

Geological Storage of Carbon Dioxide in Nova Scotia

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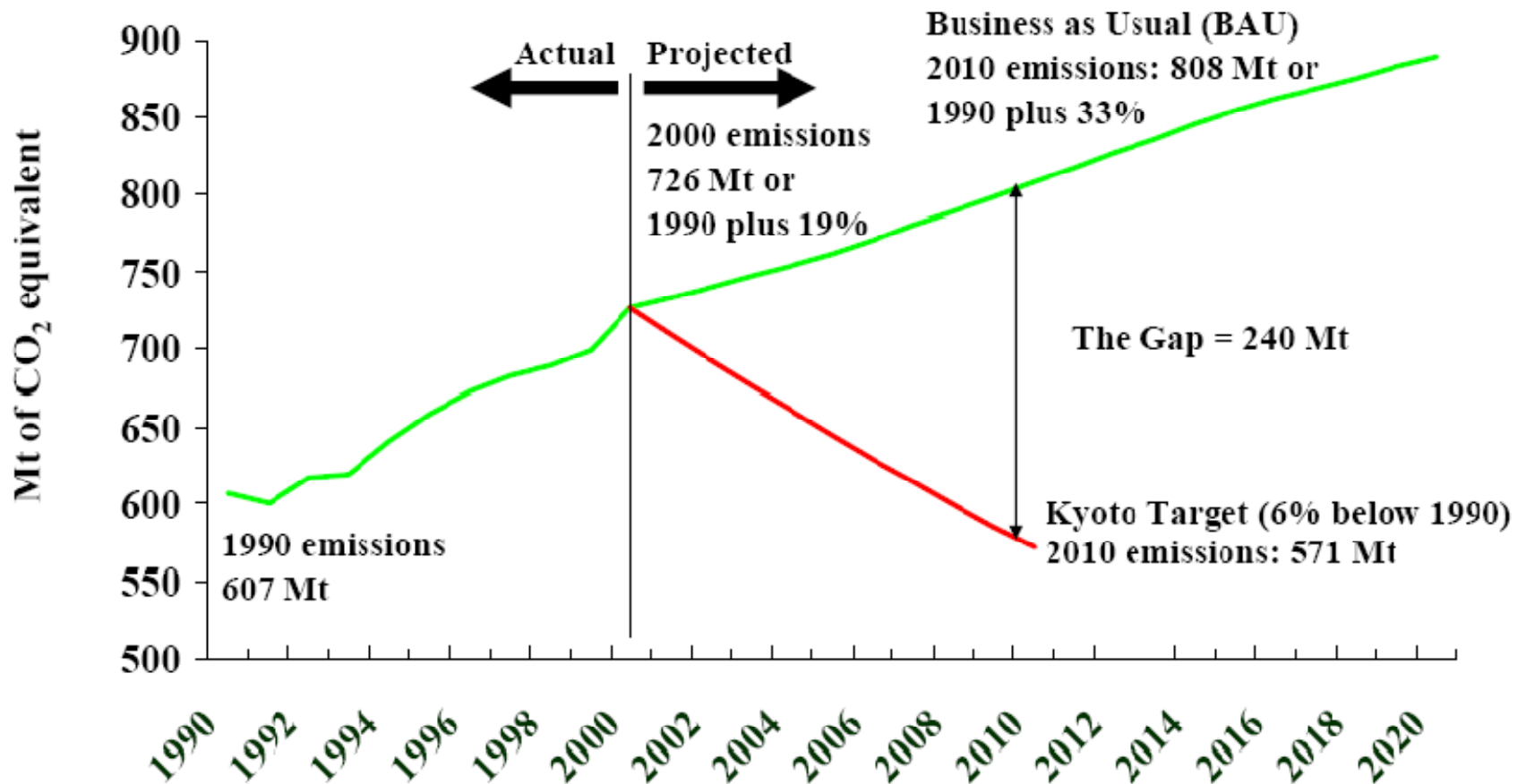
NS Energy R&D Forum
Antigonish, May 22, 2008



