



The Integrated CO₂ Network: A Path Forward for Carbon Capture & Storage

May 28, 2008



Agenda

- **Introduction of IC₂O₂N**
- **Canadian Dynamic**
- **Policy Development**
- **Partnership as the path towards deployment**

ICO₂N Overview

ICO₂N

- **18 leading companies from a variety of industries**
- **Represents:**
 - >100 Mt/yr of CO₂ emissions, 15% of Canada's emissions
 - >60% of Alberta's power generation
 - ~95% of oil sands production

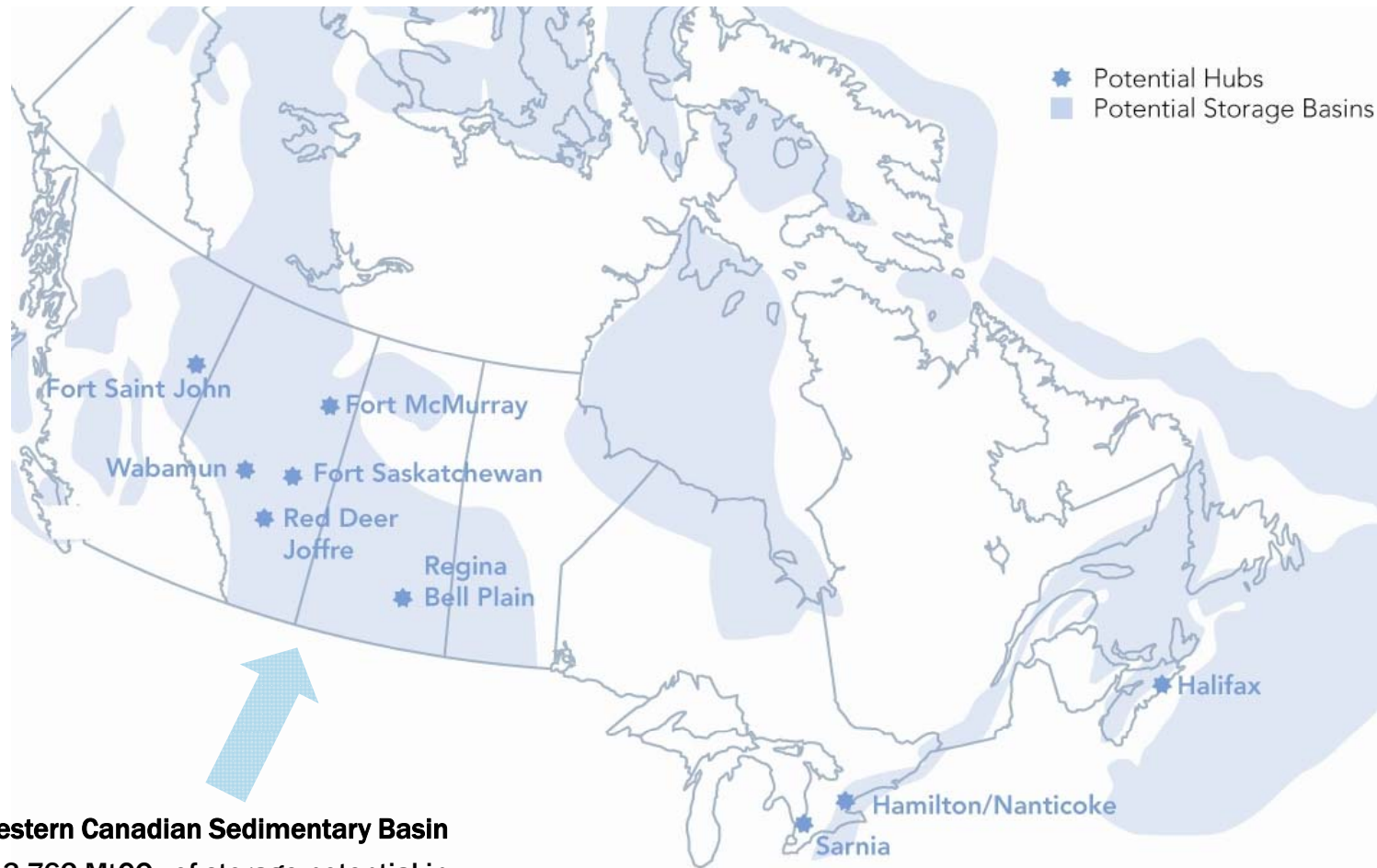


ICO₂N's Mandate

OBJECTIVE: *Work proactively with governments and stakeholders to establish policy and risk-sharing for CCS that will encourage uptake in the near term and set the stage for a functioning long-term Integrated CO₂ Network (ICO₂N) that can handle large volumes at minimal overall cost*

