Implementing CO_2 Capture and Storage

An Alberta Case Study for the Integration of Climate Change and Petroleum Production Objectives

Alaska Forum on the Environment
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Alberta Research Council

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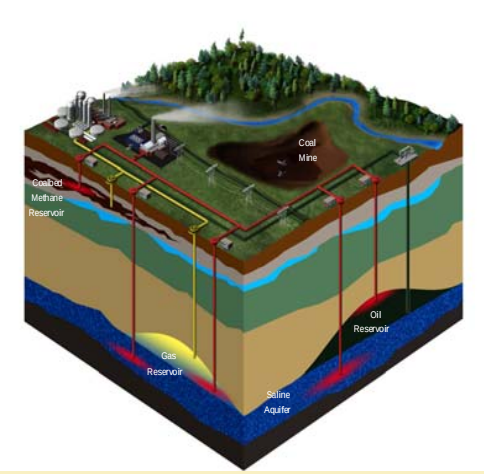

About the Alberta Research Council

Mission: To develop and help deploy innovative science and technology solutions for the benefit of Alberta.

- Over 500 highly qualified people
- $100M annual operating budget
- 4 locations in Alberta
- Not-for-profit corporation wholly owned by the province of Alberta and governed by a Board of Directors

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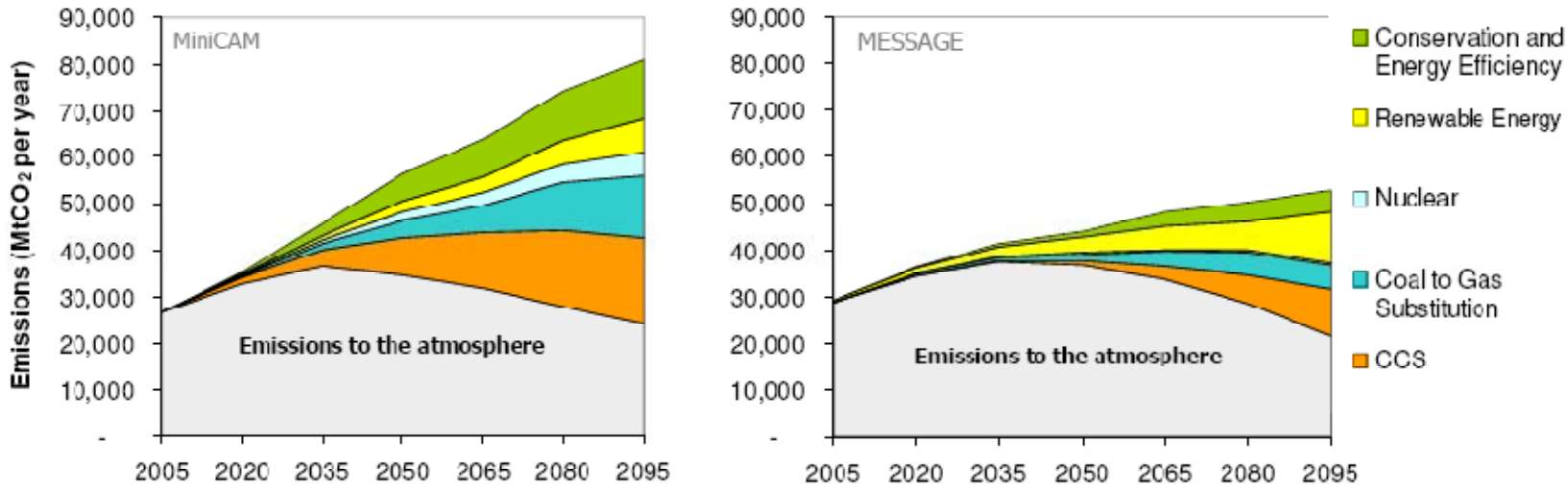
Summary

- Carbon capture and storage is a critical mitigation technology for Alberta and the world
- CCS remains a higher cost GHG mitigation option but…
  - International effort to bring costs down
  - Government expectations becoming clearer
- Synergies with petroleum and enhanced resource recovery provide opportunity to derive from CCS activities
- Alberta's approach suggests combination of regulations and incentives critical for stimulating initial projects