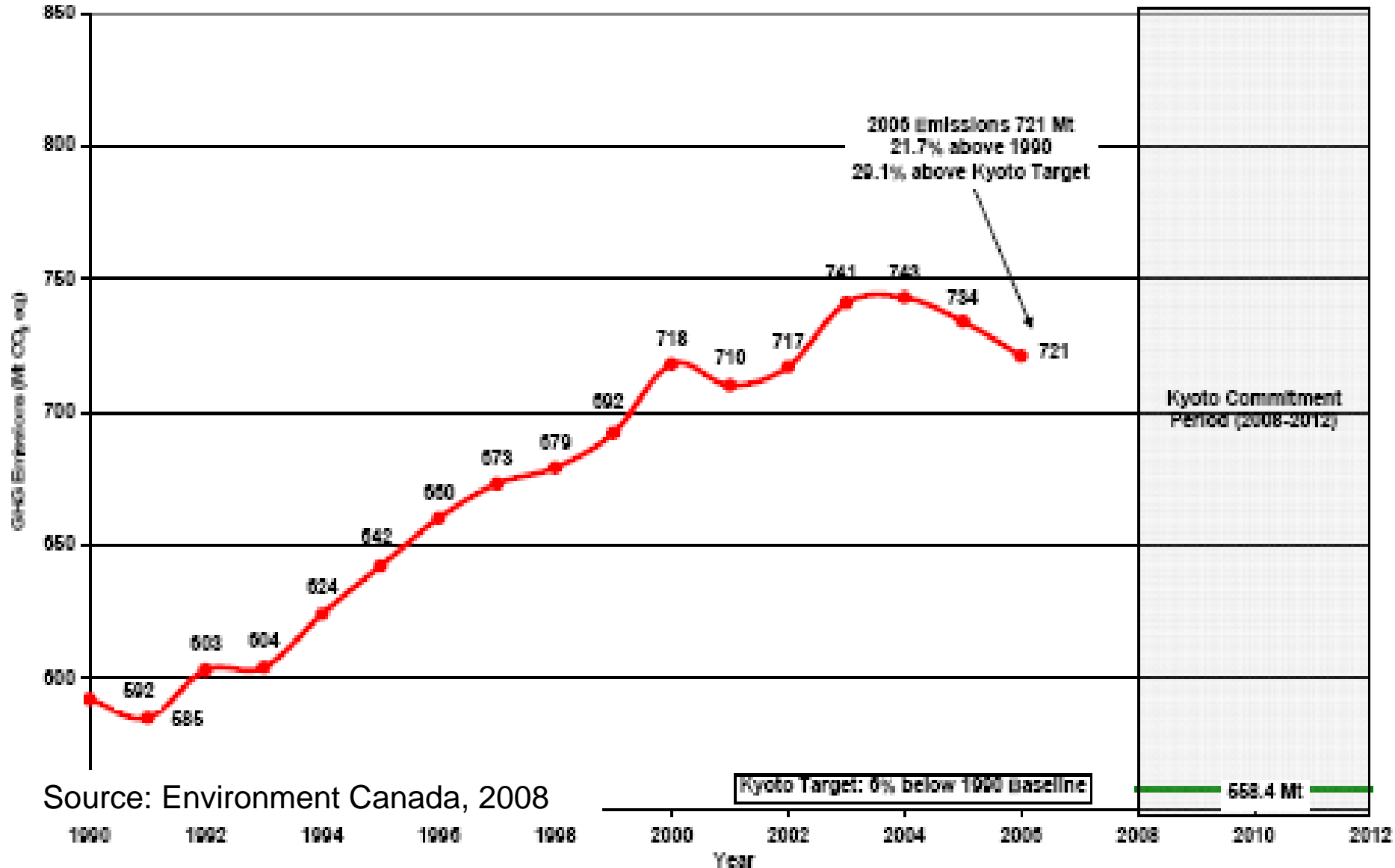
Geological Storage of Carbon Dioxide in Nova Scotia