The Canadian Dynamic

Long-term Vision of CCS Across Canada

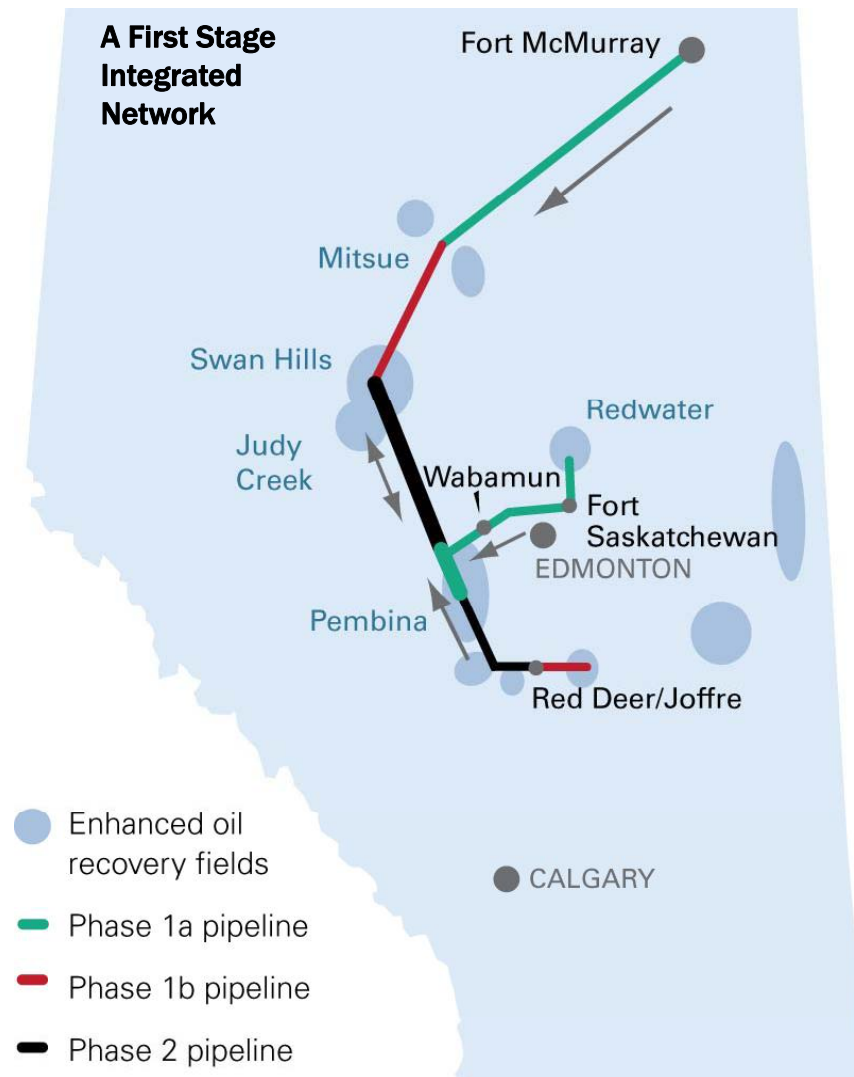


Western Canadian Sedimentary Basin

- 3,762 MtCO₂ of storage potential in oil and gas reservoirs alone

ICO₂N's Long-term Vision

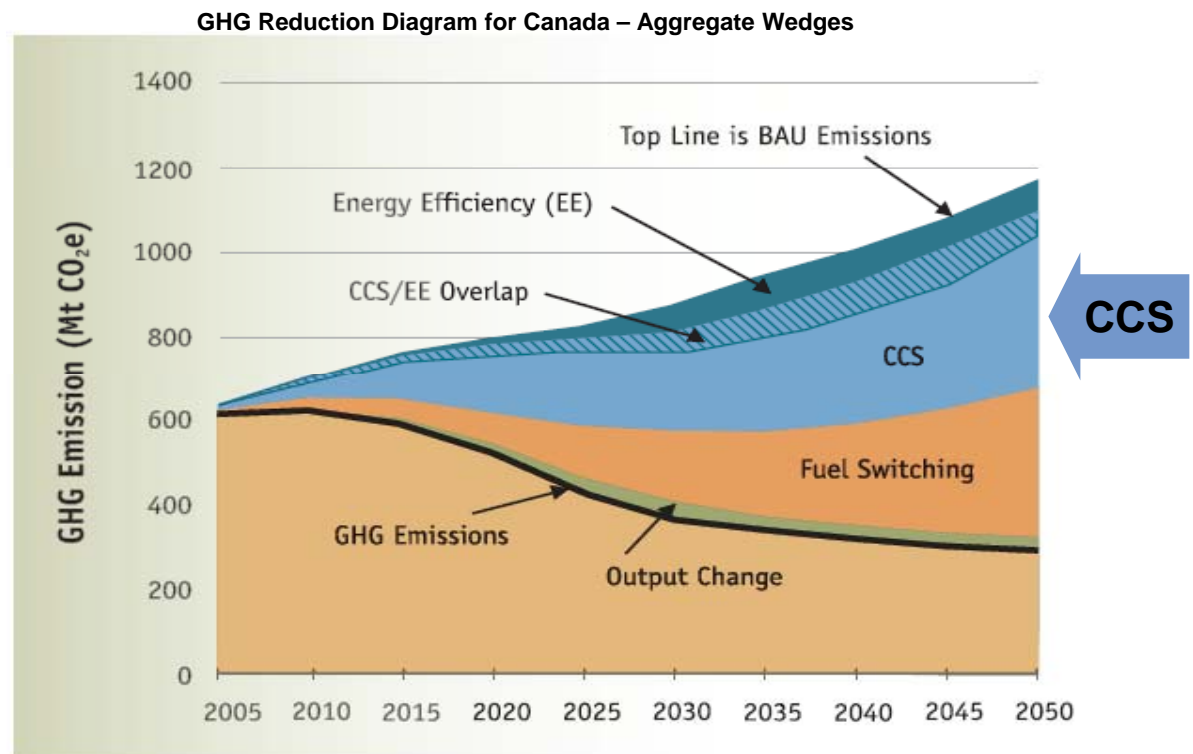
**A large-scale,
long-term vision
is essential to
realize the full
potential of CCS**



CCS is Important

A Strategic Investment for Canada

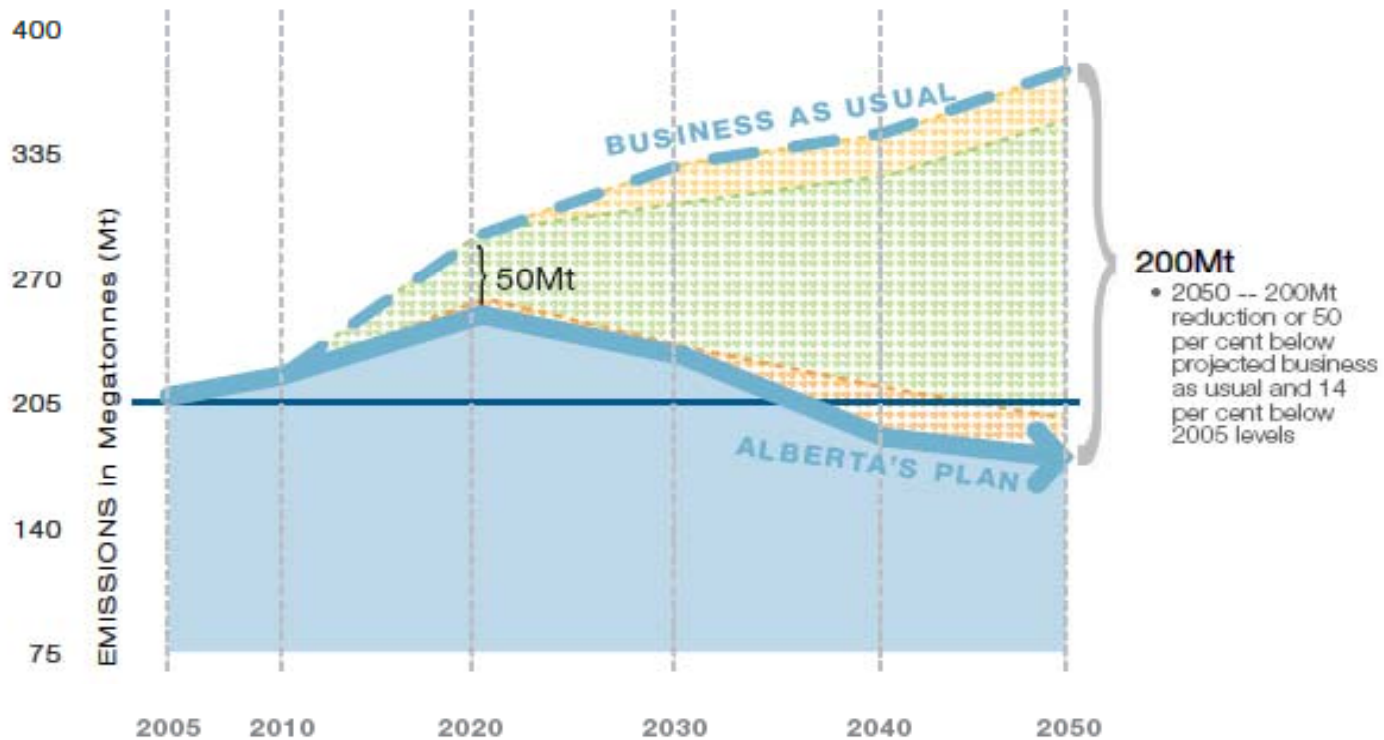
1. A critical component of Canada's GHG reduction strategy
2. A critical component of Canada's energy strategy
 - Balancing economics with GHG reduction
 - Coal & Oil
3. A 'Made in Canada' solution






