Advanced Technologies for Renewable Energy in Canada

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Challenges facing Canada:

- Canada's Kyoto target: 6% below GHGs in 1990
- GHGs as of 2006: 27% above 1990
- Population growth 1990-2006 of 16.7% is obviously not the only explanation

What other factors are causing Canada to not meet Kyoto?

- From 1990 to 2004:
  - GHGs from transportation, electricity generation, space heating, fossil fuel production and consumption, mining and manufacturing rose 30%
  - These sectors accounted for 91% of the growth in total emissions in Canada

What other factors are causing Canada to not meet Kyoto?

- Oil, gas and coal industries 32% of the overall increase
- Road transportation 24%
- Thermal electricity and heat production 22%

Increase in GHGs from 1990 to 2004:

- Oil, gas and coal industries: 49%
  - proven reserves of 178.8 billion bbl versus Saudi Arabia at 267 billion bbl
  - Canadian crude oil requires much more energy for extraction, e.g. Tar Sands

Increase in GHGs from 1990 to 2004:

- Road transportation: 36%
  - 1.6 more roadways per capita population than USA
  - shift from automobiles to minivans, sport utility vehicles and small pickup trucks
  - doubling in the number of trucks (advent of "just-in-time" delivery systems)

Increase in GHGs from 1990 to 2004:

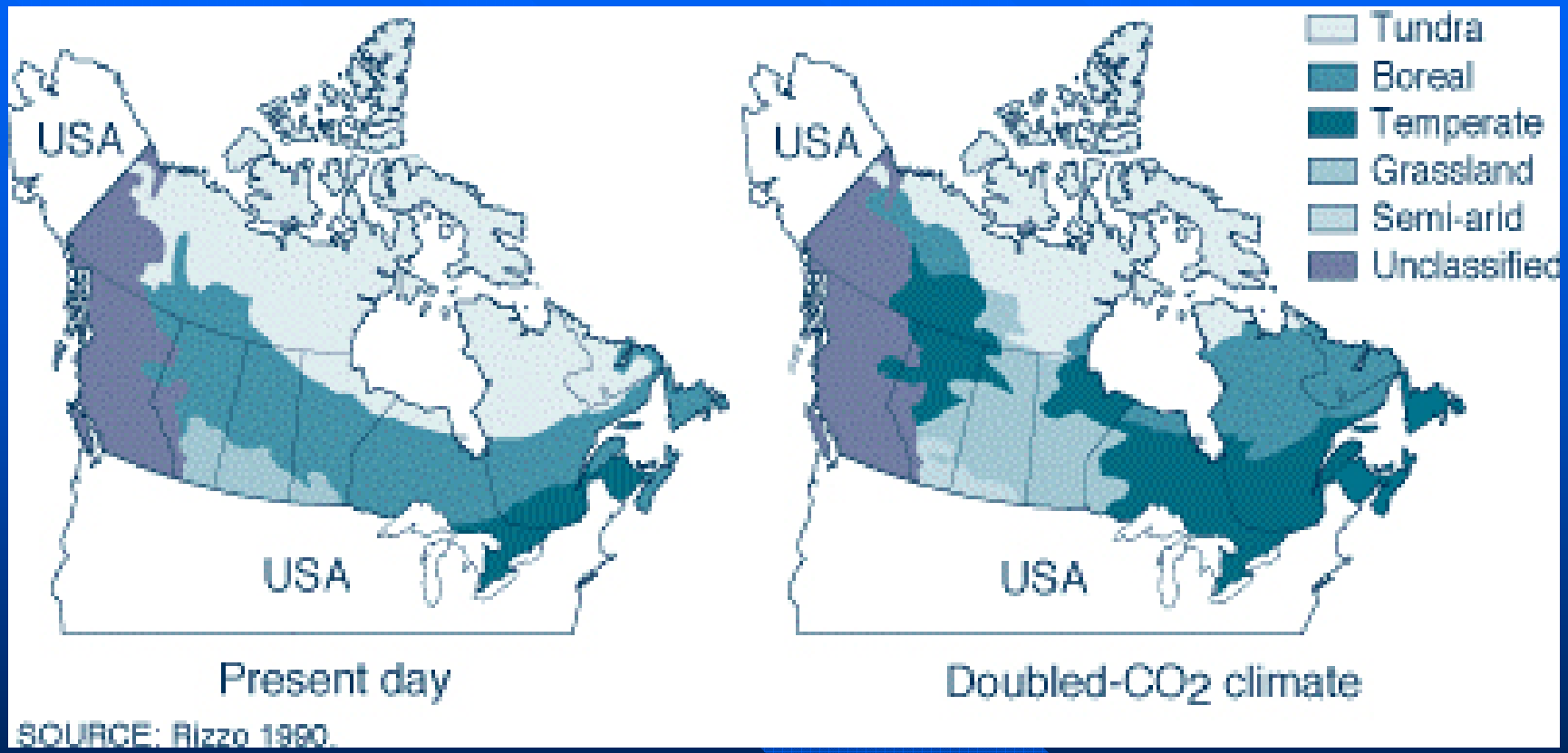
- Thermal electricity and heat production: 37%
- Heating of homes and buildings is major factor (i.e Canadian winter)
  - Percentage growth in electrical generation: 26.3%
  - However, percentage growth in hydrocarbon based generation is only: 14%