- The Climate Change Challenge
- CO₂ Capture and Storage
- Carbon Storage Research Consortium
- NS Carbon Storage R&D Project
 - ▶ Objectives
 - ▶ Research strategy
 - ▶ Funding
- Conclusion

Canada's Climate Change Challenge: The Gap



Canada's GHG Emissions 1990-2006



A Logical Approach to CO₂ Management

Maximize Renewables

Hydroelectric

Solar

Wind

Geothermal

Biomass

Ocean

Maximize Demand and Supply Side Opportunities

End User Efficiency

Production Efficiency

Combined Heat and Power

Then...

What is CO₂ Capture and Storage (CCS)

- Carbon dioxide capture and storage is a process for reducing GHG concentrations in the atmosphere by first extracting CO₂ from gas streams typically emitted during electricity production, fuel processing and other industrial process.
- Once captured and compressed, the CO₂ is transported to a geological storage site, where it can be injected and safely stored for the long-term.

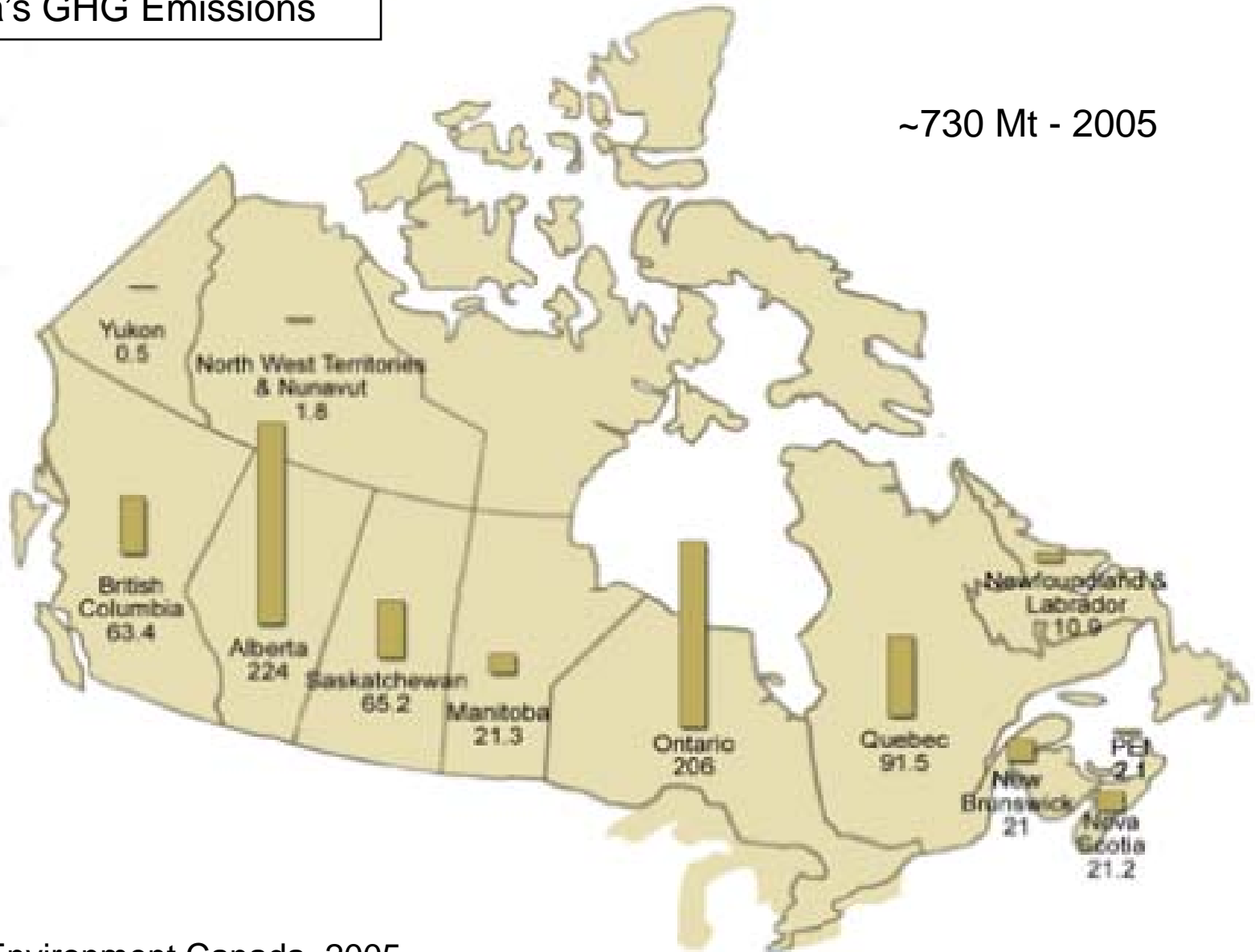
Carbon Capture and Storage (CCS)

