Climate Change Central

# Carbon Capture and Storage:

# The Need for a Longer-Term Collective Approach to Implementation

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# Table of Contents

# Introduction

There is broad agreement amongst key stakeholders – governments and industry – that Carbon Capture and Storage (CCS) is a critical component of Canada's long-term challenge of significantly reducing greenhouse gas (GHG) emissions. This has been highlighted in numerous Canadian and international studies over the past few years.

CCS is not without challenges however. Three of the key challenges that are often highlighted are:

- the costs of implementing a CCS system
- the need for carbon dioxide ($CO_2$) capture technology breakthroughs
- a clearly defined longer-term regulatory environment.

There are other collective challenges (and collective solutions) that are not as widely discussed. These relate to:

- delineating the relative importance of CCS to other GHG reduction approaches including energy efficiency, renewable energy sources, nuclear energy, east-west transmission line initiatives, and vehicle fuel efficiency standards;
- developing innovative public/private partnership approaches to managing the financing, development, and operation of CCS systems;
- improving the understanding of CCS by the public and key stakeholder groups.

It is these "other" challenges that are the focus of this report. There may be lessons to learn from the implementation of previous technologies and transformative infrastructure projects. Some of these examples from history could help guide Canada's path as we move forward with CCS in the next few years.

A collective effort of industry, governments, and other key stakeholders will be needed to implement CCS over the long term and to provide a significant contribution to reducing GHG emissions in Canada.

# What is Carbon Capture and Storage?

Carbon capture and storage is a process that involves three critical steps to significantly reduce the amount of carbon dioxide that is released into the atmosphere. The steps are:

- **Capturing the carbon dioxide**

In this initial step the carbon dioxide gas is separated from other gas emissions at industrial plants (chemical, oil sands, and coal-fired power generation) using a variety of different separation technologies. A significant number of these industrial facilities in Alberta are in the Fort McMurray, Fort Saskatchewan, Red Deer and Lake Wabamun areas.

The separation processes are expensive and require additional energy and compression (and emissions) to effectively isolate the carbon dioxide from the other gases. There is significant R&D underway worldwide to develop more efficient separation technologies.

- **Transporting the carbon dioxide**

The carbon dioxide is then compressed and transported by buried pipelines to the underground storage fields. Over 5800 km of $CO_2$ pipelines are in operation in the U.S. today.[1] CCS pipelines would operate in a similar fashion to the multitude of gas pipelines in Alberta today.

- **Storing the carbon dioxide underground**

The carbon dioxide would be further compressed and injected into a variety of reservoirs for storage over a period of hundreds of years. The carbon dioxide could be used in some reservoirs to drive out additional oil. This process is called enhanced oil recovery (EOR). In Alberta, there are EOR fields and gas reservoirs scattered across the province, of which the largest are in the Pembina, Swan Hills and Redwater areas. These fields would provide safe storage for carbon dioxide.

Over time as these initial reservoirs fill, the majority of the $CO_2$ in the CCS system would be stored in deep saline formations, salt caverns, or coal beds that cannot be mined.

[1] U.S. Department of Transportation

# Time is of the Essence - The Window of Opportunity

The window of opportunity to move forward on CCS is now. It is driven by a number of factors that influence Canada's and Alberta's long-term environmental and economic performance – our long-term sustainability. These factors include:

- projected capital expenditures in energy production facilities in the next decade;
- the timing of systems implementation and emission reductions;
- emerging low carbon fuel standards in North America;
- a growing global market for clean coal and CCS technologies.

## • Planned Alberta oil sands production facilities in the next decade

The immensity of Canada's oil resources, its planned development, and its emissions impact are borne out in a number of statistics:

- Canada's estimated oil reserves are 179 billion barrels (second largest in the world after Saudi Arabia), approximately 174 billion barrels lie in the oil sands.[2]
- By 2015, oil sands production is expected to almost triple to about 3.0 million barrels per day with capital expenditures of over $80 billion over this period.[3]
- By 2015, oil sands greenhouse gas emissions will more than double despite significant improvements in the energy efficiency of production processes.[4]

The global need for oil continues to rise as the economies of China and India grow exponentially. The importance of the oil sands to North America's and the world's energy needs is demonstrated in the number of foreign-owned companies that have taken significant positions in Alberta's oil sands. Over a dozen countries now have equity positions in the oil sands and analysts have predicted that foreign ownership of the oil sands may be as high as 60 per cent by 2015.[5]

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[2] U.S. Energy Information Administration
[3] National Energy Board
[4] Bramley, Pembina Institute
[5] Patterson, Council of Canadians

With large capital expenditures planned in the next decade, it is imperative to start work on a comprehensive CCS system as soon as possible (complete with the necessary policy elements). This is important to avoid "carbon lock-in" in the design and construction of these new facilities that can take four to five years from planning to full operation. Retrofits can be very costly and the estimated life of these facilities is in excess of 40 years in many cases.

