Major User of Energy*



Energy Use in Canada

Energy in a
Canadian Home

Energy in Ontario – *More Than Just an Issue of Electricity*

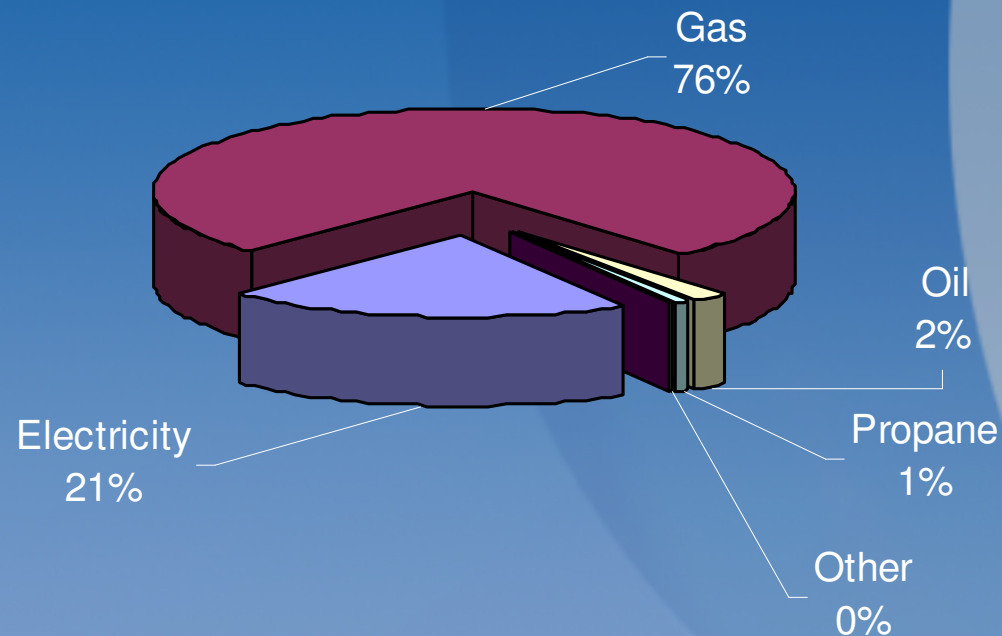


Note: Electricity is a secondary source (produced by hydro, nuclear, coal, etc..)

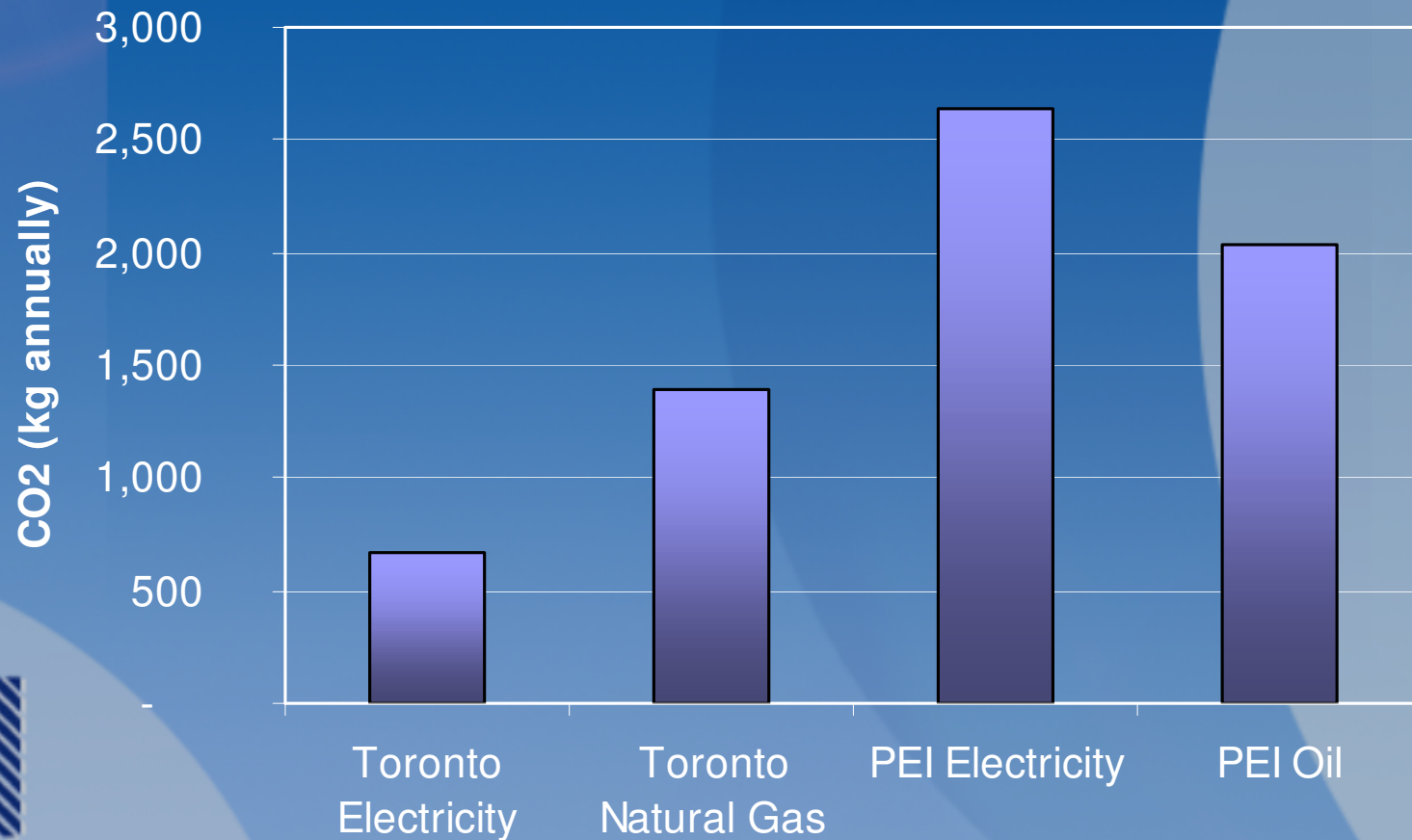
Hot Water in Ontario

Where the heat comes from

- Limit to what can be switched off electricity (areas where NG is not available – rural, north, apartment buildings)