- Will provide the early, large CO₂ reductions necessary to bridge the gap.
- Provides a transition technology from our fossil-based economy to some other techno-economic platform during this century
- Perhaps the only method to meet the target of not exceeding 550 ppm CO₂ in the atmosphere.

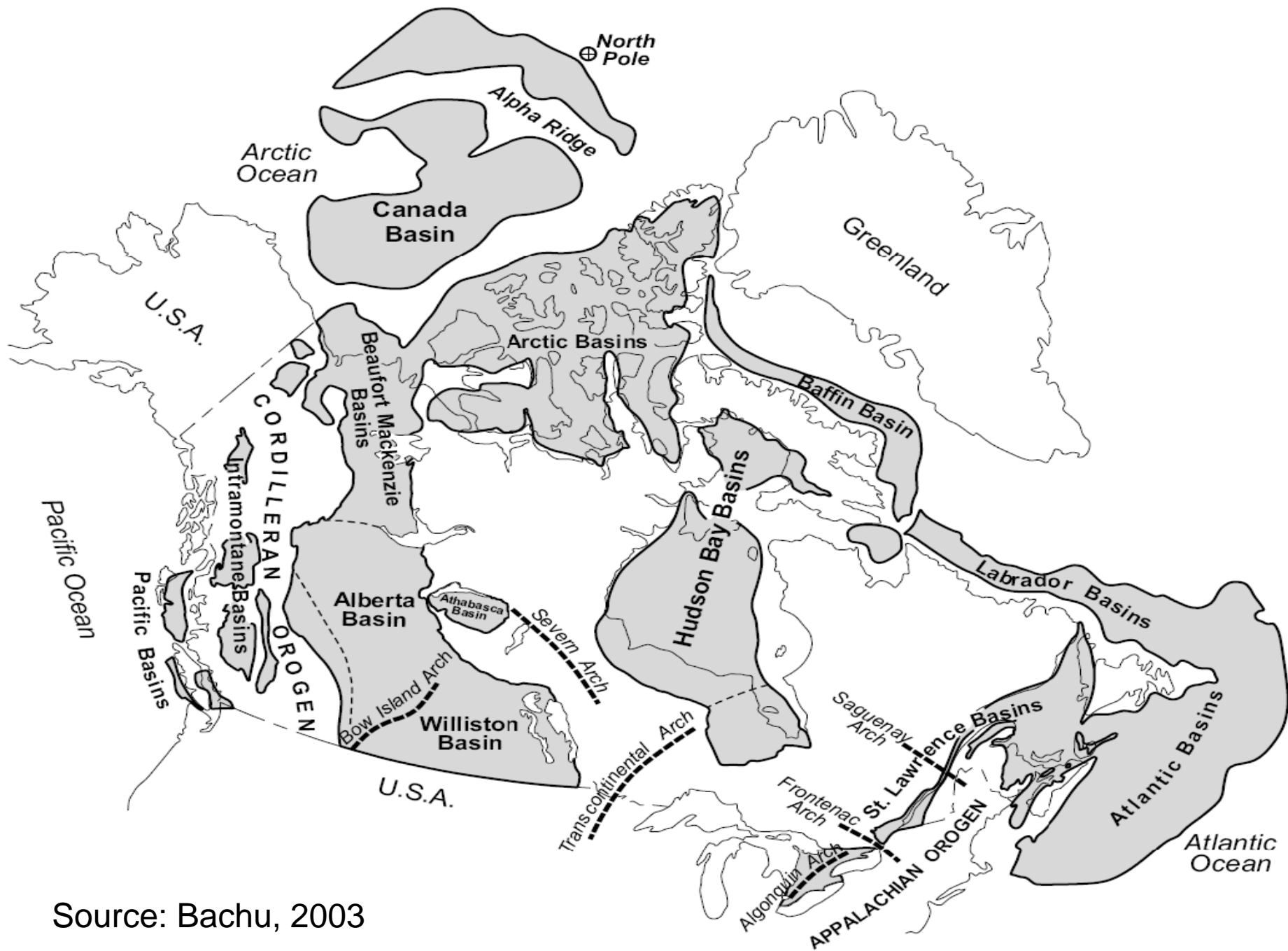
GHG Emissions in Nova Scotia

- Over 20 million tonnes annually
- Largest single-site emissions: coal-fired power plants
 - ▶ ~ 80% of power generation from coal
 - ▶ ~ 3 million tonnes/yr of coal are burned
 - ▶ ~ 10 million tonnes of CO₂/year
- Provincial legislation calls for a 10% reduction in greenhouse gas emissions, below 1990 levels, by 2020
- This means about 40% reduction below today's emission levels

Canada's GHG Emissions



Source: Environment Canada, 2005



Source: Bachu, 2003

Carbon Storage Research Consortium

- Dalhousie University, Nova Scotia Power Inc., and Nova Scotia Energy - an Academic, Industry, Government Partnership
- Formed in 2004 to conduct interdisciplinary research into the range of issues involved in safely isolating stationary source carbon dioxide emissions in an environmentally acceptable manner.
- To be a leading research consortium for greenhouse gas mitigation working in collaboration with industry, government, and academic partners within our region and beyond.

R&D Objectives

- Assess regionally appropriate onshore and offshore geological storage locations from among:
 - ▶ Deep saline aquifers
 - ▶ Hydrocarbon reservoirs
 - ▶ Deep coal beds
- Conduct concurrent research into:
 - ▶ Public awareness and perception of CO₂ storage
 - ▶ Verification and monitoring of stored CO₂
 - ▶ Policy and regulatory issues
 - ▶ Economic assessment and impacts