Source: NRTEE 'Getting to 2050: Canada's Transition to a Low-emission Future', 2008

The Alberta government emphasis on CCS....

ALBERTA'S REDUCTION COMMITMENTS



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

2008 Alberta Climate Change Strategy

Politics

Canada is a Confederation

Canada is a federal state, however it is among the world's most decentralized federations

Jurisdictional issues are making timely adoption of a climate change policy challenging

National Climate Policy

National plan for 20% below 2006 emissions by 2020

- 330Mt from BAU projections
- 165Mt from industry with a focus on coal and oilsands

Industry targets:

1. Existing facilities (pre-2004)

- 18% intensity reduction in 2010, decreasing by 2%/yr thereafter

2. Facilities operational between 2004 & 2011

- Clean fuel (nat. gas) standard
- 3 years to set emissions baseline, then 2%/yr intensity reduction

3. Facilities operational 2012 onwards

- Clean fuel standard or CCS 'capture ready'. CCS equivalent by 2018

Canadian Provinces

Many Climate Change plans

- **Quebec**
 - Focus on hydroelectric
- **Ontario – Phase out coal**
 - Focus on Nuclear and natural gas
- **British Columbia - 33% reduction by 2020 - Net zero electricity by 2018.**
 - Carbon tax
- **Alberta – operational cap and trade system (mid-2007)**
 - Intensity targets, but less than federal

Alignment with the US

- **Western Climate Initiative:**
 - Quebec, Manitoba, British Columbia are members
 - Ontario and Saskatchewan as observers
- **RGGI – Quebec and Eastern Provinces are observers**

Policy to incent CCS Development

Canada/Alberta Task Force

- Reported to governments in January
- Goal of 5Mt by 2015
- \$2B needed to cover the gap on the first 3-5 projects (allocated through an RFP)

Federal

- \$125M RFP for large-scale CCS projects. Matching funds from industry and max government contribution of \$30M
- \$250M for SaskPower retrofit of a 100Mw coal-fired power plant
- Pre-certification credits to help cover the gap

Alberta

- Industry led 'Development Council' reporting back fall 2008
- Location of majority of future CCS activity

Current CCS Operations in Canada

Weyburn / Midale

- 2 Mt/yr CO₂ from gasifier in N. Dakota via 320km pipeline to EOR in SE Saskatchewan

SaskPower – Boundary Dam

- Retrofit 100 MW coal fired power plant with delivery to Weyburn area
- \$250M Federal and \$750M provincial funding announced

Glencoe

- Commercial project of 0.18Mt/yr - combining EOR & low cost CO₂

Proposed full scale projects

- TransAlta and EPCOR each moving ahead with CCS FEED studies
- Northwest Upgrading – gasifier to incorporate CCS (awaiting financing)
- Sherritt coal gasifier – on hold ‘because of uncertainty’

Overcoming CCS Inertia

Overcoming CCS inertia

1. Investment Risk

- Large capital expenditures up front
- Uncertain policy future
- Early adoption may not pay