GHG Produced From Water Heating

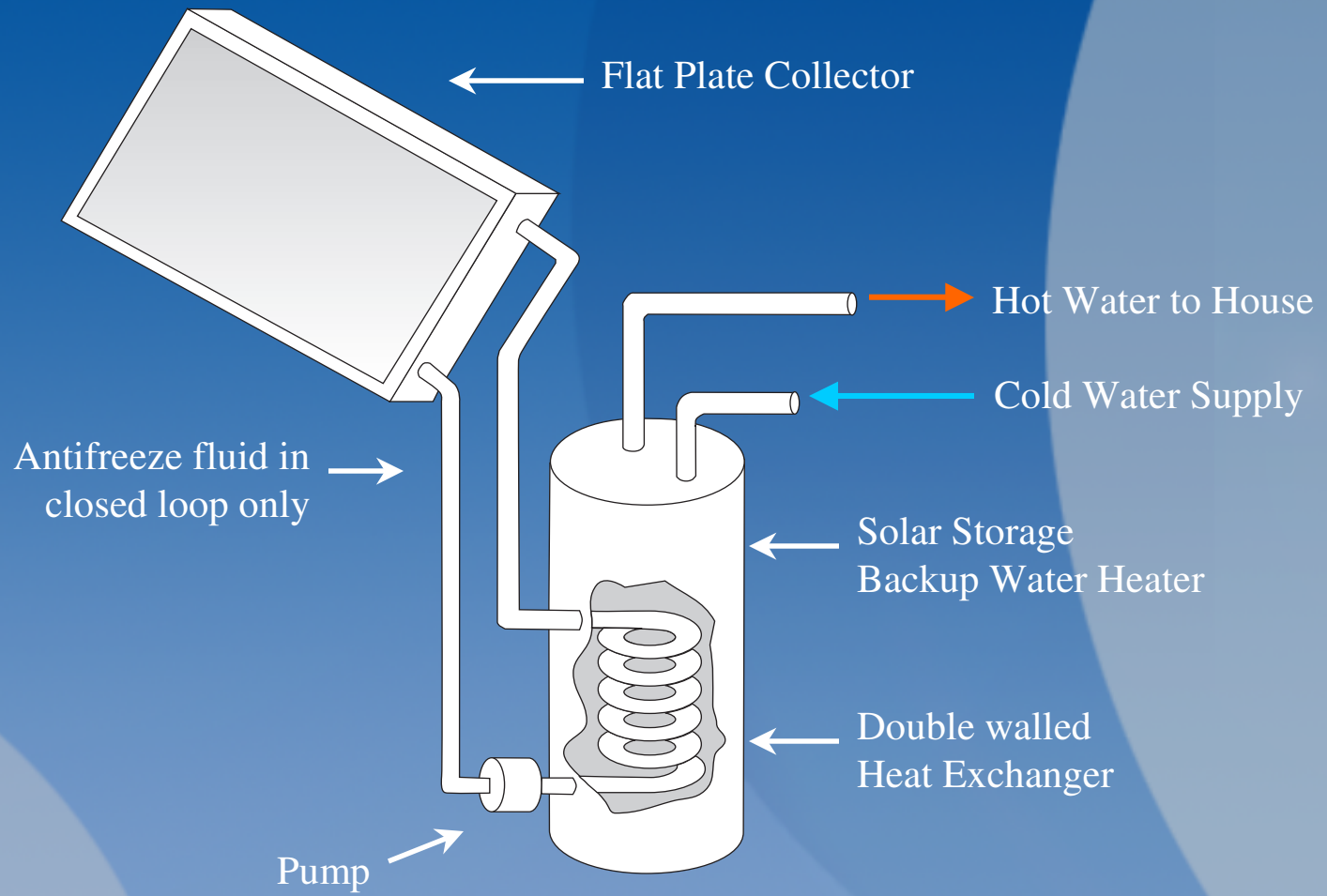


Getting into Solar Hot Water

The Potential...



Solar Water Heater System



Solar Domestic Hot Water

- Can provide 45% of hot water needs in Toronto
- Yearly Savings vary: \$150 (Natural Gas); \$225 (Electricity) – as of the spring 2005
- Typical cost is \$3,500-\$4,500 for average house
- Currently 100-200 systems installed per year in Canada – mainly as retrofits – 35% in Ontario



Solar Commercial Water Heating

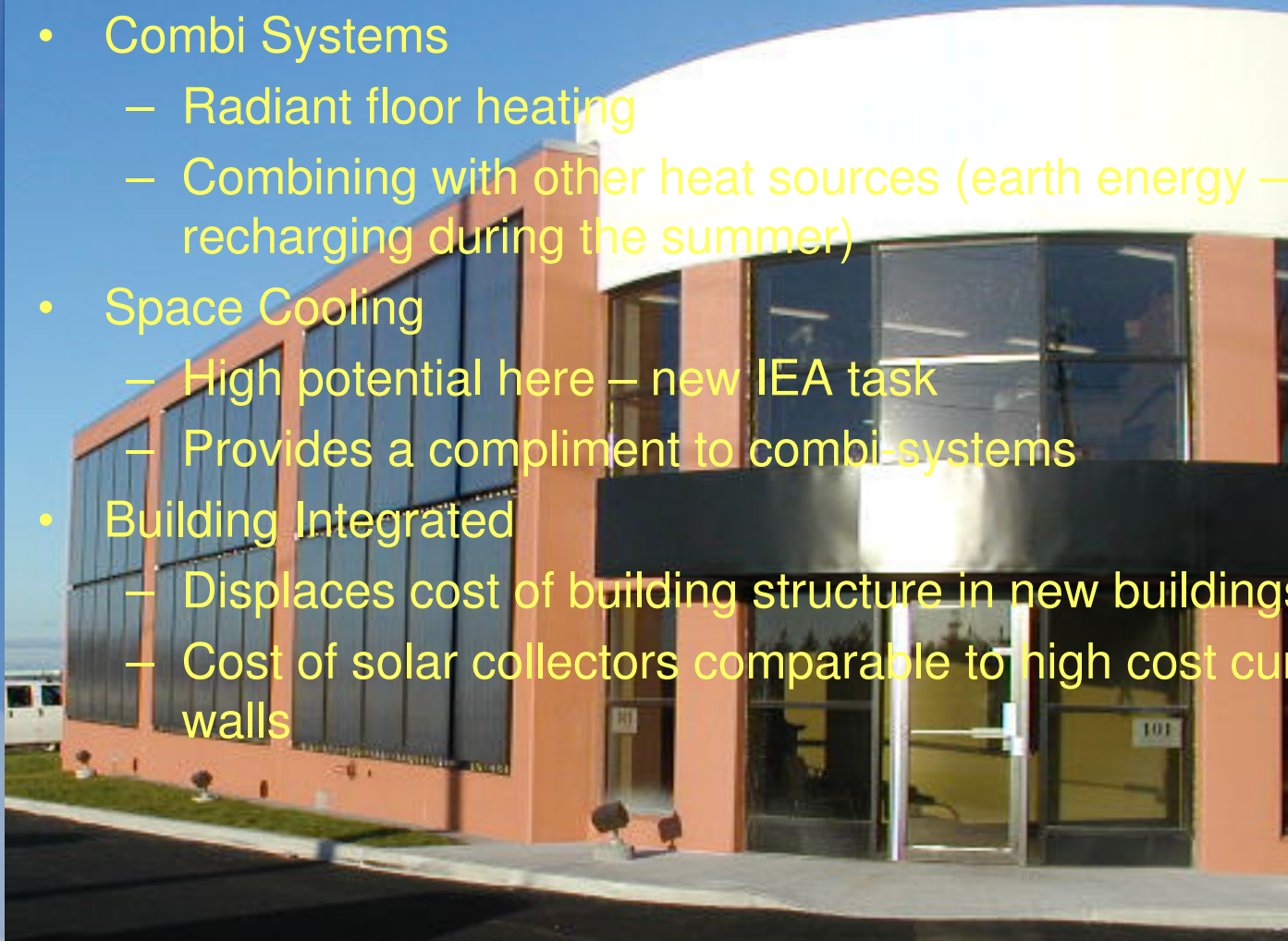


- Can be built into a DSM program
- Economies of scale
- Only support in Canada for solar is for commercial & industrial applications
 - 25% subsidy – REDI
- Financing is difficult to get – but can be gotten
 - Role for ESCOs