"For new plants, now is the time for the right policy to be established."[6]

The planned investment schedule drives the need to implement CCS as soon as possible.

- **The timing of CCS-driven emission reductions**

Implementing a CCS system that can capture significant amounts of GHGs will take time. Each oil sands and power generation facility requires unique process innovations to optimize the separation and capture of $CO_2$. The pipelining and disposal of the $CO_2$ requires that contracts be put in place for EOR facilities and that the liabilities related to cavern storage be resolved. The number of capture facilities fully implemented is dependent as well upon the effective cost of $CO_2$ capture and the cost-sharing arrangement arrived at between industry and governments. CCS long-term policies need to be finalized in consultation with industry.

The complexities of these technology, economic, and policy choices highlight the need to move quickly on CCS.

In addition, Canada needs to bring about deep GHG emission reductions as soon as possible and CCS is a key contributor in meeting the government's long-term emission targets.

Alberta's 2008 Climate Change Strategy notes that 70 per cent of emission reductions in Alberta by 2050 will come from CCS.

"Ultimately, $CO_2$ capture and storage technologies provide the province with the greatest potential to substantially reduce greenhouse gas emissions while, at the same time, retaining our ability to produce and provide energy to the rest of the world."[7]

[6] ICO2N Report
[7] Alberta 2008 Strategy

- **Emerging North American energy environmental standards**

Canada is part of an integrated North American energy market and is fast becoming part of an integrated North American GHG policy and regulatory environment. The U.S. is forging ahead with GHG emission reduction bills in Congress and a number of U.S. states are developing their own GHG legislation. Of particular concern to the oil sands is the Low Carbon Fuel Standard (LCFS) proposed by California and now the subject of discussions in 12 states in the U.S. This standard proposes that a maximum carbon intensity of gasoline in California be defined and that the standard be traceable back to the originating oil production facilities. It has the potential to create an added price differential on the carbon-intensive production from Alberta's oil sands. Whether the standard is implementable or not will be the subject of intense legal debate.

President Bush has recently signed a bill into law that specifies that all U.S. government fuel purchases (military, vehicle, etc.) need to meet a "clean fuel" standard. The U.S. government is the largest customer in North America for transportation fuel products.

Notwithstanding the uncertainty, it is prudent for Canada to start work on any processes to reduce the carbon intensity of the oil sands – CCS being one of the key emission reduction processes available.

"Canada's oil sands will face large-market risk unless the Canadian government, or the Alberta government, take this challenge seriously," said Hal Harvey of the California-based William and Flora Hewlett Foundation, which helped develop a low-emission fuel standard in California.

- **A growing global market for CCS**

CCS systems are in various stages of development in all parts of the world. There are over 100 CCS projects that range from conceptual design through testing to actual operations. The sticking point to most of these facilities has been costs and appropriate policies to mitigate the liabilities related to these projects. Canada has developed significant expertise in specific parts of a CCS design over the years but, even with broad agreement that CCS is needed, has not committed to the development of CCS on a larger, long-term basis. Canada's opportunity to reduce emissions domestically with CCS is coupled with a large global market opportunity to provide technology and expertise in CCS.

There is a burgeoning market developing for clean coal and CCS technologies in the rapidly expanding economies of China and India. Expertise developed at home in Canada will be exportable worldwide in much the same way that Canada's and Alberta's oil and gas development skills are at work in all parts of the world.

Canada was a leader in CCS technology and development in the late 1990's. Canada needs to reclaim its leadership role and contribute to one of the most promising global emission reduction approaches.

There are many reasons for Canada to move forward with implementing CCS on a broad scale. What is the relative importance of CCS versus other emission reduction approaches and what are the challenges to implementing CCS?