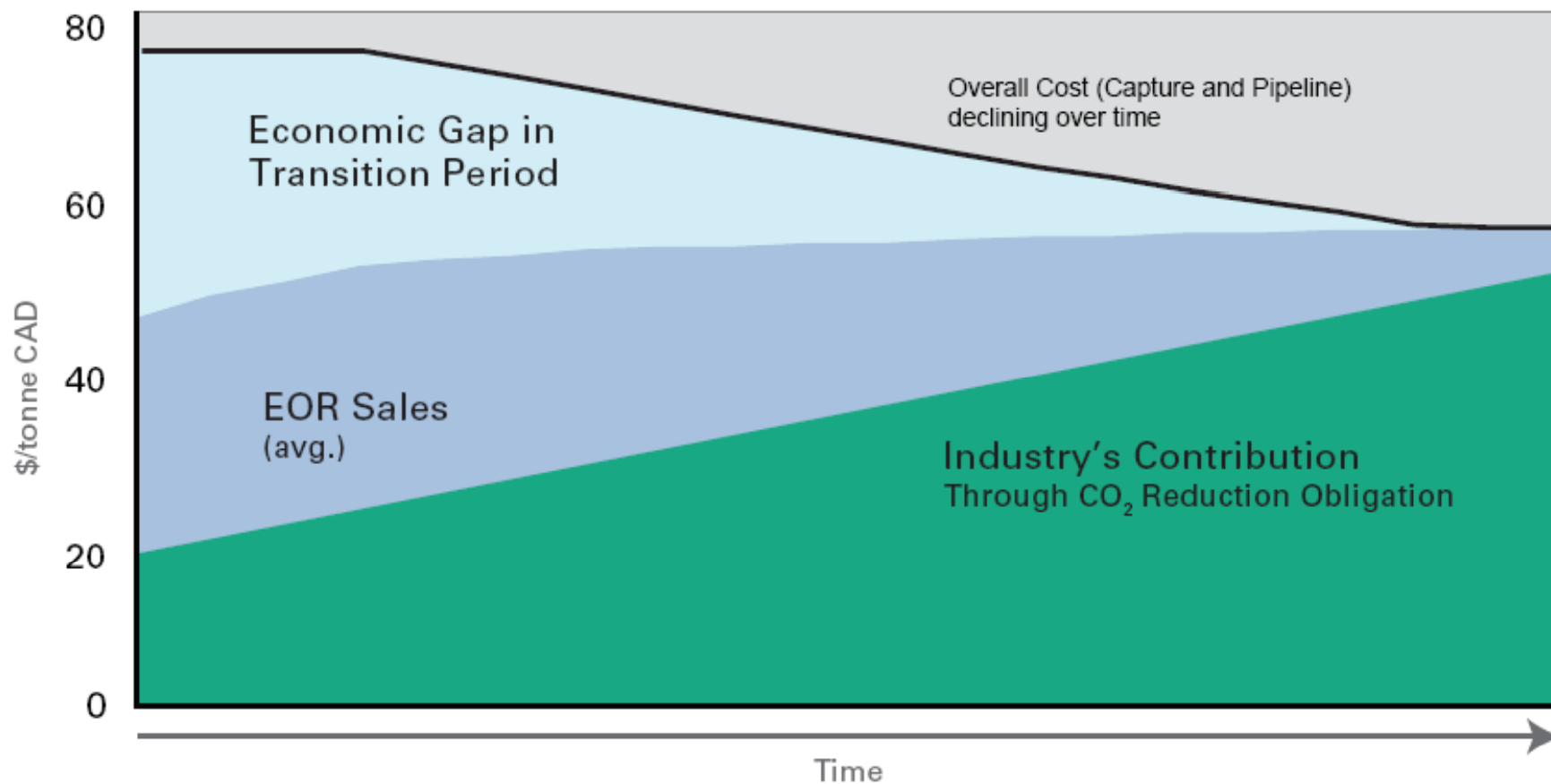
2. Technology Risk

3. Economics

- Economic gap in foreseeable future
- Questionable EOR revenue sources

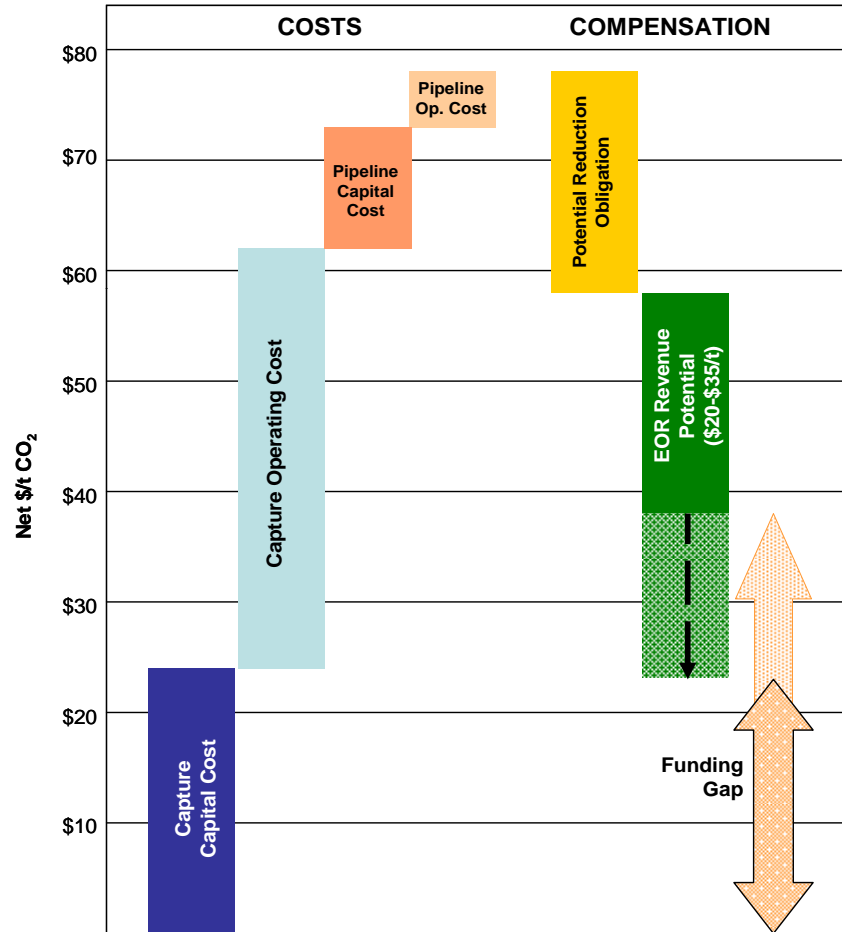
A Case for Partnership

Conceptual Portrayal of CCS Economics

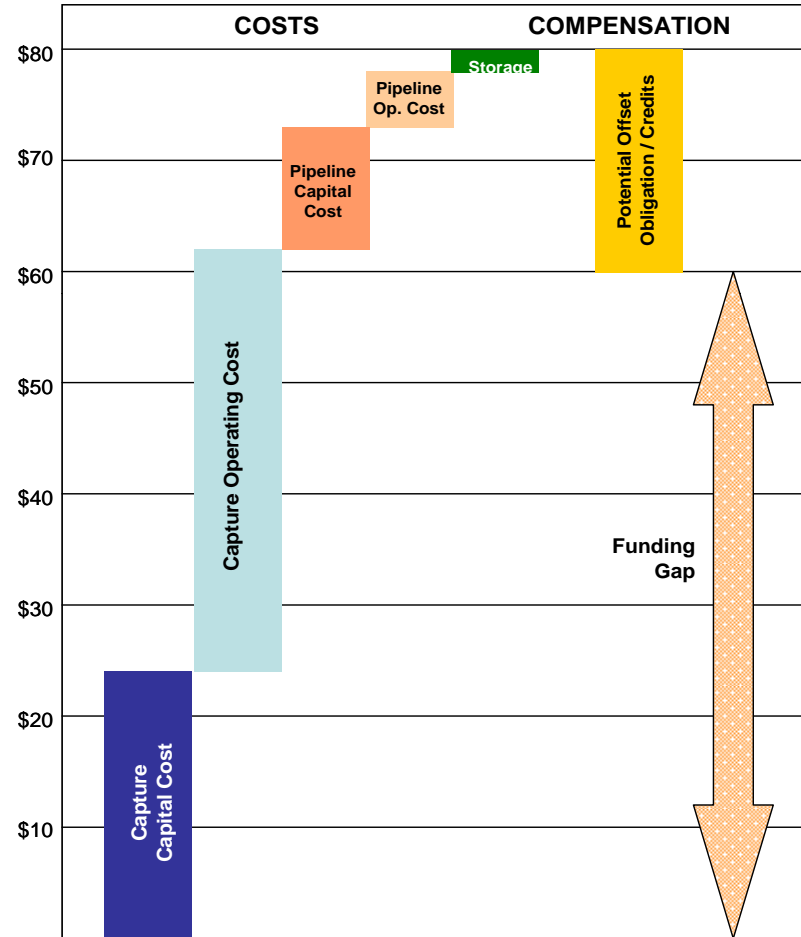


Conceptual CCS Economics

Hypothetical Economic Profile
WITH A MARKET FOR CO₂
 (VOLUMES TO ENHANCED OIL RECOVERY)



