



The Vision: To realize Canada's largest single greenhouse gas mitigation opportunity. ICO₂N will be a framework for an efficient, environmentally sensitive system of CO₂ capture, transport and long-term storage. It will also explore opportunities for using captured CO₂ to enhance hydrocarbon recovery.

What is ICO₂N?

ICO₂N stands for Integrated CO₂ Network and is a proposed system for the capture, transport and storage of carbon dioxide (CO₂). ICO₂N members represent a group of industry participants that want to demonstrate climate change leadership by providing a framework for carbon capture and storage development in Canada. Once constructed, the system will move CO₂ from multiple sources to storage sites. The system will be available for use by all parties who are interested in capturing or using CO₂. It will include the appropriate regulatory and policy framework to allow investment by the public and private sectors.

What is carbon capture and storage?

Carbon capture and storage (CCS) involves capturing CO₂ from large industrial sources, before it can be emitted to the atmosphere, and storing it in deep geological formations. In some cases, the CO₂ can be injected into formations in mature oil fields where it can be used to enhance hydrocarbon recovery.

Why pursue carbon capture and storage?

CCS provides a significant opportunity to safely and responsibly manage large volumes of CO₂. ICO₂N's proposed CCS project is intended to demonstrate Canadian leadership on climate change through tangible CO₂ reductions.

CCS can form a significant part of an integrated and sustainable energy strategy by focusing on technology and investment in Canada. It could play a major role in reducing the environmental footprint of both the oil sands industry and electrical generation plants powered by fossil fuels.

Across Canada, CCS promises to add economic value. In addition to providing a revenue source to offset the costs of capture, the development of an Enhanced Oil Recovery (EOR) industry could have many economic benefits. These

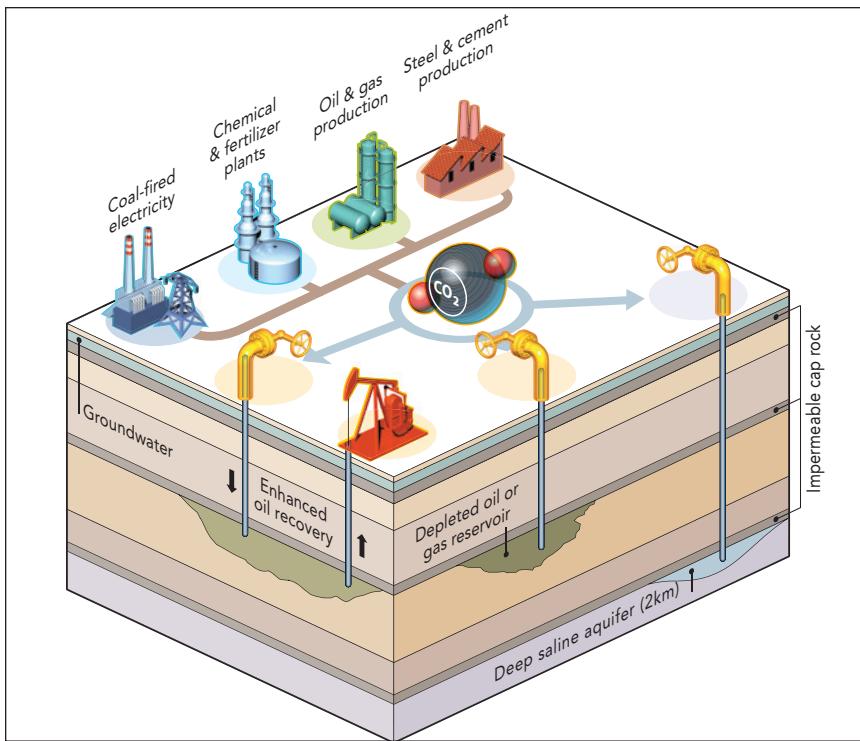
include job creation across Canada and potentially increased revenues for both provincial and federal governments.

Canada can and should be a world leader on carbon capture and storage. ICO₂N can help facilitate the deployment of this technology and promote a timely and efficient implementation of the necessary infrastructure.

Where can carbon capture and storage occur and when can it happen?

CCS has potential for development across Canada. In particular, the area covered by British Columbia, Alberta and Saskatchewan has the right combination of high-volume CO₂ emission facilities located in close proximity to abundant geological storage sites with potential for EOR. The ICO₂N project would tap into these opportunities as a natural first step in creating a CCS network that would eventually extend across Canada.

CCS can be achieved at large industrial facilities at a significantly lower per-tonne cost than any similar attempts to capture CO₂ from primary combustion sources such as automobiles and furnaces. A clear government commitment to CCS would positively impact investment decisions and speed up the implementation of this technology.



CO₂ capture and storage has potential across multiple industries. Various end use applications can provide economic benefits and safe storage.

- The strategy should be aimed at designing a large system that could be constructed in phases. This would result in large-scale emission reductions, help maximize and accelerate EOR market development and allow for economies of scale to reduce costs.
- With such a strategy, significant CCS is achievable and there is potential for it to mitigate the release millions of tonnes of CO₂ per year.
- A large-scale CCS system that meets climate change objectives is not economical on its own.
- Partnership between industry, the Alberta government and the federal government is essential to moving the ICO₂N proposal forward. If left to market forces alone:
 - Emission reductions will be very small and will not occur in the short term.
 - The EOR market will be slow to develop and will not reach full potential.
 - CCS infrastructure will be fragmented and difficult to support in economic terms.