# The Relative Strategic Importance of CCS to Canada

The relative importance of CCS versus other approaches that might be taken to reduce emissions has been a point of discussion in Canada. The challenge in attempting to rank the various emission reduction technologies and processes involved is the large number of parameters that govern these choices. Some of the factors include:

- the cost per tonne of emission reductions achieved
- the absolute emission reductions achieved
- the complexity of policy requirements to deal with multiple- versus single-point emission sources
- the relative technology and financial risk of specific processes
- the timing of potential emission reductions.

These factors demonstrate the need for a broad portfolio of available options to reduce GHGs both in the short and long term.

- **The importance of CCS**

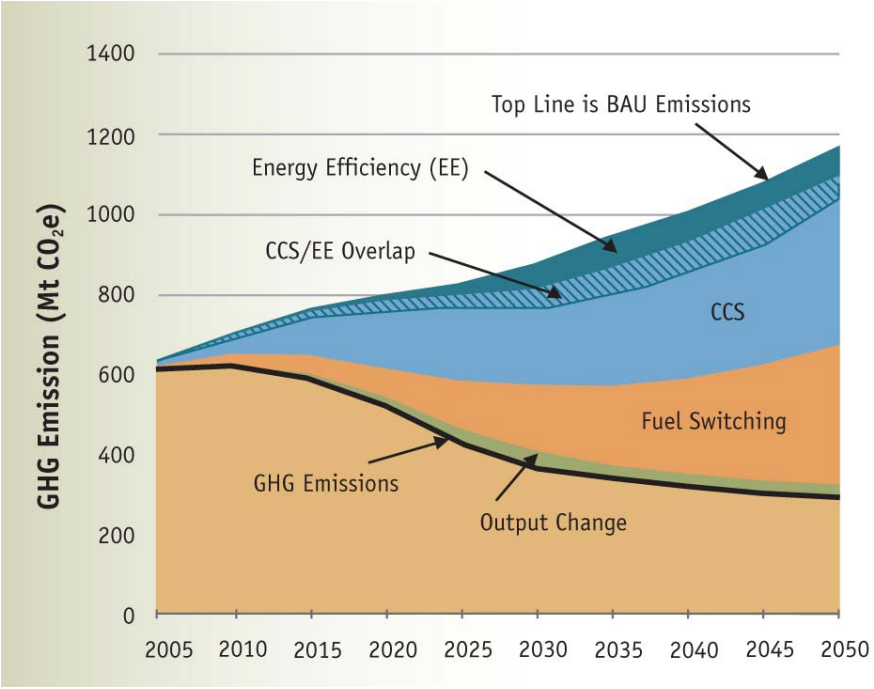
CCS is viewed as a key strategic initiative for Canada and Alberta in significantly reducing its greenhouse gas emissions. Recent reports by the National Round Table on the Economy and the Environment, $ICO_2N$, the Fraser Institute, the Pembina Institute, and the Canada West Foundation have referenced CCS as a key emission reduction opportunity.

"CCS will provide a significant part of an integrated and sustainable energy strategy by focusing Canadian technology and investment in Canada. It will play a major role in reducing the environmental footprint of the oil sands, electric power generation, and

industrial chemicals industries."[7]

"…a well-funded research and development initiative on carbon capture and sequestration could well lead to truly global contributions along with the attraction of expertise and employment to Canada."[8]

The following graph from a 2008 National Round Table report illustrates the relative importance of CCS to Canada's and Alberta's initiatives to reducing greenhouse gas emissions.[9]




NRTEE Note: CCS represents the carbon capture and storage wedge. CCS/EE represents the carbon capture and storage (CCS) and energy efficiency (EE) overlap. The fuel switching wedge represents the contribution of switching from coal to oil products to natural gas to electricity; this portion also includes the contribution of renewables (wind, hydroelectricity, etc.) and nuclear power. The output wedge represents the GHG reductions due to lower physical output.

CCS represents the largest single-point source contribution with the other wedges requiring contributions from many distributed actions across Canadian society. The complexities of implementing CCS on a large scale are counter-balanced with large-scale implementation of energy efficiency and fuel switching across many sectors of the

[7] ICO2N Report
[8] Gibbins, Canada West Foundation
[9] National Round Table on the Economy and the Environment Report

Canadian economy.

- **The relative importance of CCS to other emission reduction options**

Concern has been expressed that a strong financial, policy, and technology focus on CCS will deflect attention, financial support and intellectual capital from other approaches to reducing GHGs in Canada. It is clear that Canada needs to move on all emission reduction opportunities with a sense of urgency if we, as a nation, are going to significantly reduce our carbon footprint.