Outline

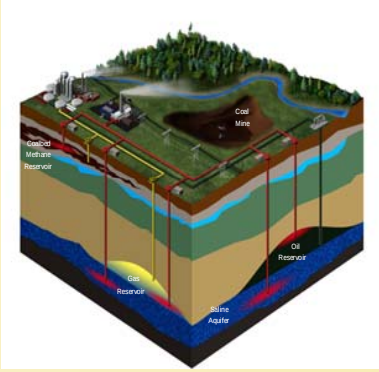
- What is CO_2 Capture and Storage (CCS) and why is it needed?
- Opportunities for CCS
- Implementation Barriers
- Alberta's approach
- Opportunities for Alaska?
- Conclusions

GHG Mitigation Portfolio



Most scenario studies: role of CCS increases over the course of the century

Carbon Conversion, Capture & Storage



Carbon Conversion

CO_2 Capture

Transport

Sequestration

Hydrocarbon Recovery

Aquifer Storage

MMV

Political/Public

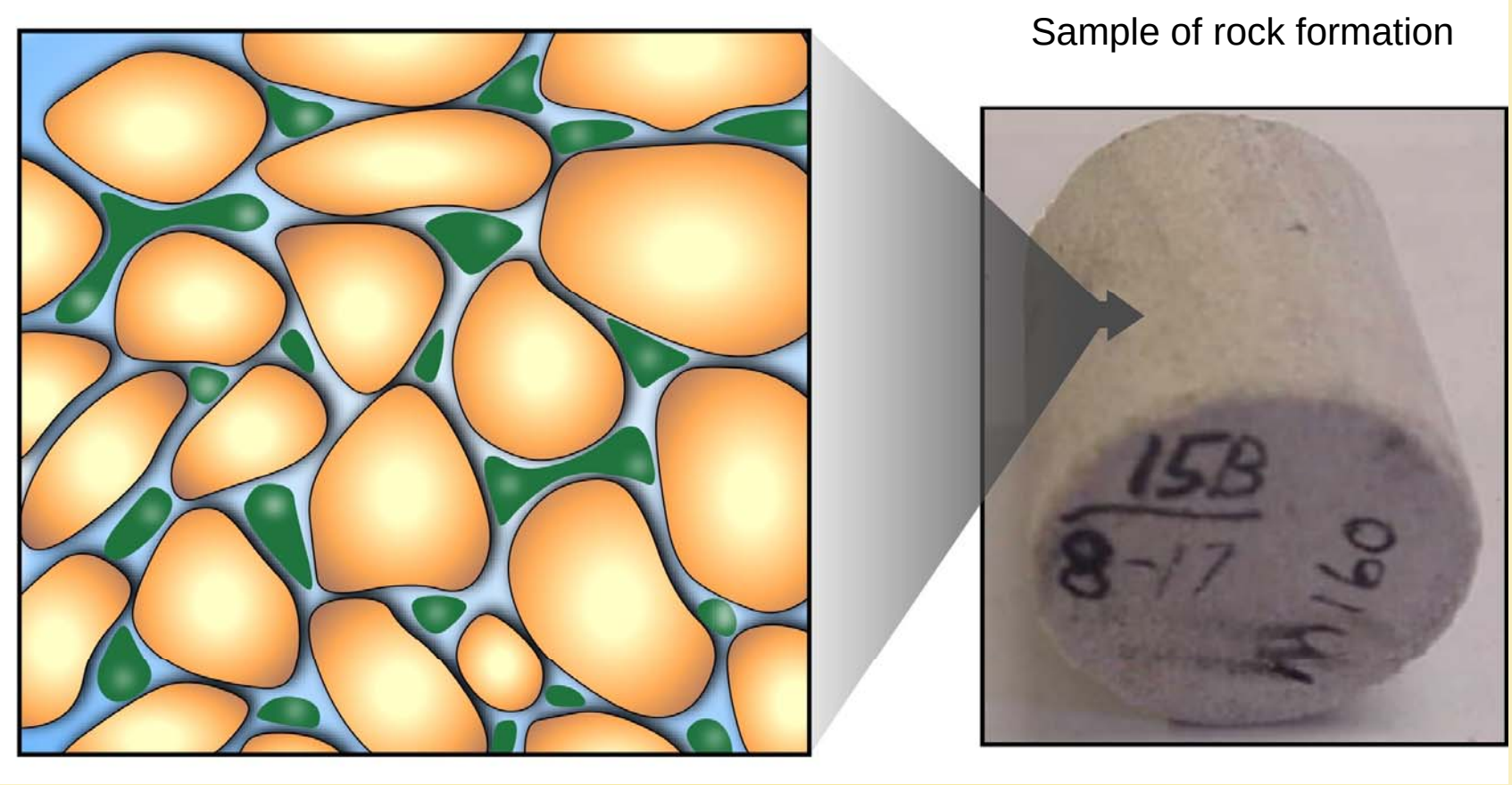
Legal

Environmental

Economic

Commercial

How CO_2 is Stored



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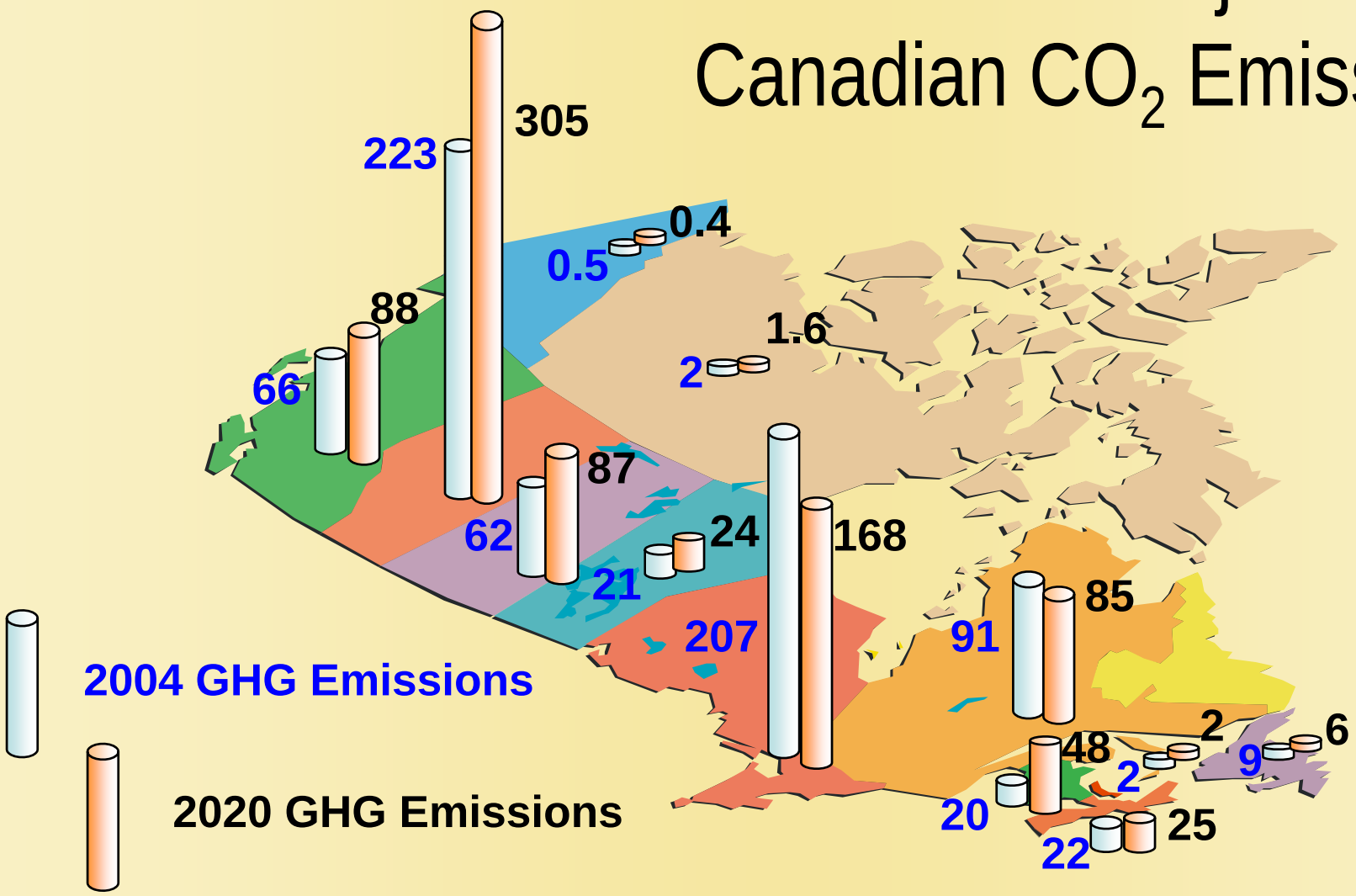
Current and Projected Canadian CO_2 Emissions