Hypothetical Economic Profile
WITHOUT A MARKET FOR CO₂



Capture Costs for Canada

CHART 1
Availability of facilities for CO₂ capture



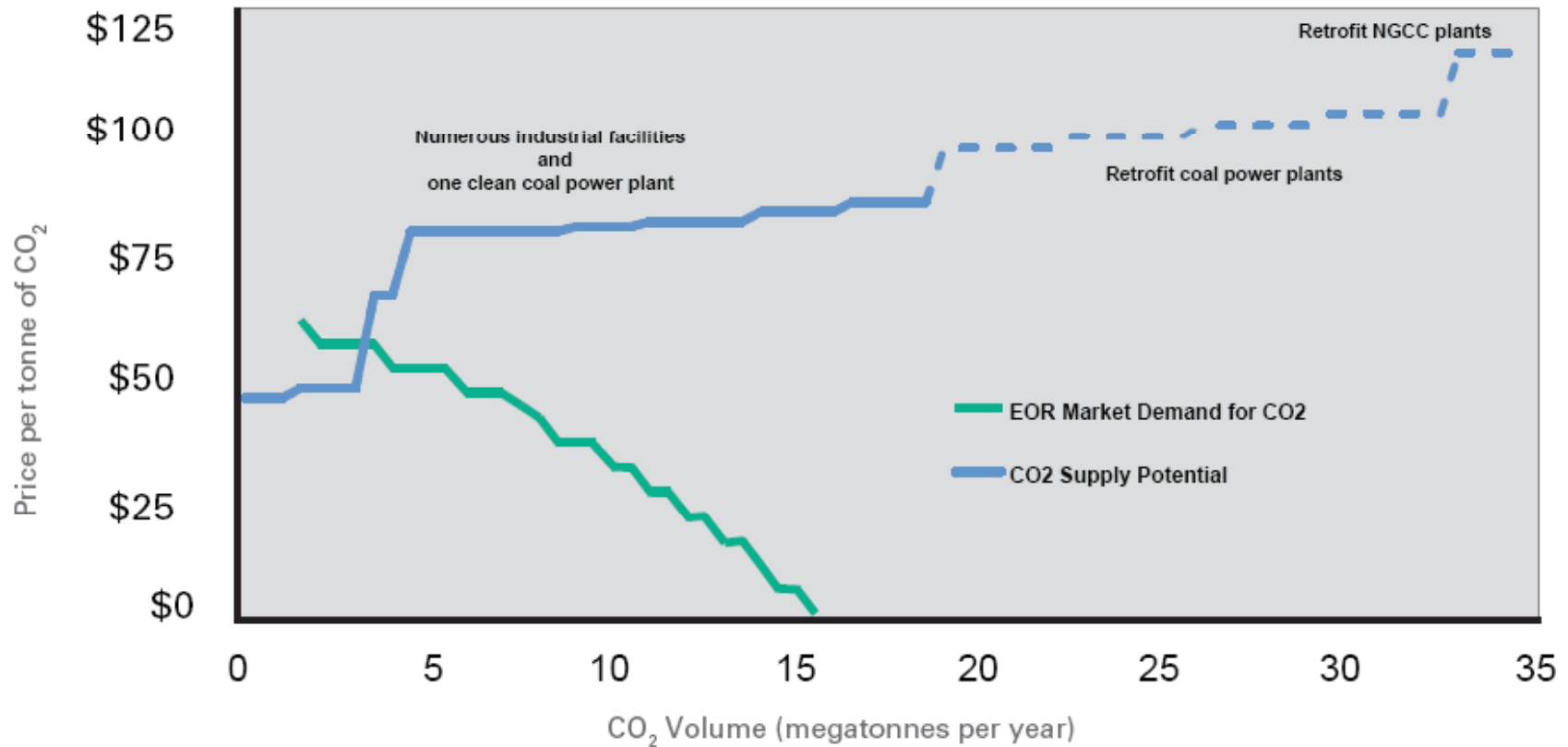
Notes: - Error bands are +50% -30%, better cost estimates will be site specific.
- Includes compression, excludes pipeline or injection/storage/monitoring costs

Balancing Supply and Demand

CHART 6

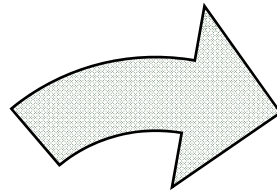
CO₂ Supply & EOR Demand Potential 2012 - 2015

(Supply cost includes capture and transport)

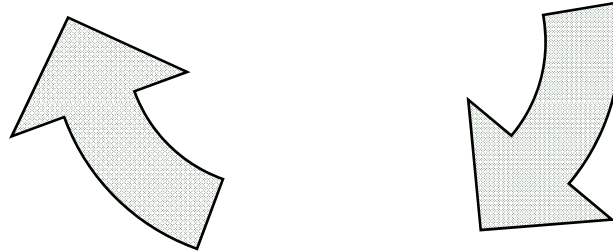


ICO₂N's Key Principles to Make CCS a Reality

GOAL: The staged development of a long-term, large-scale CCS solution that strategically addresses environmental, energy and economic growth.



APPROACH: A strong public-private partnership to drive initial deployment of an integrated approach to CCS