"The Pembina Institute considers CCS to be one available option among others for achieving the needed deep reductions in Canada's greenhouse gas emissions."[10]

The Delphi Group was recently commissioned by $ICO_2N$ (an alliance of 19 companies promoting a long-term integrated $CO_2$ system) to report on the potential supply, timing, and cost of GHG emission reductions from a variety of GHG emission reduction alternatives in the Canadian context out to the year 2020.[11]

For the report, the following GHG emission reduction alternatives were considered:

- Biofuels (bioethanol and biodiesel)
- Wind Power
- Photovoltaic (PV) Power
- Small Hydro Power
- Nuclear Power
- Landfill Gas Collection
- Vehicle Fuel Efficiency Improvements
- Agricultural Sinks (no-till farming)
- Afforestation
- Carbon Capture and Storage / Enhanced Oil Recovery

Energy efficiency was not directly included due to the difficulty in defining the relative supply, cost, and timing.

Some of the conclusions from this report include:

"Nuclear power, carbon capture and storage (with and without enhanced oil recovery), and vehicle fuel efficiency improvements (in that order) present the most significant opportunities for emission reductions (in terms of total volume) out to 2020 of the GHG emission reduction alternatives considered in this report."

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[10] Griffiths, Pembina Institute
[11] Delphi Report

"Of the major emission reduction alternatives identified (on a supply basis), CCS/EOR appears on average to offer the lowest cost per tonne of emission reduction."

Another major infrastructure project that has the potential to reduce GHG emissions is an east–west transmission line (part of a national fuel switching or substitution program that would see hydro power displace coal-fired power generation in Central Canada). This project has received significant press coverage over the last few years. The project is not without its challenges as well. Energy Probe has questioned the cost, reliability, and power loss issues related to this project.[12] There are also significant time constraints to settling any right-of-way land purchases needed for this project.

On a broader global basis, as oil prices increase and pollution and climate change issues escalate, the investment market for 'cleantech' technologies and processes is increasing rapidly. The definition of clean energy technologies covers a wide range of technologies and processes from remedial clean-up to end of pipe to clean substitutes (biofuels) to efficiency processes and products to pollution prevention to industrial ecology.

Worldwide capital investment in renewable energy and energy efficiency industries topped $85 billion in 2007, an increase of 200 per cent in three years.[13] For the first time "cleantech" became the leading venture investment category in the United States in 2007 surpassing IT and Biotechnology. Investor momentum in clean technologies reached an all–time high as venture capitalists in North America and Europe invested a record $4 billion in 2007.[14]

This increased interest by investors and Third World countries may bring about technology breakthroughs over the next decade that may challenge hydrocarbon-based energy products. The challenge will be the development of a viable alternative to transportation fuels. This will take time and requires a significant re-design of the global energy distribution networks.

It is clear that none of the GHG emission reduction options for Canada come without challenges. CCS represents one opportunity to bring about large emission reductions from a limited number of point sources. It is one of a number of initiatives (including improved energy efficiency, fuel switching to lower carbon or no carbon fuels, renewables, and vehicle fuel efficiency standards), that are needed to significantly reduce greenhouse gas emissions in Canada.

A portfolio of greenhouse gas emission reduction options needs to be developed and, certainly, CCS has the potential to be a prime contributor to this portfolio.

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[12] Energy Probe
[13] UNEP
[14] Cleantech Group LLC

# Key Challenges to the Implementation of CCS

Some of the key challenges related to the implementation of CCS include:

- the economics of CCS
- the technology challenges of $CO_2$ separation
- the need for a longer-term policy environment.

These challenges have been well documented in a number of recent reports.

The economics of CCS would suggest that it will cost $50 to $80/tonne to successfully sequester large quantities of $CO_2$.[15] This cost may be mitigated by the sale of $CO_2$ to EOR projects but this will provide a limited $CO_2$ market. The balance of the $CO_2$ will have to go to direct reservoir or cavern storage with no financial return on the $CO_2$.

Removing $CO_2$ from the atmosphere represents a societal cost. A collective solution to the economics of CCS is needed.