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Alberta's Policy Context

- Fossil-fuel focused economy
  - Resource extraction, upgrading and transport
  - Oil sands growing as a major source of secure energy
  - Driver of economic and emissions growth (oil sands, upgrading)
- Thermal-based electricity
  - Coal at 60% generation capacity
  - Growing wind generation (400% since 2000) but <5% generation
- Disbursed population
  - Limited but growing concentration in a few urban areas
- Transportation accounts for 15% of total greenhouse gas emissions
- 100 large point source facilities account for about 50% of total emissions

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Canada's Sedimentary Basins Most Suitable for CO_2 Storage
North Pole
Alpha Ridge
Canada Basin
Greenland
Beaufort Basin
Arctic Basins
Baffin West Basin
Foxe Basin
Mackenzie Basins
CORDILLERAN OROGEN
Intramontane Basins
Pacific Basins
Rocky Mountain
PRECAMBRIAN SHIELD
Alberta Basin
Athabasca Basin
Severn Arch
Hudson Bay
Labrador Basins
PRECAMBRIAN SHIELD
Bow Island Arch
Williston Basin
Moose River Basin
Transcontinental Arch
St. Lawrence Basins
Saguenay Arch
Nova Scotia
Atlantic Basins
U.S.A.
Frontenac Arch
Algonquin Arch
APPALACHIAN OROGEN
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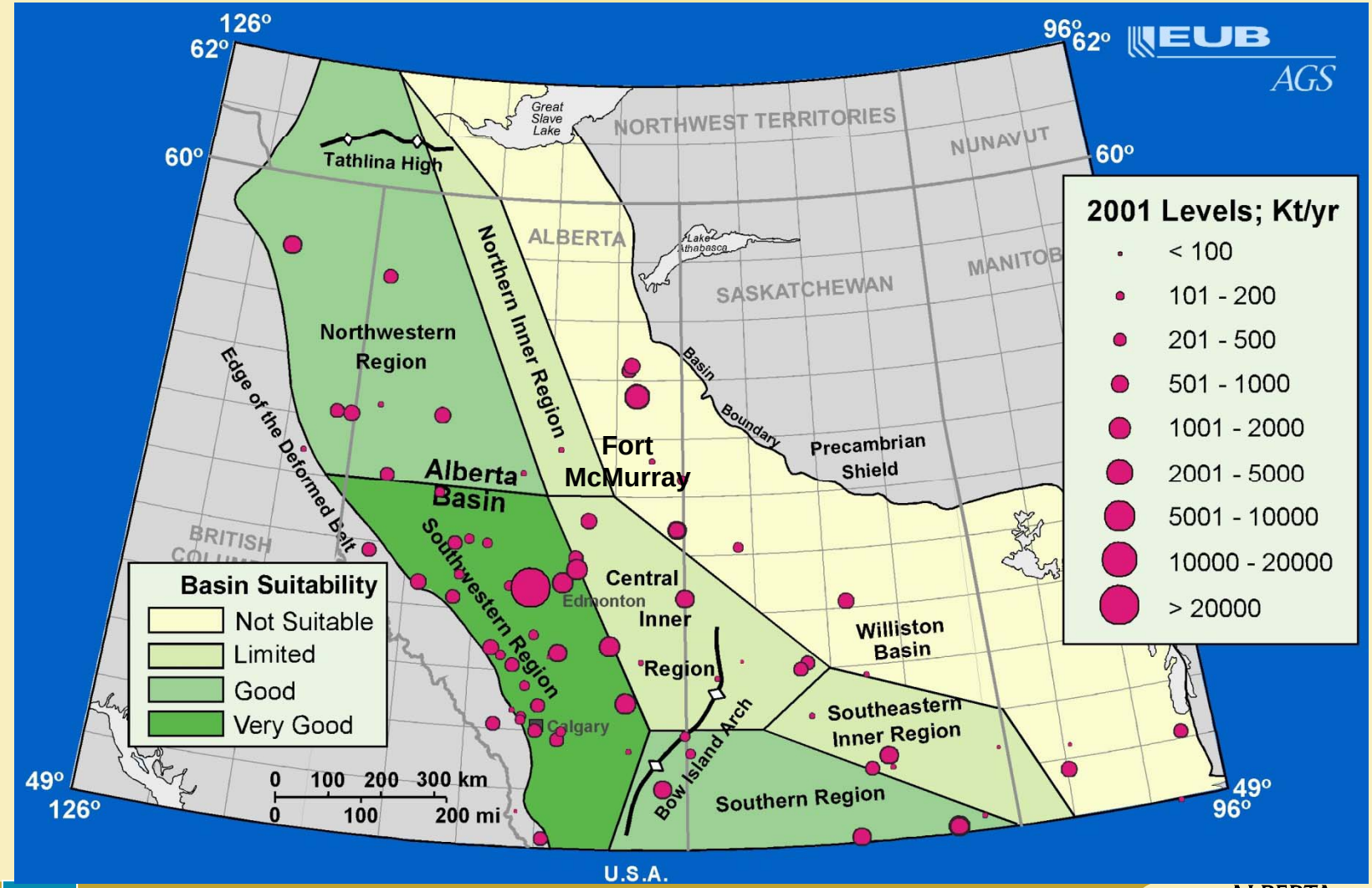
Suitability of Western Canada Sedimentary Basin for CO_2 Storage