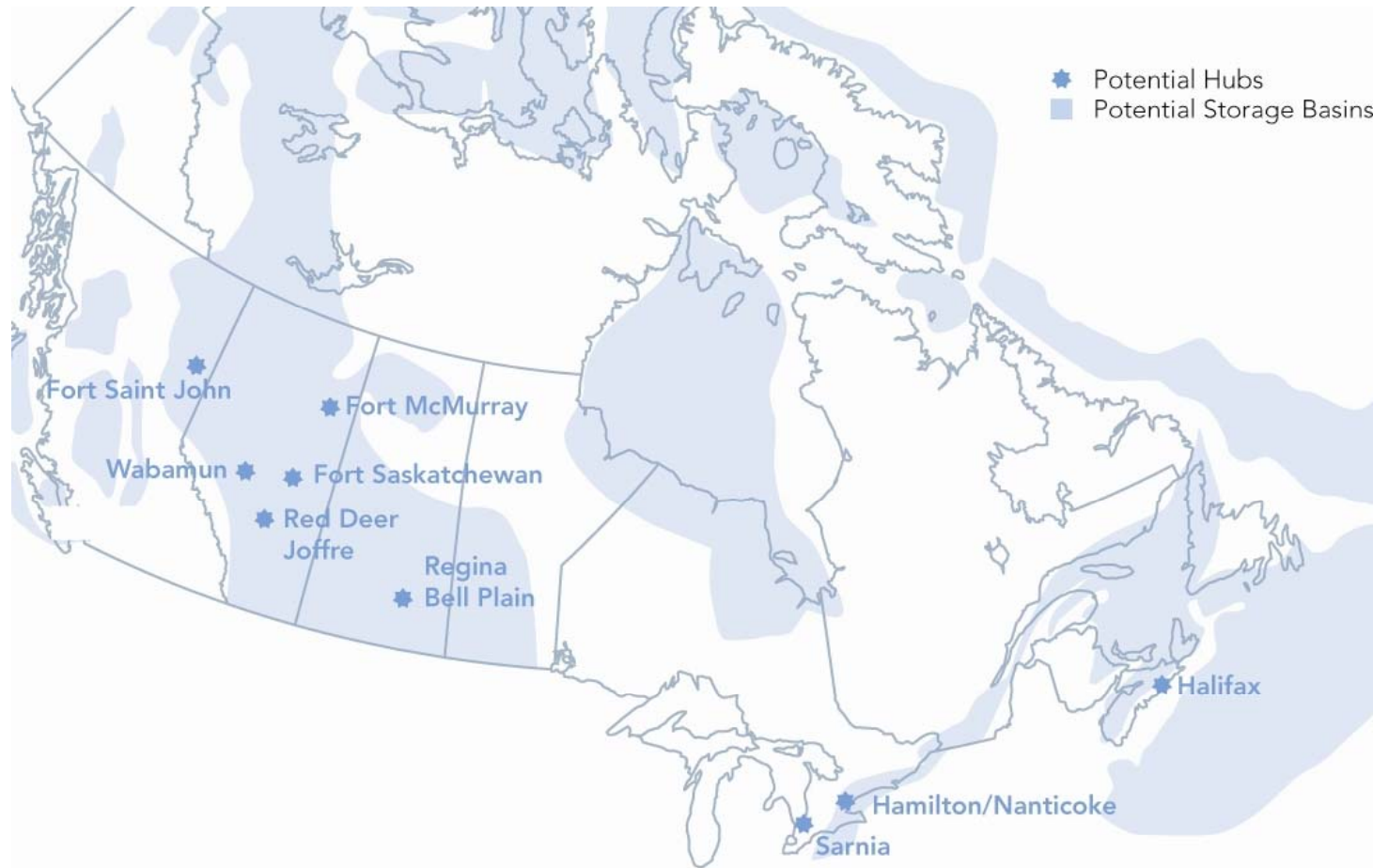


IMPLEMENTATION: Range of tools and policy innovation to encourage major investments in CCS

Moving Towards Deployment

- **Government direction on CCS has been established**
- **ICO₂N: Significant value in an integrated system.**
- **As much an oil sands issue as it is coal.**
- **Joint ventures a likely structure for initial deployment**
 - Spreads first-mover risk
 - Addresses issues of lumpy expenditures and timing
 - History of collaboration in the oil sector
- **Partnerships as the way forward**
 - Policy tools are being explored

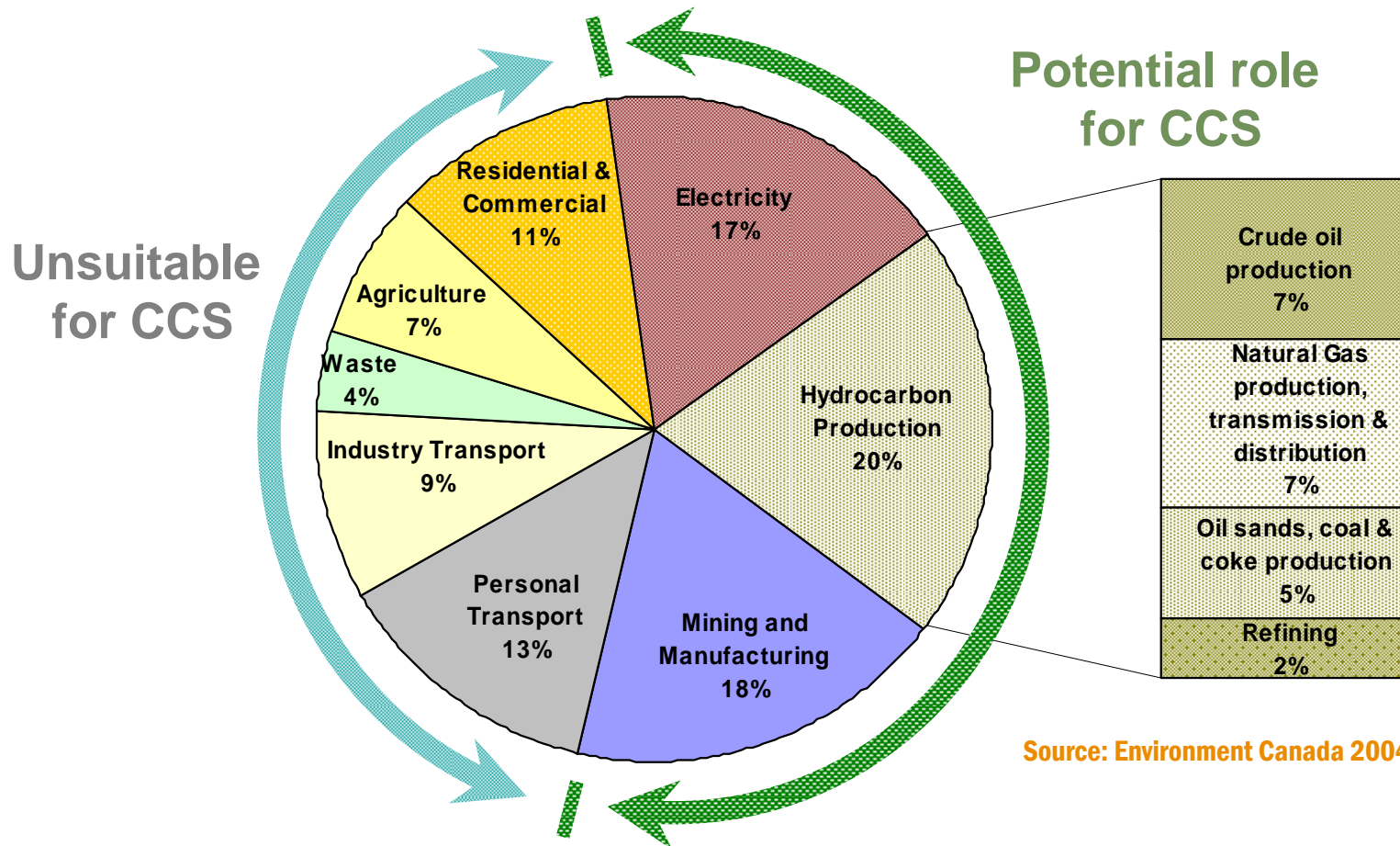
Canada: A potential leader in CCS deployment...