"Just for pure sequestration, the value is derived from not having $CO_2$ in the atmosphere. That doesn't pay revenue, it's more of an avoided societal cost. The question is who's going to pay for that societal cost."[16]

The cost of $CO_2$ capture represents 70 to 80 per cent of the cost of a CCS system.[17] This is a major investment for any industrial facility and points to the need for significant technology development involving all key stakeholders to lower the separation costs.

"Given our resource base, the development of world-class expertise in the gasification of carbon-based fuels, including biomass, is a high-priority opportunity for Canada. If coupled with $CO_2$ capture and storage, these technologies will also significantly reduce the environmental footprint of fossil fuel industries."[18]

A longer term well-defined policy environment is needed given the capital costs involved in implementing CCS. A comprehensive CCS network in Alberta to capture and sequester significant GHG emissions would involve billions of dollars in investment. Policies related to any fiscal incentives, pipeline access, and storage liabilities need to be developed with involvement by all key stakeholders.

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[15] ICO2N Report
[16] Szmurlo, Enbridge
[17] ICO2N Report
[18] National Advisory Panel on Sustainable Energy Science & Technology

To solve the economic, technology, and policy challenges and deal with the urgency to implement CCS, there is a need to develop a collective approach to the financing, technology development, and policy framework with governments, industry, and other key stakeholders actively involved.

# Collective Solutions to CCS[19]

- **An innovative governance approach is needed**

Given the large infrastructure capital expenditures needed and the supply/demand complexities of implementing a CCS system, a partnership between industry and governments needs to be created to share both the costs and the associated risks.

The partnership might be defined as:

*A cooperative venture between the public and private sectors to actively manage and accelerate the development of the capture, transportation, EOR, and direct storage components of a CCS system while maximizing economic and environmental efficiencies through effective policy development and delineation of risk and investment commitments by key stakeholders.*

The partnership might provide leadership in response to a number of the challenges previously discussed:

- The long-term, and transformational, investment needed to effectively implement a CCS system.
- The common delivery and storage elements of a CCS system.
- The need for participation by multiple levels of government and industry.
- The need for a clear policy framework and regulation for CCS.
- The need for risk sharing in the early implementation of CCS technologies and the development of markets.
- The overall "public good" nature of this significant $CO_2$ reduction opportunity.
- The lack of public understanding of CCS and the ultimate need for well-managed stakeholder input as capture and pipeline facilities are proposed.

[19] Section based, in part, upon a preliminary working paper prepared for AERI

Some of the advantages include:

- Providing a focal point for all important partners and stakeholders in CCS to debate, formulate, and manage CCS development.

- Providing an arms-length vehicle for governments to manage and monitor CCS development while appropriately managing direct government involvement and risk.

- Developing a short, medium, and long term plan for the staged development of CCS to maximize both economic and environmental efficiencies.

- Providing a bridge to international CCS technology and policy developments.

- Providing the potential for an investment vehicle to effectively manage the funding of CCS and emission reduction costs fairly across the key stakeholders.

The Alberta 2008 Climate Change Strategy has defined a Development Council to work on some of the aspects noted above. It has been defined as having a specific time-limited mandate (nine months). Amongst the tasks assigned to the Development Council are:

- Ensure new large scale industrial facilities are designed and built to enable the capture of $CO_2$.

- Ensure existing large-scale facilities have plans in place to be capture-ready.

- Meet the emission reduction milestones through the development of specific CCS plans.

- Develop a policy approach and secure the necessary financial resources to build the $CO_2$ infrastructure.

- Examine a suite of tools and incentives to maintain Alberta leadership in implementing CCS.

- Support research and demonstration projects on CCS.

- Report to the government by the fall of 2008 with a recommended plan to move forward.

This interim governance step may need to be extended into a more formal permanent structure if the complexities of CCS are going to be promptly addressed and the momentum of CCS implementation is to be maintained.

It is foreseeable that an equity partnership of the key stakeholders – governments and industry – may be needed over the long term to effectively manage the financing, transportation, ownership, and storage of $CO_2$.

- **Are there precedents for a common governance approach to transformational infrastructure development?**

  - **From an oil and gas/energy perspective**

The collaborative development of oil and gas fields through the use of "unitization" legislation dates back to the development of the Turner Valley fields and originated in the U.S. (Texas, Oklahoma) oil and gas fields. The concepts of common operators, common carriers, and common processors are well known in Canadian oil and gas production and defined within the Alberta Oil and Gas Conservation Act. Some of the objectives of that Act include:

- to effect the conservation of, and to prevent the waste of, the oil and gas resources of Alberta;
- to provide for the economic, orderly and efficient development in the public interest of the oil and gas resources of Alberta;
- to afford each owner the opportunity of obtaining the owner's share of the production of oil or gas from any pool;
- to control pollution above, at or below the surface in the drilling of wells and in operations for the production of oil and gas and in other operations over which the Board has jurisdiction.