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CCS Benefits for Alberta

- Most significant sources of emissions are ideally suited to carbon capture and storage (e.g. power generation)
- Analysis shows technology could account for 70% of Alberta's emission reduction objectives by 2050
- Technology can put oil sands producers on par with or better than conventional oil producers with respect to CO_2 intensity

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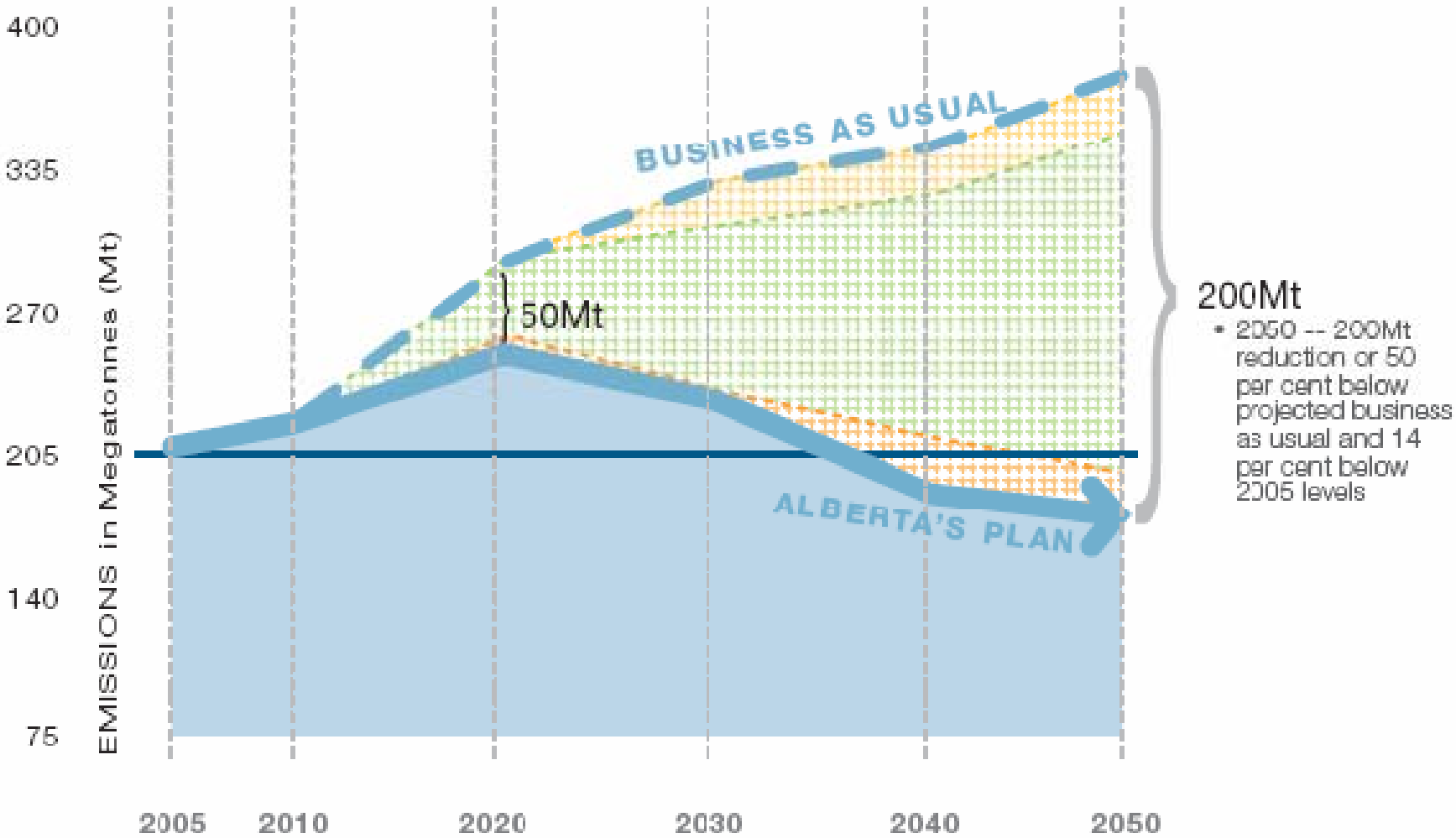
ALBERTA'S REDUCTION COMMITMENTS