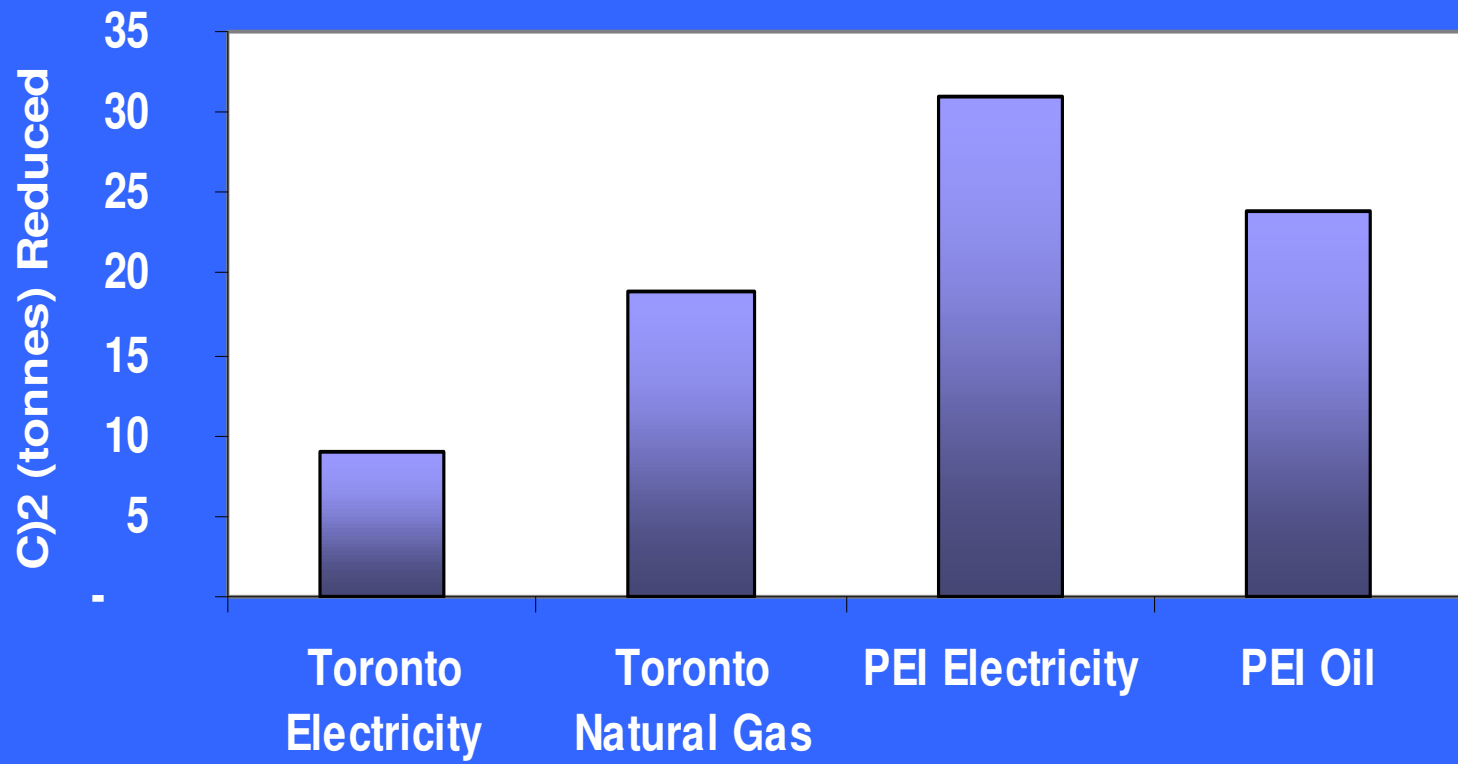
Other Solar Water Heating Applications

- Combi Systems
 - Radiant floor heating
 - Combining with other heat sources (earth energy – recharging during the summer)
- Space Cooling
 - High potential here – new IEA task
 - Provides a compliment to combi-systems
- Building Integrated
 - Displaces cost of building structure in new buildings
 - Cost of solar collectors comparable to high cost curtain walls



Climate Change Benefits to Solar Hot Water

Lifetime GHG Reductions
Using a life expectancy of 30 years



The Economic Benefits of Solar Hot Water

- A locally manufactured energy source
 - Solar Manufacturing is already being done in Ontario
 - EnerWorks, Solcan, Conserval, Enersol, Spherical Solar
 - Most other energy sources have to be imported into Ontario – Fossil fuels, new hydro power, wind generators
 - We're exporting energy dollars outside of Ontario
- Highest Job Potential of any energy source
 - Per 1,000 GWh
 - Nuclear Power – 72 jobs
 - Solar Thermal – 3,960 jobs
 - Job market is local and spread across the province – relating to engineering, sales, installation, and manufacturing
 - Potential job market is large
 - Currently China has 100,000 workers in their solar industry
 - Europe – estimated 350,000 full-time jobs by 2030