There are also some analogies to the CCS challenge with the coordinated effort in the 1990s of building sour gas plants that would serve a series of producers on a regional basis rather than risk a landscape dotted in a multitude of smaller gas processing facilities. In this case, the government felt it necessary to coordinate plant developments with industry to minimize the environmental impact on the province.

  - **From a large transformational infrastructure perspective**

There are many examples of government and industry cooperating in support of developing large-scale, economically-challenging infrastructure in support of industry transformations or development of common goods, services, and products. A few

examples include:

- Syncrude and its development of the oil sands
- The Alberta Gas Trunkline system
- The Alberta Petroleum Marketing Commission

The amount of formalized structuring of these cooperative efforts varied depending on the issues and partners involved. Syncrude was a joint venture between industry and a number of levels of government. Alberta Gas Trunk Line was defined by an Act of the Government of Alberta and funded by the province and industry players but also required cooperation with the federal government (TransCanada) to establish an end market for the natural gas. The Alberta Petroleum Marketing Commission was defined by an Act of the Government of Alberta but also required coordination with the federal government on tax issues and with industry on the development of natural production and markets.

A few lessons from these examples (but true for many other examples of government/industry cooperation) include:

- Formal collaboration between governments and industry was essential to bring about the level of industry change required. This collaboration started before the governance entity was constituted and was necessary to get all parties working with the same mental models of how the system/process might work. It was vital to get this negotiation of roles started early in the development of a new entity.
- All of these entities provided a transition role and structure to launch the business or market and then were privatized/ phased out over time as the market matured. (There still is an Alberta Petroleum Marketing Commission within the Alberta Department of Energy but all its marketing functions now fall within the private sector).
- The path to the formation of these entities was not always smooth. It involved significant engagement of governments and industry and negotiations over several months.
- All required legislation and tax changes.

It is also worth noting that $CO_2$ is at the front end of its development as a true commodity much the same as natural gas was in the 1960s and 1970s. The commoditization of $CO_2$ requires government and industry support and collaboration at the front end similar to the development of natural gas markets. (Even if $CO_2$ never becomes a true commodity, regulations on compliance could eventually make CCS "commercial" as companies react to tightening emission restrictions in much the same way that a market price developed for SOx and NOx emissions. This required close cooperation between governments and industry to grow the SOx/NOx markets).

- **From a technology risk management perspective**

There are a number of international partnerships involving both governments and industry that are working on $CO_2$ capture and storage from the perspective of technology development and research: $CO_2$ Capture Project (multinationals, EU, U.S., and Norway), FutureGen (industry and U.S.), seven separate regional partnerships in the U.S. – one example - Southwest Regional on Carbon Sequestration (industry, NGOs, universities, governments).

This collaborative funding and development approach to tackling a common interest challenge within industry has been successfully proven in other sectors. Semiconductor Manufacturing Technology (SEMATECH) is a 20-year-old collaborative effort by the worldwide semiconductor industry to address the common technology challenges that they have faced. The Pipeline Research Council International is a 60-year collaborative effort of the worldwide pipeline industry to address common technology, safety, and environmental challenges that they have faced.

The issue of CCS and, in particular, the issue of carbon capture involves significant investment in attempting to reduce the waste stream ($CO_2$) by-product from important energy producing facilities. The waste stream is of limited commercial value and, as a result, represents a significant cost (either in investment or de-rated production output) to these facilities.

A common approach to dealing with this type of challenge in support of climate change "public good" seems appropriate and timely.

## • A significant communication and public engagement program is needed

In addition to the development of a governance structure for CSS, there is a need to increase the level of understanding by all stakeholders and the public of the opportunities and challenges of CCS. Climate Change Central (C3) recently held a Carbon Capture and Storage Communications Workshop. One of the themes that came out of that work was that:

"Once formed, opinions can be slow to change."[20] This is an important consideration given the level of activity and recent press coverage of CCS in Alberta and Canada.