CONSERVATION & ENERGY EFFICIENCY	24Mt
CARBON CAPTURE & STORAGE	139Mt
GREENING ENERGY PRODUCTION	37Mt
TOTAL =	200Mt

Alberta Government Investment

- $2 billion commitment to accelerating the development of CCS projects
- Represents one of the largest commitments to the technology in the world
- Seeking to support 3-5 projects
- Expectation is to have the projects up and running by 2015
- Annual total storage expected to be 5 million tonnes per year
- Alberta taking steps to develop regulatory framework, outline CO_2 monitoring expectations, address long-term liability

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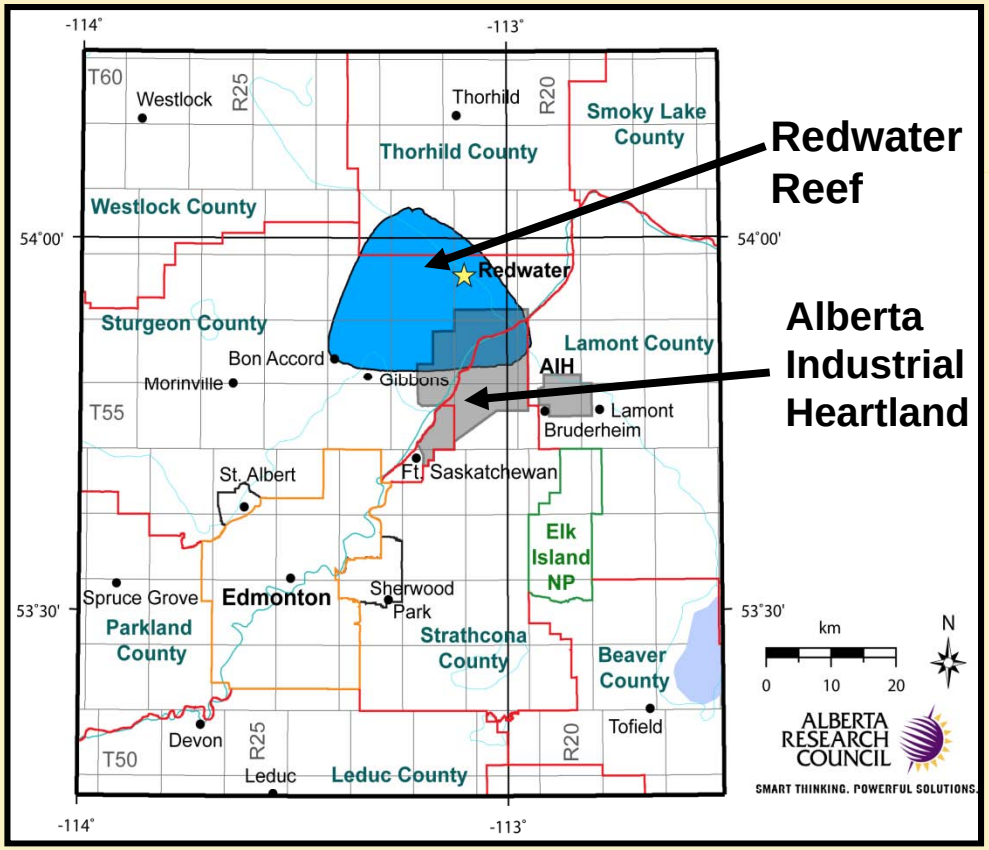
An Ideal Site for Large-scale CO_2 Storage