Research and Development Plan

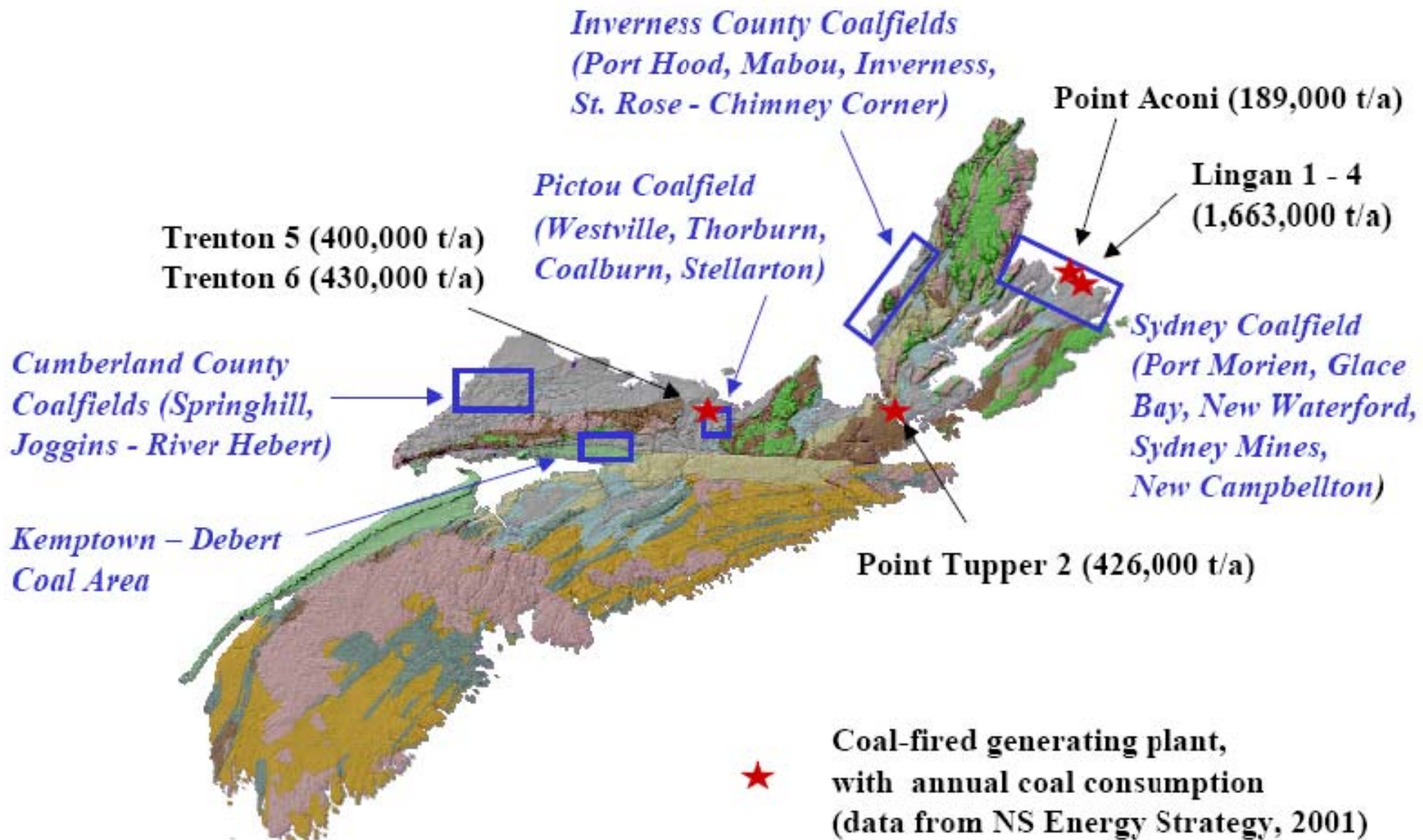
- (Phase 1) 2008 - 2011 Screening study to assess storage capacity onshore and offshore, CO₂ supply & transport and selection of several pilot sites.
- (Phase 2) 2011 – 2014 Drill data wells followed by pilot design and implementation at two sites (100 tonnes/day)
- (Phase 3) 2014 – 2018 Pilot interpretation, commercial demonstration design and implementation at one site (1000 tonnes/day)
- (Phase 4) 2018 – 2020 Commercial design (10,000 tonnes/day and start up.

Site Selection Sequence

- Inventory of CO₂ sources
- Inventory of potential basins and estimation of their immediate and ultimate capacity
- Analysis of potential CO₂ storage sites within reach of CO₂ sources
- Screening and ranking of sites based on geology, economics and safety
- Detailed analysis and evaluation of candidate sites

Site Selection for Carbon Storage

- Must ensure that the storage site:
 - ▶ Has the necessary capacity for storage
 - ▶ Meets conditions necessary for injectivity
 - ▶ Provides for safe injection
 - ▶ Is economically viable
 - ▶ Is environmentally acceptable
 - ▶ Is constructed, operated and decommissioned in a safe manner



Courtesy of Mike Cherry,
Nova Scotia Department
of Natural Resources

Carbon Storage Funding

- > \$5 M Government funding
- > \$1.5 M in industry funding
- Natural Science and Engineering Research Council
- Initial 3 year assessment project
- Potential for pilot, demonstration, and commercial projects

Conclusions

- Suitable geology
- Industry support
- Adequate funding
- Demonstrated need
- Ready to proceed

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