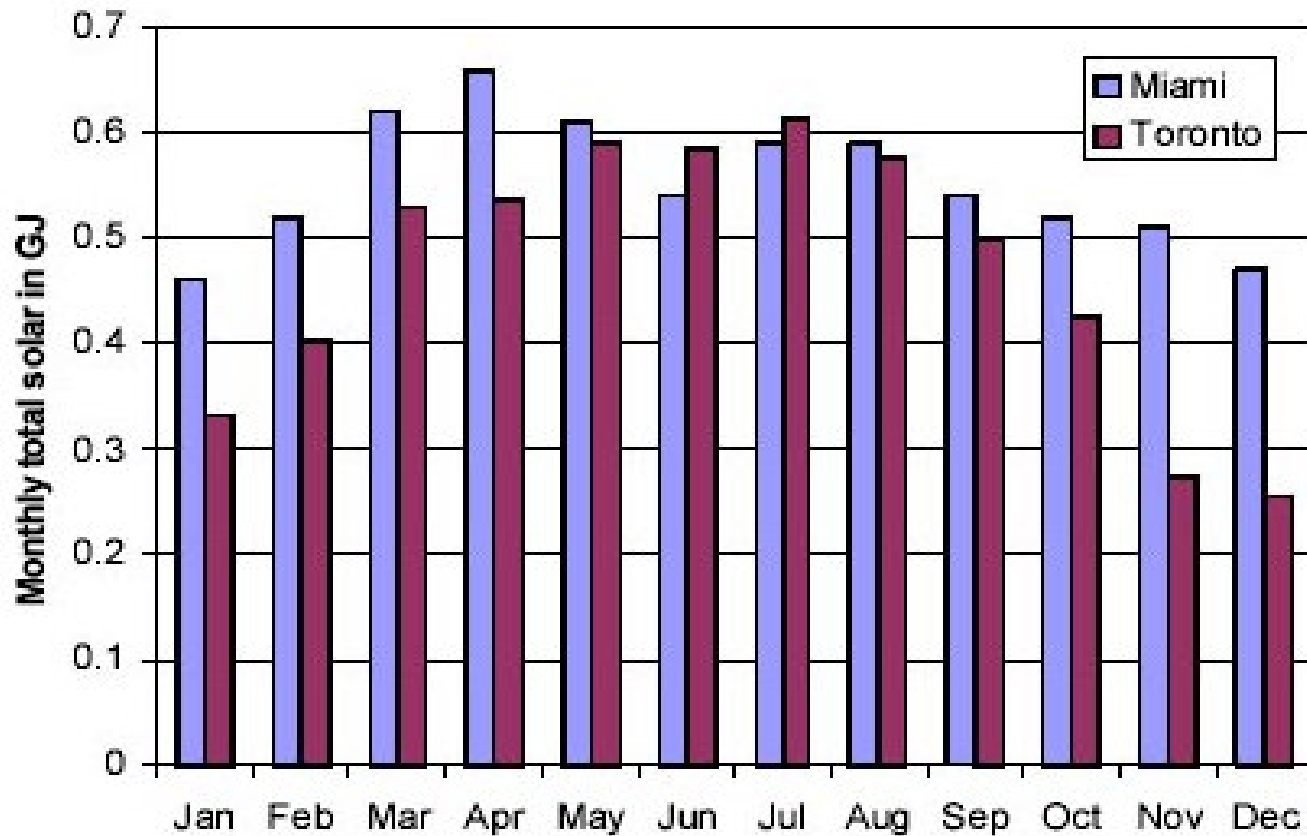
Solar in Ontario

The current situation...