SUPPLEMENTARY INFORMATION

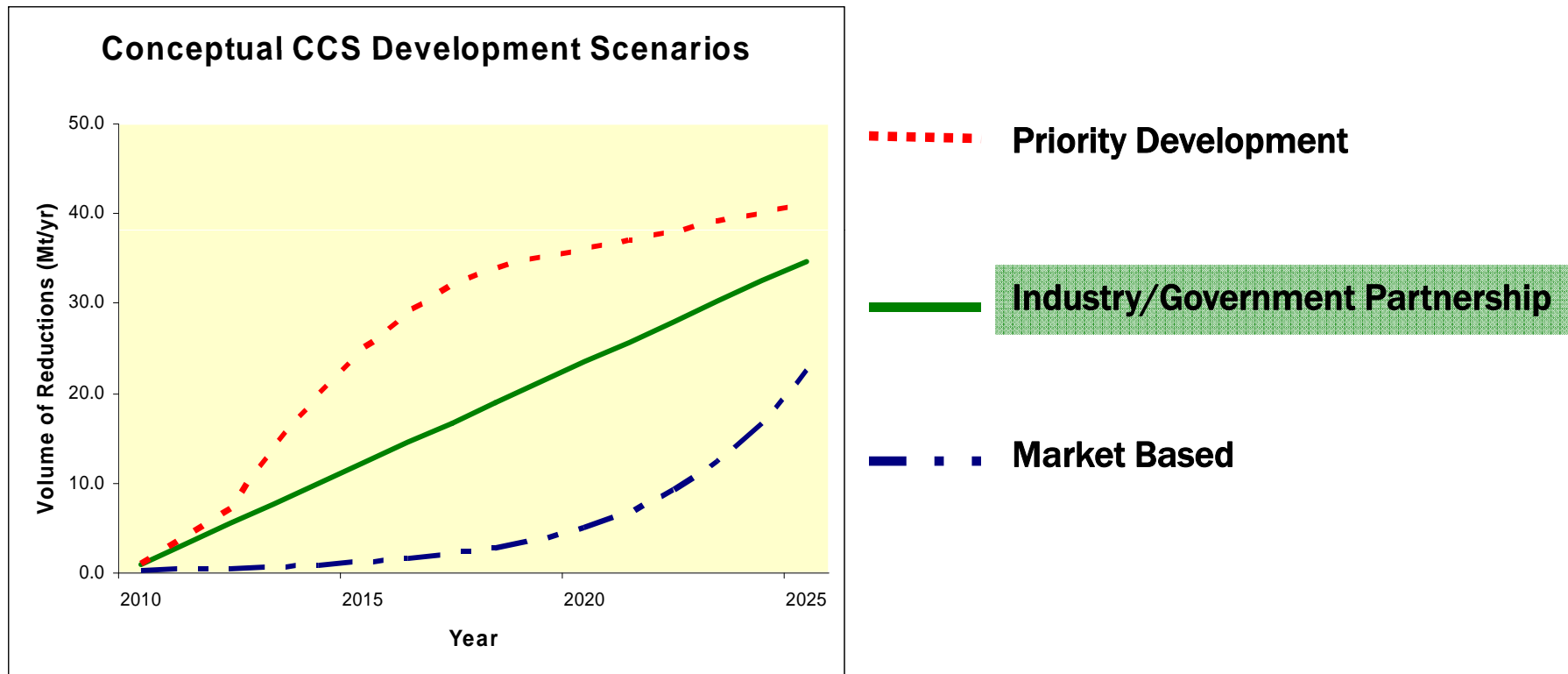
GHG Emission Sources in Canada

Only certain industries can pursue CCS



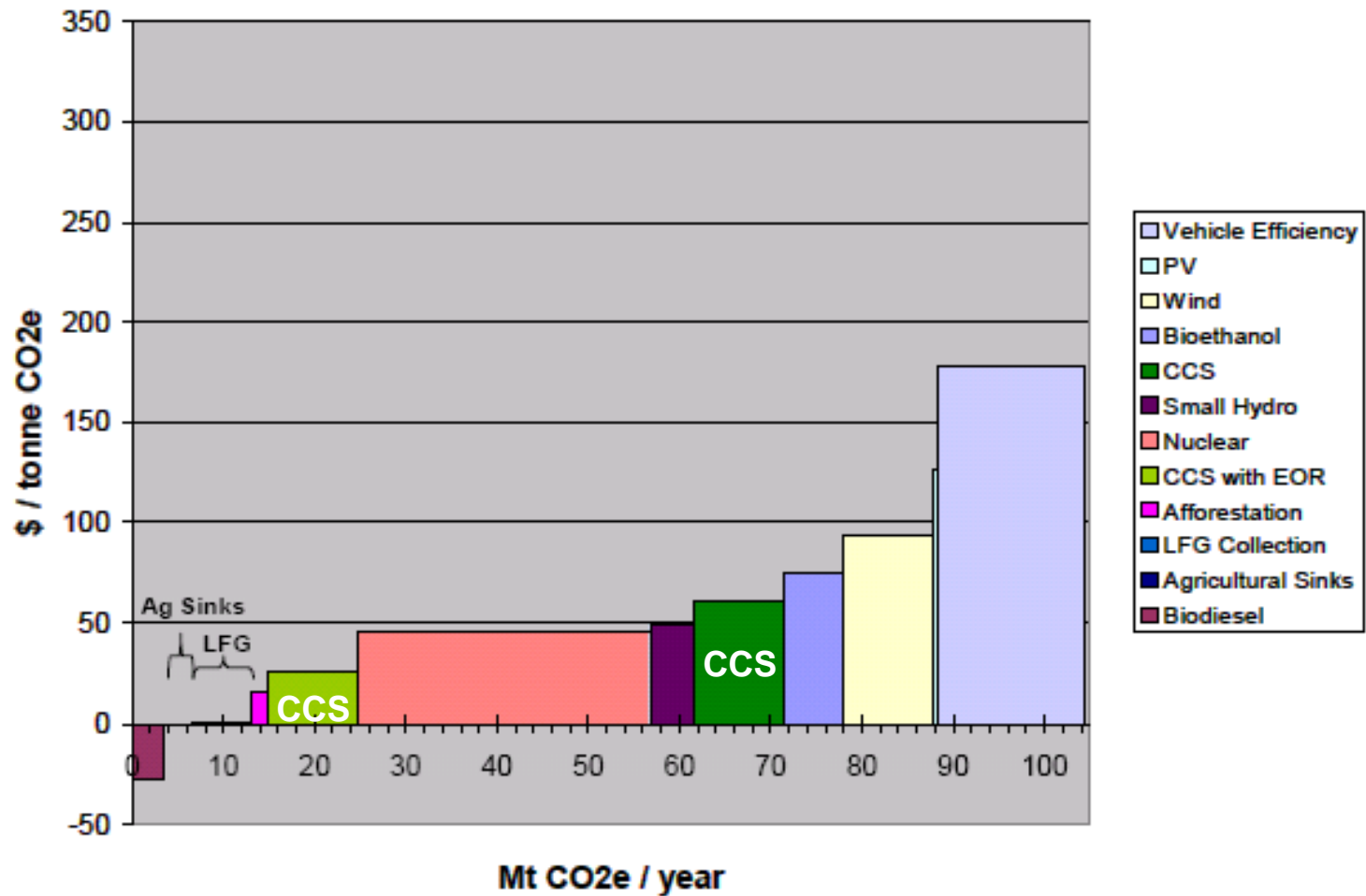
Source: Environment Canada 2004 CO₂ Emissions Inventory