Increase in GHGs from 1990 to 2004:

- Total installed capacity in electrical generation in 2006: 123,792 MW
- Of which:
  - Hydro, Wind and other renewable energies: 61.4%
  - Nuclear: 13.3%
  - Hydrocarbon based: 25.3%

How does Canada compare to the USA and Australia?

	Canada	Australia	USA
Kyoto target versus 1990 GHGs	- 6%	+8%	- 7%
Population growth 1990-2006	+16.7%	+19.7%	+20.6%
GHGs in 2006 versus 1990	+27%	+4.2%	+15.1%



SOURCE: Rizzo 1990.

Canada has now revised its targets for GHGs reduction:

- Absolute reduction of 20% from 2006 level by 2020
  - Carbon capture and storage
  - Generate 90% of our new power from non GHG sources
  - Cut GHG emissions from coal by more than 50%
  - Increase average fuel efficiency in new cars by 20%

Canada has now revised its targets for GHGs reduction:

- Absolute reduction of 20% from 2006 level by 2020 (continued)
  - Improve Canada's energy efficiency by some 20%
  - Increase electricity from renewable sources like wind and wave power by 20 times

Canada has now revised its targets for GHGs reduction:

- Mandatory targets have been set for Canadian industry
- Options available to Canadian industry in meeting mandatory targets:
  - Domestic emissions trading
  - Offsets (purchasing emission reductions from non-regulated sectors)
  - Purchase emission credits under Kyoto Clean Development Mechanism

Canada has now revised its targets for GHGs reduction:

- Absolute reduction of 70% from 2006 level by 2050

Canada's strategy for GHGs reduction:

- $4 billion in funding for ecoEnergy Initiatives:
  - $230 million for R&D in clean energy
  - $1.5 billion for 4,000 MW in renewable energy
  - $375 million to promote smarter energy use by Canadians
  - $1.5 billion to boost production of biofuels

Canada's strategie for GHGs reduction (continued):

- Development of Very Low Head turbine
  - Reduction of reservoir size
  - Reduction in fish mortality
  - Subject of an Agreement on Science, Technology and Innovation Cooperation between Canada and Brazil

Canada's strategie for GHGs reduction (continued):

- The provinces of Ontario and New Brunswick are looking at further investments in nuclear energy
- Heat from nuclear energy for processing the Tar Sands is under consideration as means of reducing the carbon footprint

Canada's strategie for GHGs reduction (continued):

- Canada has developed model for estimating life-cycle GHG emissions from conventional and alternative fuels
- The GHGenius estimates that GHGs:
  - from grain-based ethanol 40% lower than gasoline (Brazilian sugarcane 70 to 90% lower)
  - from oilseed-based biodiesel 60% lower than diesel
  - Cellulosic based ethanol 90% lower

Canada's strategie for GHGs reduction (continued):

- $45M plant producing ethanol from cellulose
- 3M litres per year sold commercially

Canada's strategie for GHGs reduction (continued):

- Ethanol from cellulose should end link between ethanol and rising food prices
- In the meantime, Canada has
  - Untied its food aid to developing countries
  - Added $50M per year to food aid program bringing it to a total of $230M per year