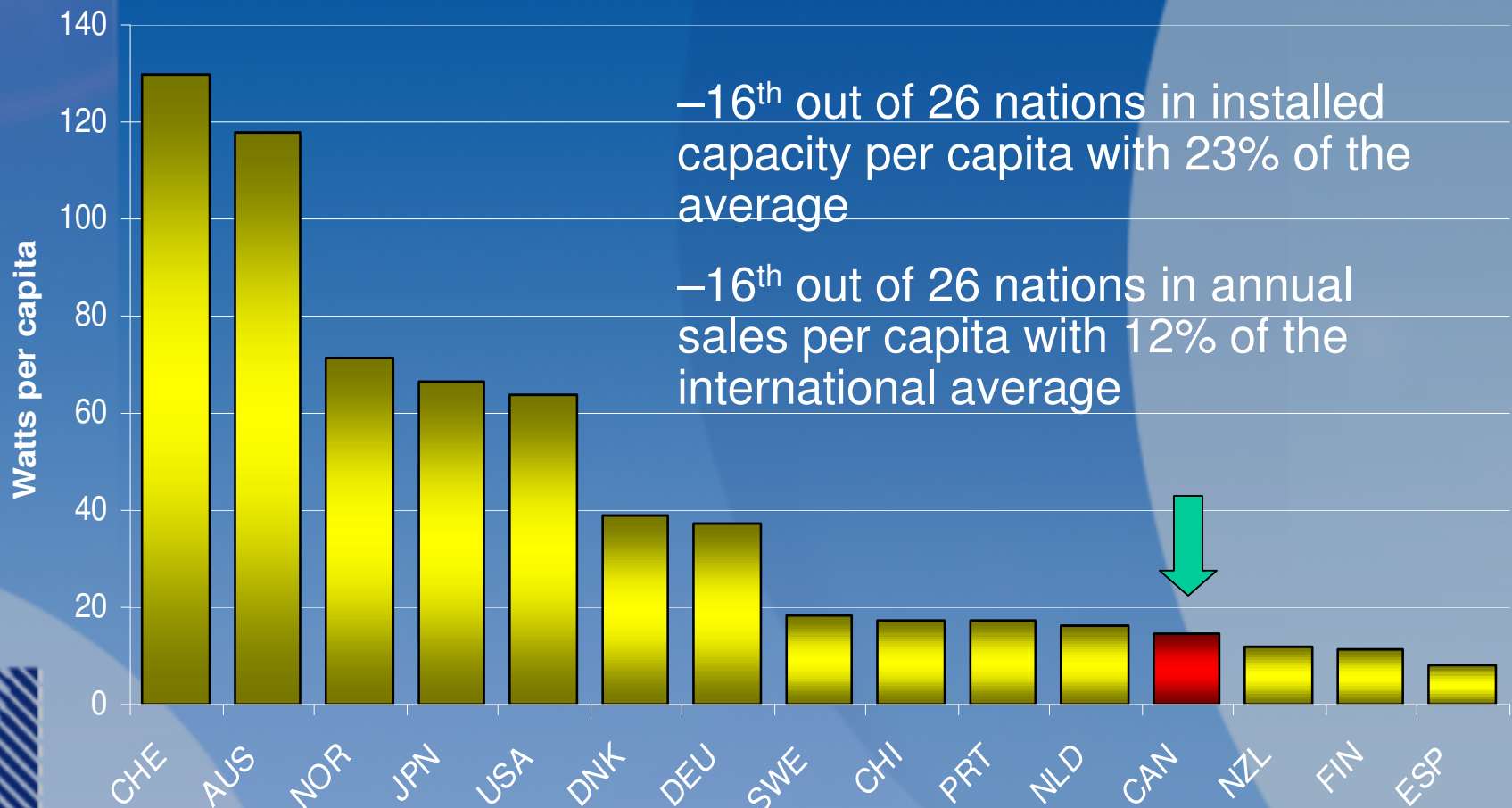
Canada Has The Solar Resource

Solar Radiation in Miami and Toronto on slope=latitude



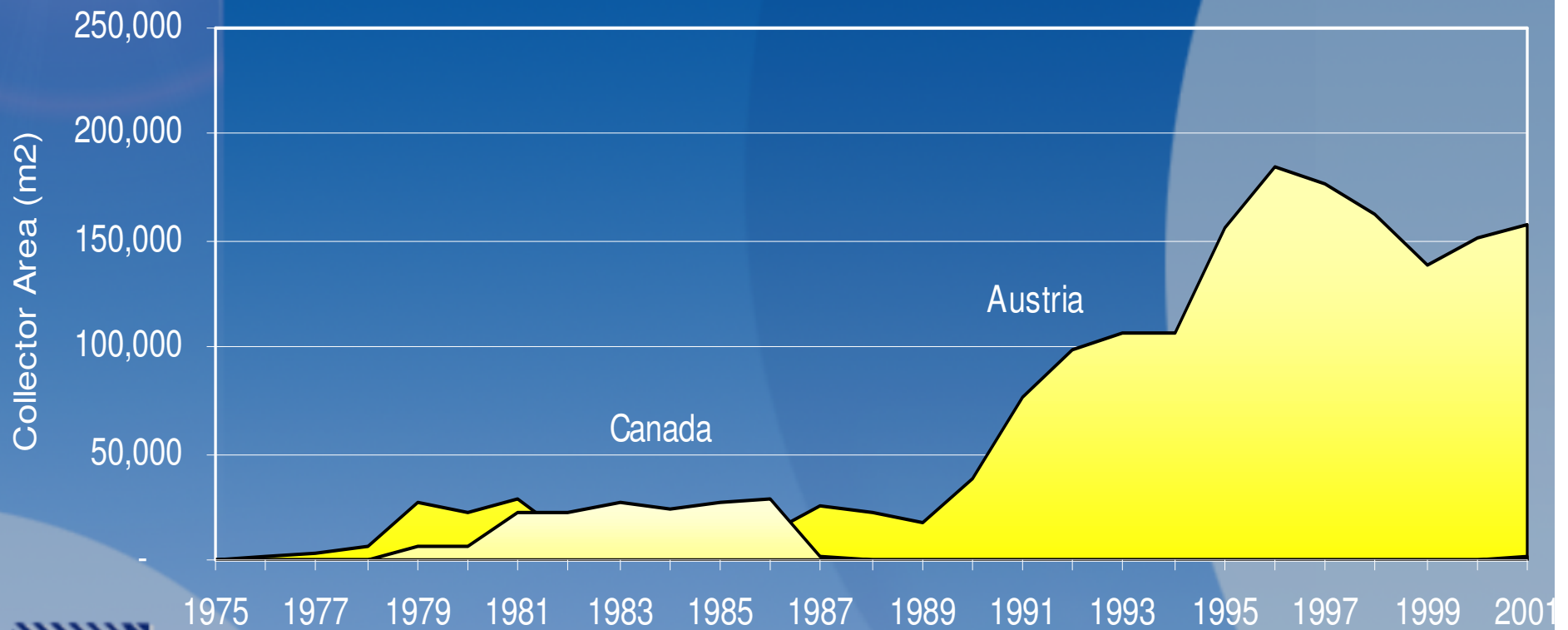
Solar Thermal Installed Capacity

(2001) (Source: IEA)