Vision of CCS Deployment: Industry / Government Partnership



Choice of path affects ability to meet national emissions reductions and could protect energy sector growth.

CCS is cost and volume competitive



Delphi Report 2008

CCS – Nascent Market Development

	<u>Mature Markets</u>	<u>Nascent Markets</u>
Price disclosure	Open	Limited
Number of buyers and sellers	Many	Few of both
Transaction Costs	Usually low	Usually high
Supply/Demand Balance	Close	Can be widely divergent
Monopoly supply or demand	Infrequent	Typically an actual or effective monopoly
Market Growth rate	Low	High, and volatile
Technology	Mature, low rate of change	New, competing alternatives

**CCS has characteristics of an immature market.
Government involvement can advance adoption.**

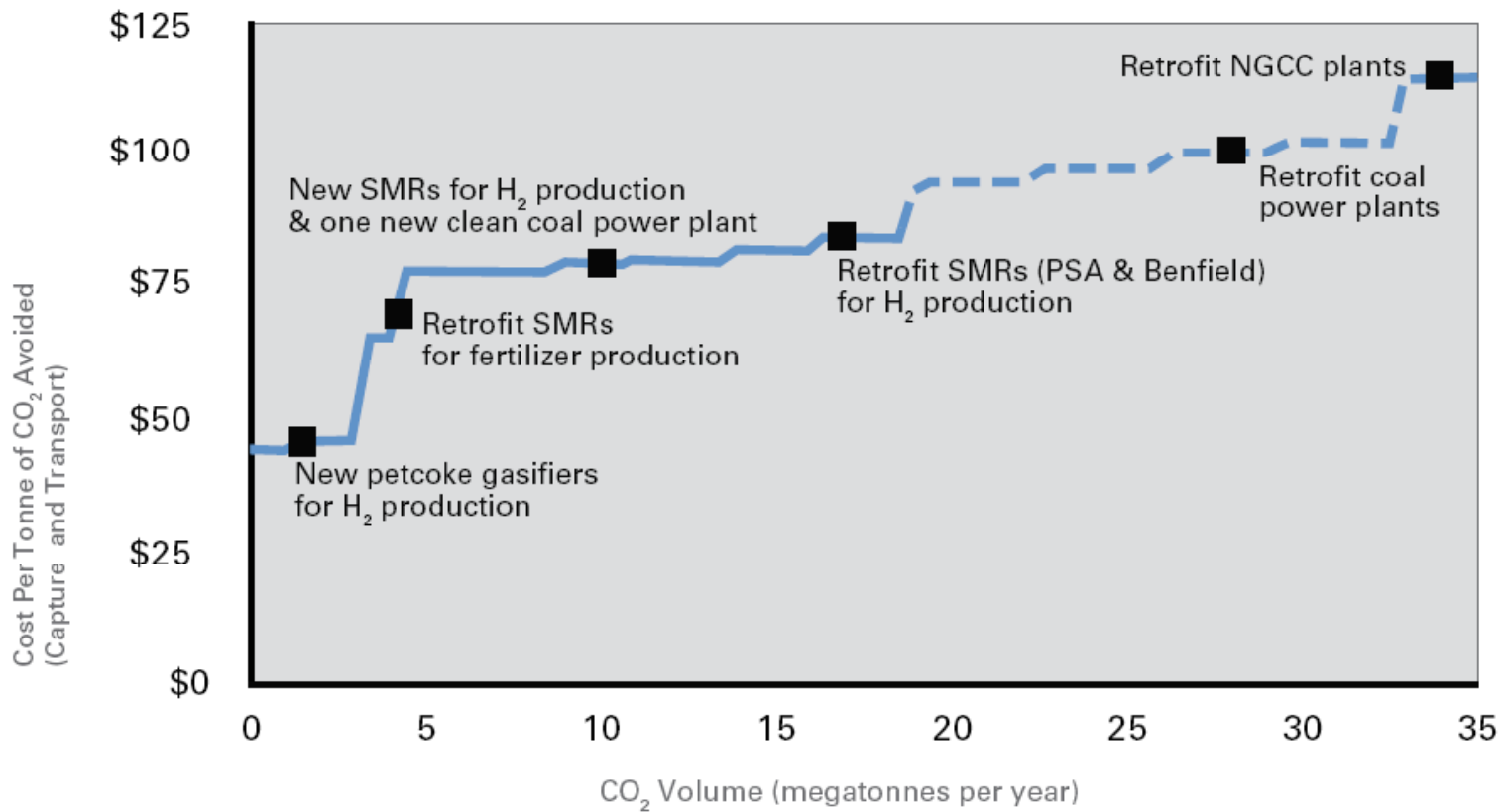
Technology & Economics

Capture Volumes

CHART 2

CO₂ Supply Potential 2012 to 2015

cost includes capture and transport



Issue of Oversupply

CHART 4
Conceptual Phasing of CCS