Heartland / Redwater

- reef directly adjacent to existing and planned oilsands upgrading facilities;
- CO_2-EOR opportunities
- Potential to store 20 years of planned oilsands-related emissions in region

Opportunities for Alaska

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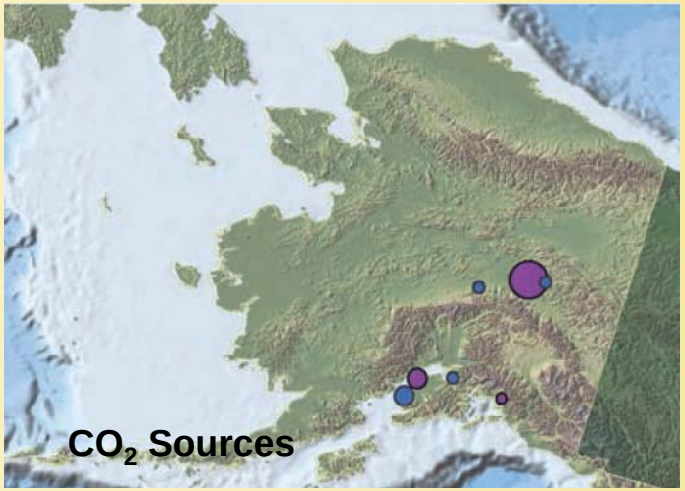
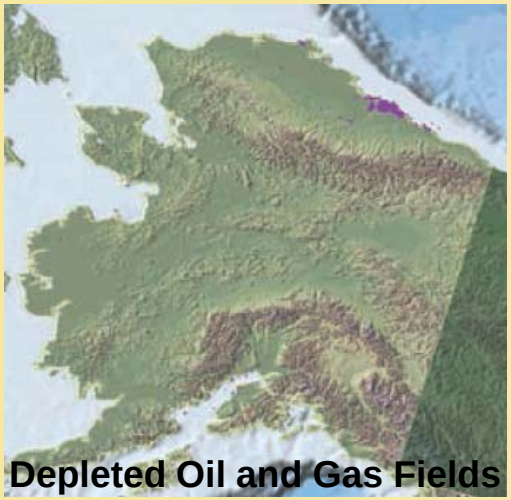
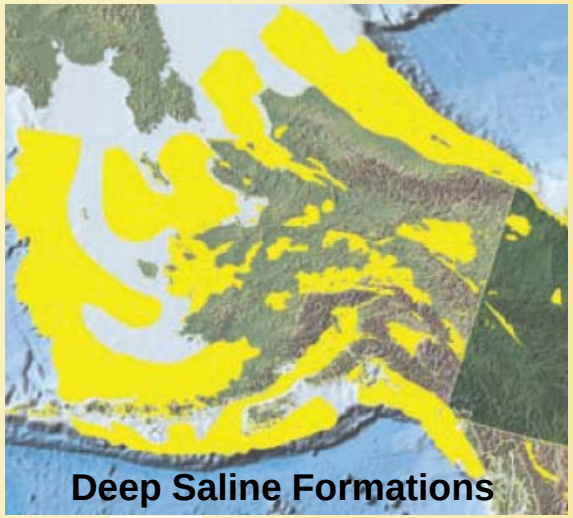
Alaska's CO_2 Sources and Sinks





In Alaska, the oil and gas fields on the North Slope are of prime interest because of the large potential for CO_2 EOR. Assessment of oil and gas fields suitable for CO_2 sequestration in Alaska and Nevada are ongoing.

Preliminary estimates of geologic CO_2 storage capacity in Alaska suggest that 84 billion metric tons of CO_2 could be stored in deep coal seams.



In Alaska, six basins contain sediments of sufficient thickness to be considered as potential sequestration targets.

Source: Carbon Sequestration Atlas of the United States and Canada, 2008

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