Note: Israel (457), Austria (205) & Greece (190) not shown

Solar Hot Water Collector Sales in Canada & Austria

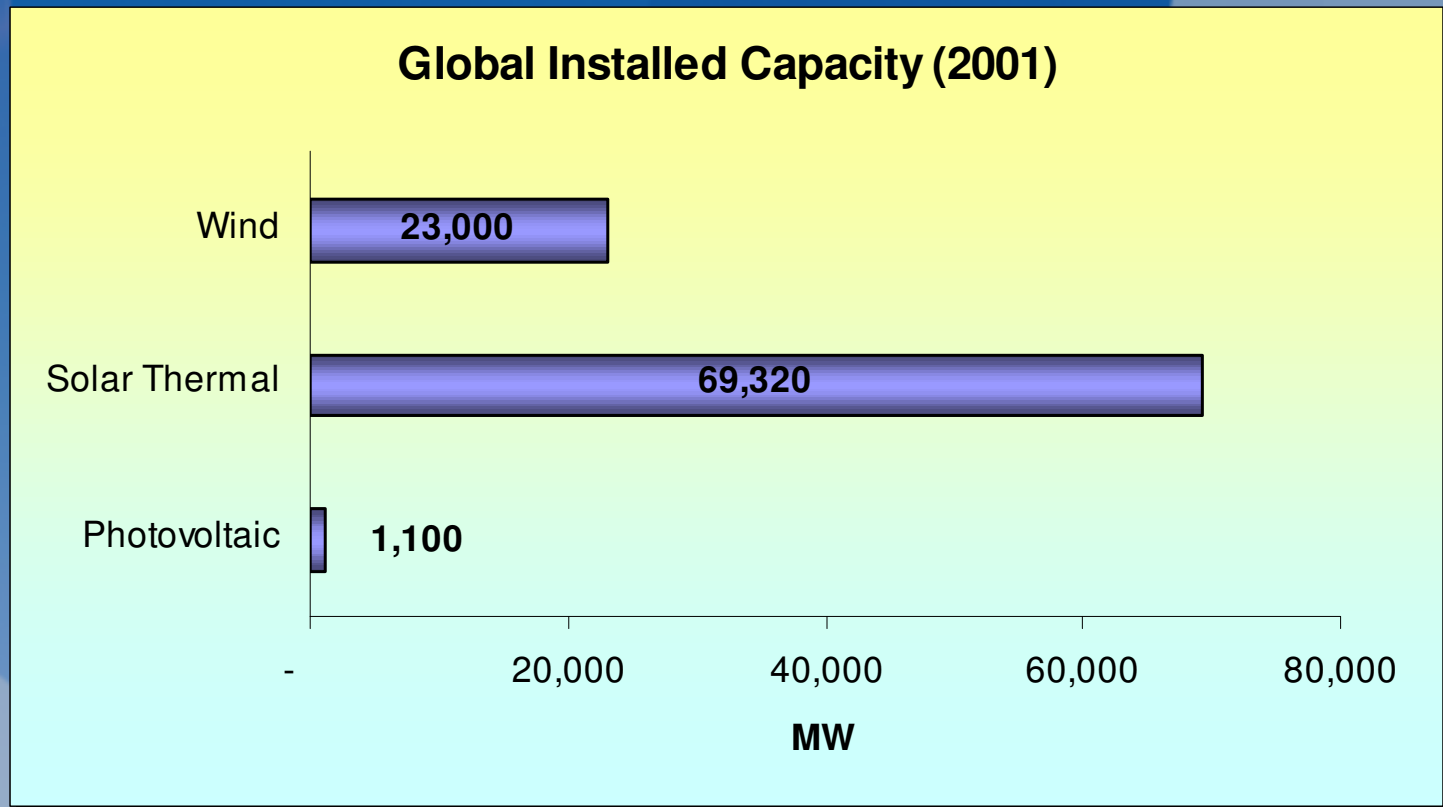


In 2001

Canada installed 1,000 m² - Austria installed 163,000 m²

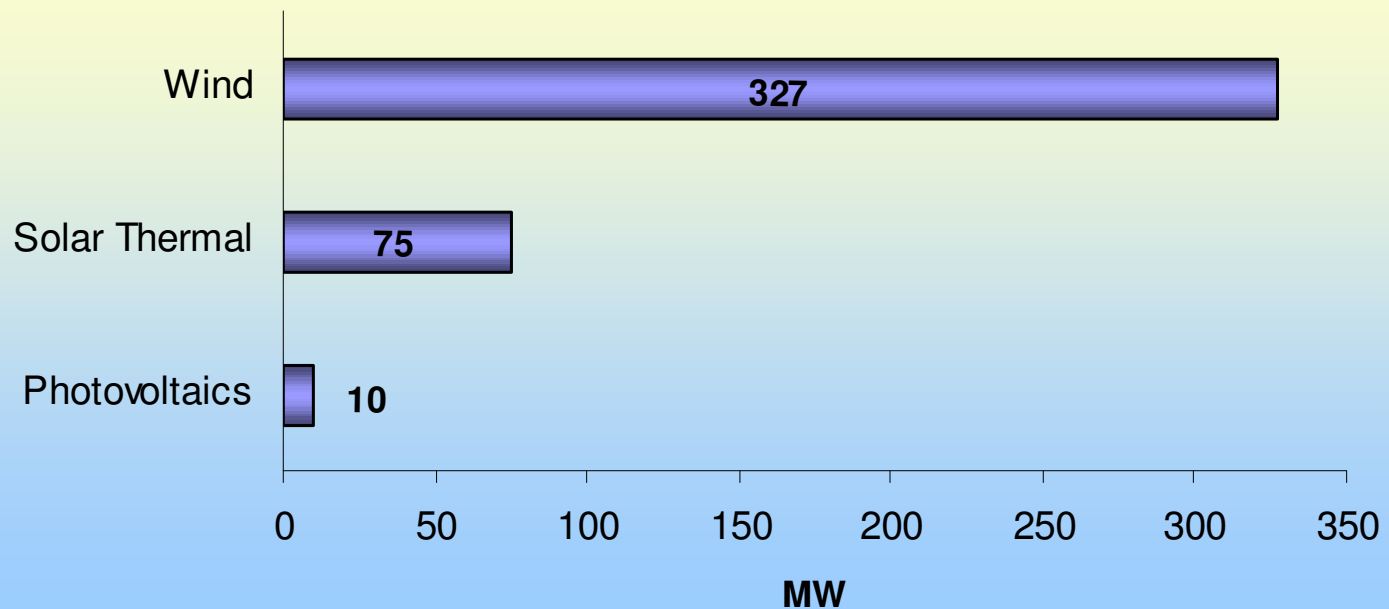
Populations: - Canada – 31 million; Austria - 8 million

Global Renewable Energy



Canadian Renewable Energy

Canadian Installed Capacity (2003)



Understanding Energy Prices Issues

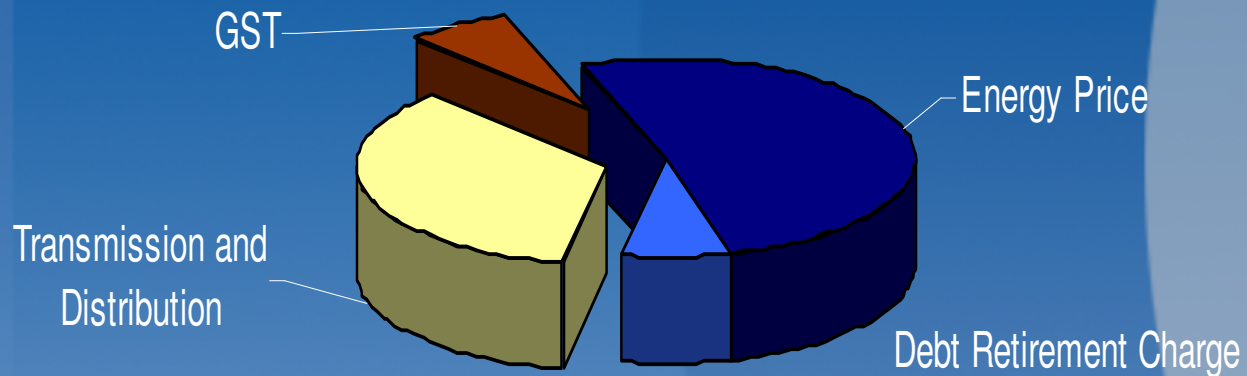
In 5 minutes of less...

Energy Price vs Energy Costs

- Choices made based on “the best economics” need to use similar reference points to compare.
 - Central Power Generation (natural gas, nuclear, wind)
 - Base on what the cost of energy is at the power plant
 - Distributed Generation (solar thermal, solar electricity, earth energy)
 - Based on what the customer buys the energy for
 - The two reference points can be significantly different.

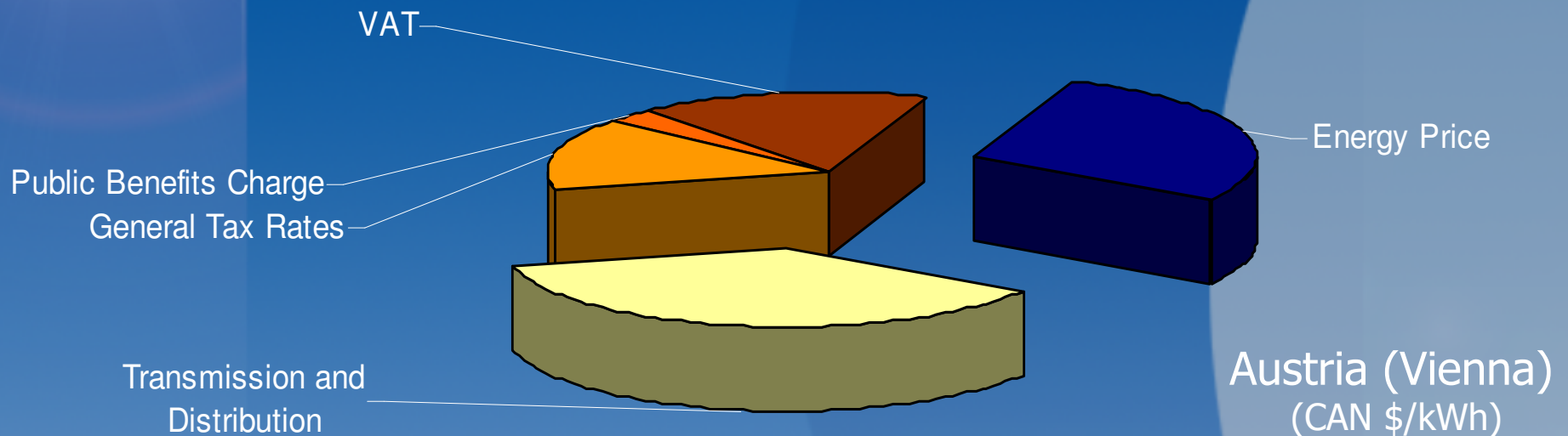
The Cost & Price of Electricity in Ontario

Hydro Ottawa
(CAN \$/kWh)



Energy Cost	\$0.057	Central power generation competes here
Distribution	\$0.034	
Taxes	\$0.006	
Total Energy Price	\$0.097	Distributed Generation competes here

The Cost & Prices of Electricity in Austria



	Ontario	Austria	
Energy Cost	\$0.057	\$0.064	1.12x higher
Distribution	\$0.034	\$0.083	2.44x higher
Taxes	\$0.006	\$0.077	12.8x higher
Total Energy Price	\$0.097	\$0.224	2.3x higher