With the release of the Alberta 2008 Climate Change Strategy, CCS has been thrust into prominence in the public's eye. The opportunity to educate the public about the benefits

[20] Carbon Capture and Storage Communication Workshops

of CCS is timely and prescient.

Recent polls by Cambridge Strategies Inc. and The Strategic Counsel of the public's perception of the oil sands reveal promising views of the positive economic development that the oil sands has provided.

"Some 87 per cent of Albertans believe that the oil sands are an important part of Alberta's prosperity …."[21]

"As you know, one of the main factors creating economic growth in the province has been the oil sands projects. In thinking about the development of the oil sands, do you feel that, overall, this has been a good thing or a bad thing for Alberta?"[22]

The response to this question was 79 per cent of Canadians and 83 per cent of Albertans felt that oil sands development was a good thing.

These positive feelings about the oil sands are tempered with a significant response from the public to the need to "green" the oil sands and mitigate the environmental effects of the oil sands as soon as possible.

"Albertans are clear in what they aspire to in terms of oil sands development. They know it is very important to their future prosperity and they are very clear in that they want a green lens to trump any economic or growth dynamics."[23]

"Has oil sands development had a positive effect on the quality of the environment?"[24] In response to this question 55 per cent of Canadians and 61 per cent of Albertans felt that the oil sands development has had a negative effect.

CCS is at an inflection point given its recent publicity and there is a strong need to increase the level of understanding of the technology and the trust level of all stakeholders.

As an example of how CCS can quickly be perceived as a negative technological solution is illustrated by recent European experiences. The EU announced, in early 2008, a major program to accelerate CCS implementation. The following responses, correct or otherwise, were picked up and published by the press:

"Ultimately, CCS still promotes a fossil-fuel economy," says Rebecca Harms, the vice-chair of the Greens/European Free Alliance group in the European Parliament, who, along with Greenpeace, are strongly opposed to the use of any state funds to support CCS at the expense of the promotion of renewable energy and energy efficiency. "We can't be giving public money to oil and coal companies to help them use more oil and coal."

"…….. it is a classic 'end-of-pipe' solution that involves storing the waste rather than eliminating it," says Sonja Meister, Friends of the Earth Europe's climate and energy

[21] Cambridge Strategies Inc. Report
[22] The Strategic Counsel Report
[23] Cambridge Strategies Inc. Report
[24] The Strategic Counsel Report

campaigner."[25]

These comments relate to some of the points noted in this report and in the Climate Change Central Communications Workshop Report. There is a need in communicating about CCS to emphasize:

- CCS can be a significant contributor to reducing GHGs.
- CCS is only one of a portfolio of approaches to reducing emissions including energy efficiency, fuel switching to low or no carbon fuels, and vehicle fuel efficiency standards.
- Oil and coal production will continue for some decades to come and there is a need to mitigate emissions from this production – CCS offers one solution to doing that.
- The issues of the relative risk of CCS technologies need to be addressed.
- The need for stringent regulation and monitoring should be addressed.
- The issue of public funding of a societal cost in concert with industry funding needs to be addressed.

To address these concerns, a credible alliance of key stakeholders is needed if the public is to be assured that CCS is a viable option to deal with one of the oil sands most significant environmental challenges.

# The Path Forward

Are the governance and communication challenges of CCS as important as the economic and policy issues? Innovative governance and communication approaches may play key facilitating roles in resolving a number of the key CCS challenges:

- Getting the key CCS stakeholders and issues at the table and in the public domain.
- Developing an appropriate cost and risk sharing arrangement between governments and industry to accelerate CCS development.

[25] EUObserver.com

- Delineating the amount of funding that should be directed at a portfolio of emission reduction options.
- Defining the relative risk and liability of the key CCS stakeholders.
- Developing a robust development program to focus on carbon gasification and separation technologies.
- Increasing the public's understanding and confidence in CCS's contributions in reducing greenhouse gas emissions.

To make progress in addressing these issues requires a strong governance model similar to the ones that have helped Canada in the past to move significant, transformational projects forward. An alliance or public-private partnership of governments and industry supported by institutions and not-for-profit organizations is needed to ensure the costs, risks, and social impacts of CCS are understood and supported.

In the end, CCS has many economic, technological, and public policy challenges but there are also significant human interaction and communication challenges.

Robert Froesch, former head of the NASA space program, once noted that "Technology transfer and introduction is first and foremost a human process engaged in by consenting adults."[26]

[26] Robert Froesch

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