The Politics of Energy

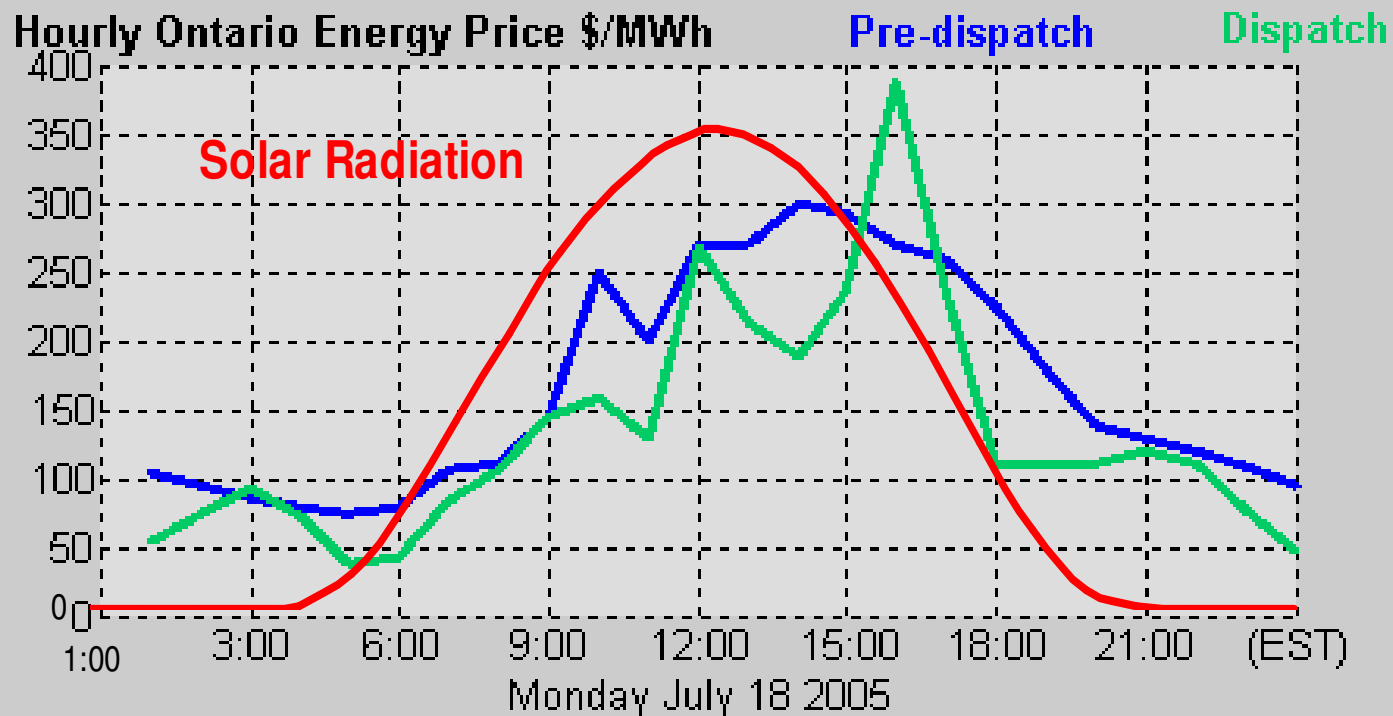
- It is government policies that drive what the consumer pays for energy
 - Taxes on gasoline
 - Taxes on oil
 - Electricity has the lowest tax rates of all energy supplies
 - Government decisions on the price of electricity (by taxes) impact Distributed Generation more than Central Power.



Capacity Ratings of Solar

- Solar is often marginalized as it has a “poor” Capacity Rating
 - It is only available when its sunny and is not “dispatchable” (i.e. is not available on demand)
 - Average 4.1 hours of peak sun per day = 17% capacity rating
- However value of solar is in its Peak Power Capacity
 - Peak Power is where the demand for electricity is highest (requires extra generation for short periods of time) – typical ratings are 90%, 95% and 99% of maximum system load
 - This generator is normally paid extra to be on “standby”

Daily Power Demand and Solar Energy



- Solar provides power during peak demand periods (very high correlation especially in summer peaking locations)
- Solar's Peak Power Capacity is >60% at 99% of peak demand
- The price of electricity at peak capacity can be > \$0.40 per kWh

Accounting for the Costs of Solar Energy

How you account and who accounts can lead to very different answers



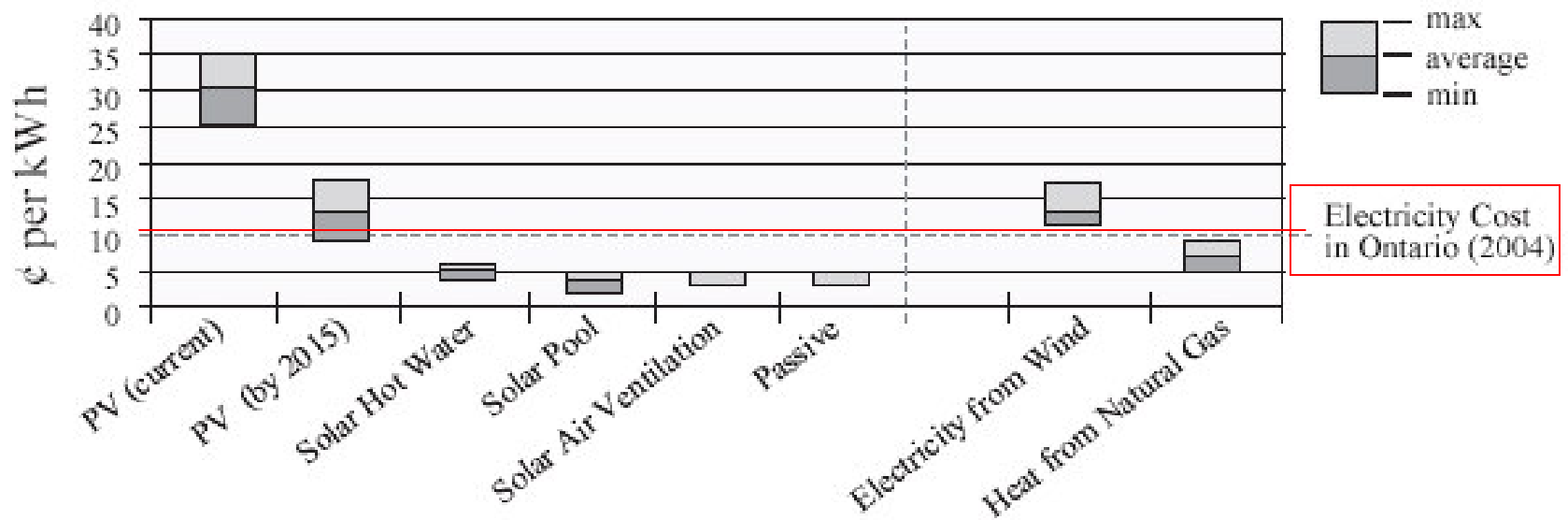
Economic Metrics of Solar

- There are three ways to account for solar's cost:
 - Payback – typically 7-10 years
 - This reduces the potential market penetration to less than 5% of customers
 - Return on Investment – 10-14%
 - Very good return for a secure investment however most people don't view solar as an investment
 - Life Cycle Costing – 5 - 7 cents/kwh
 - The purchasers of solar do not use this metrics but utilities do (remember that the customer is buying electricity at 9 cents/kWh)



The Challenge: How can solar, which is accounted for using payback, compete with utility power which is accounted for by life cycle costing?

The Cost of Solar



When the cost of solar is accounted for in the same way as central power plants then many solar technologies are the best least cost option.

The Potential of Solar Heat in Ontario

Could we be in for sunny days?

Putting a Little Sunshine on Everyone's Roof

- Ontario has 2.5 million homes – this will rise to 3.8 million by 2025
 - 63% of homes have the roof to install solar hot water systems
- The current limitation to growth is the size of the industry
 - At 60-80 systems installed per year – even at 50% growth rate - it will take years and years to have a major impact
- CanSIA projects it is feasible to install 800,000 SDHW systems in Ontario by 2025
 - 1 out of every 5 homes
 - Austria is already at 1 out of 7 homes (it took them 25 years of steady growth)



Barriers to Growth

- Upfront Cost
- Accounting mechanism used (payback) is different from all other energy sources
- Low awareness of solar technologies
- Heating issues do not have a high-tech image amongst consumers and policy makers
- Lack of Codes and Standards (being addressed)
 - Ontario Plumbing Code prevents the installation of solar hot water systems
- Lack of skilled installers
- Right to Light – Canada lags the rest of the world in protecting the individuals access to light



Strategies to Overcome the Barriers

- Provide financing mechanisms
- Set positive examples by using solar on public buildings
- Assist in raising awareness of solar
- Incorporate into binding regulations (building codes)

The Solar Bank and the Solar Utility

Proven mechanisms to overcome the upfront cost

How to Overcome the First Cost Barrier

- Solar is the only energy source in the consumer's hands
 - First cost – not the price of the energy delivered - is the barrier
- To overcome the first cost issue - two options:
 - Sell the energy not the product (the solar utility)
 - Finance (with low interest rates) the purchase over a period long enough so that the energy savings are greater than the monthly payments (the solar bank)

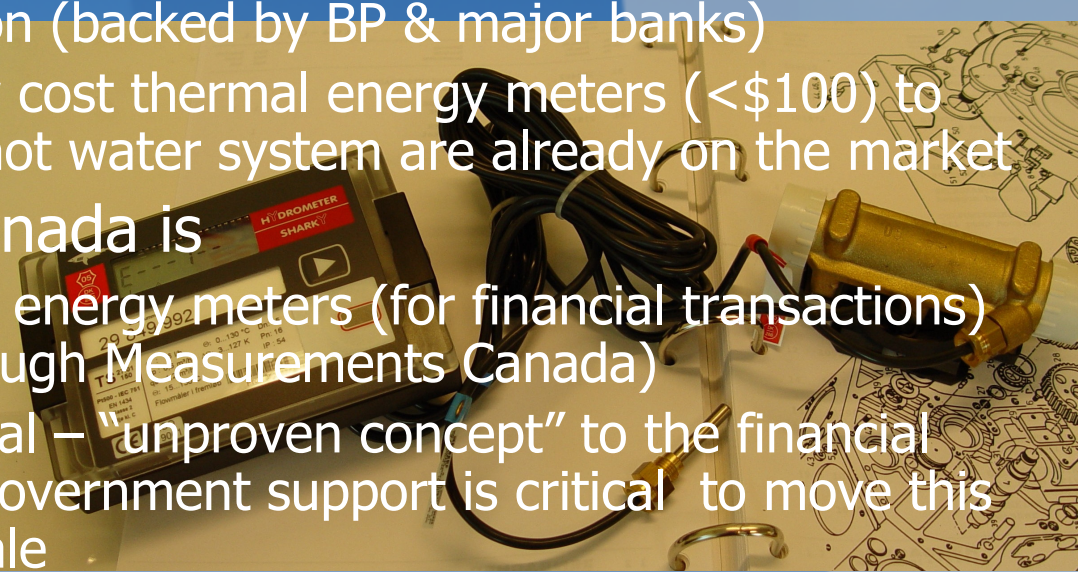


A Solar Utility?

- If...
Solar's energy cost is 5 cents per kWh
- And..
The customer's price of energy is 10 cents per kWh for electric water heating
- Can a business case be made for someone to own the solar heating system and sell the energy it produces?

The Solar Utility

- Canadian solar firms are leaders in working towards this concept due to:
 - low electricity prices makes this the only current road to success
 - No financial support programs from governments
- Still relatively small scale in Canada however:
 - US – Sun Edison (backed by BP & major banks)
 - Germany – low cost thermal energy meters (<\$100) to meter a solar hot water system are already on the market
- Challenge in Canada is
 1. To get thermal energy meters (for financial transactions) approved (through Measurements Canada)
 2. Access to capital – “unproven concept” to the financial community – government support is critical to move this into a large scale





Financing Solar's First Cost

- If..
 - Solar is already the cheapest sources of heat energy
- Is it possible to...
 - Simply finance the first cost and pay for the solar hot water system out of the savings?

The Barriers to Get Financing

- Purchase price is relatively small (for many homeowners and for the bank)
 - Not worth the trouble for the homeowner to apply for a loan
 - Banks are not interested in small loans
- Solar is an unknown risk for lenders in Canada – loan terms are short and interest rates high.
 - Central Power generation can obtain equity financing and or low-long term financing
 - Solar is at a competitive disadvantage

Financing Options – An Example

- Typical system
 - \$4,000 installed price, \$1,000 down, \$3,000 financed
 - System displaces electricity
 - Solar fraction of 45%
 - Savings of 2,500 kwh/year - \$250
 - Savings of \$21/month
- Return on Investment
 - Need to “sell” the investment approach
 - On an investment of \$1,000 what is a good return?
 - 10% = \$100/year = \$8/month
 - Need to have a positive cash flow of at least \$8/month

Financing Costs on Solar Loans

	Interest Rate	Term	Monthly Payment	Cash Flow
Solar Savings			(\$21.00)	
Line of Credit (typically what is available)	12% (prime +7.75%)	5 year	\$66.73	(\$45.73)
Secured Loan	7.75% (prime + 3%)	10 year	\$36.00	(\$15.00)
Small Business Loan (with government backing)	3.25% (prime – 1%)	10 year	\$29.32	(\$8.32)
Mortgage	5.75% (prime + 1.5%)	25 year	\$18.87	\$2.13

Making Financing Work

- Need two elements:
 1. Subsidy to eliminate the down payment (25% - REDI already does for commercial systems)
 2. Government backed loan guarantees and/or interest rate buy down to 3.75% for 20 year terms (same term as proposed SOC program)

	Interest Rate	Term	Monthly Payment	Cash Flow
Solar Bank	3.75% (prime – 0.75%)	20 year	\$17.80	\$3.20

- Loan cost to government
 - \$56/year per system – 2 cents per kWh

Conclusion

- A business case for solar can be made if its costs are spread over a long period (20-25 years) which equal the system's life expectancy and a low interest rate is available to finance it
 - This is already offered in other countries:
 - US – US Dept of Agriculture offers a Loan Guarantee for on-site generators (solar) which reduces the interest rate to 5-6%
 - Germany – National - 10 year 4% rate; 40 state LDC programs that provide subsidies of \$1,600-\$2,400
 - India – 100,000 solar hot water systems installed under a 0% solar loan program



Solar Hot Water does not need high subsidy levels – its needs financing programs with government backed loan guarantees and minimal interest rate subsidy

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