Carbon dioxide capture in Alberta

A significant amount of CO₂ could be captured from Alberta supply sources (most likely in Fort McMurray, Fort Saskatchewan and Red Deer).

However, the costs to generate this benefit are significant. Preliminary estimates indicate these costs are greater than the potential offsetting revenue stream from CO₂ sales to the EOR market and the anticipated value of CO₂ offset credits. Companies making CCS investments face significant capital cost exposure. Industry is prepared to step up and contribute to the significant up-front costs, but it can't be expected to bear the burden alone. As a result, there is an important role for government to play. Policy certainty is needed to mitigate risks and encourage investment.

While gasification has great potential for making CO₂ capture more economical at industrial and coal-fired electricity plants, new plants are not expected to come online until after 2011.

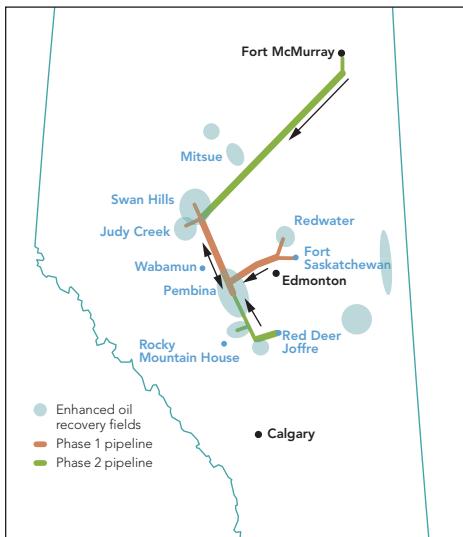
Making ICO₂N a reality

Two key public policy elements underpinning the ICO₂N concept are reduction of CO₂ emissions and development of potential EOR markets.

Accomplishing these two goals requires large scale infrastructure that links CO₂ supply and demand sources and promotes economies of scale. The proposed ICO₂N system requires substantial long-term investments in CO₂ capture, treatment, compression, pipeline infrastructure and injection facilities. The system also requires the development of an EOR market to purchase CO₂.

The ICO₂N group has completed an extensive technical and economic study of how that system could be configured in Western Canada. Some key conclusions:

- The interests of the project must be aligned with federal and provincial environmental policies and regulations currently being developed.



Pipeline transportation in Alberta

CO₂ suppliers, end-use markets and storage locations would be connected by a high pressure, large diameter, long distance pipeline system. The pipeline likely would consist of a large main line (manifold) connecting the Swan Hills/Pembina/Red Deer market and storage locations. CO₂ supply lines from Fort McMurray, Fort Saskatchewan and Red Deer would then be connected to this line. The main line would run by the Wabamun coal facilities, enabling tie-in when clean coal technology is operational. The pipeline build-up would likely take a phased approach with the first phase incorporating work underway on other individual CCS projects:

- Phase 1: Manifold between

Swan Hills and Pembina, segment from Fort Saskatchewan to the Manifold

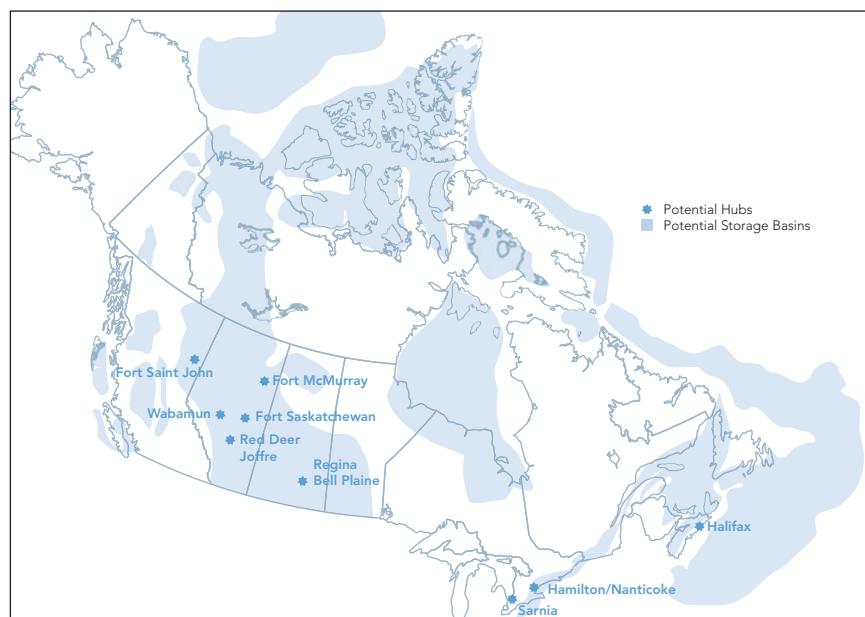
- Phase 2: segment from Fort McMurray to Swan Hills plus various other segments
- Phase 2+: Additional segments including segment from Red Deer

It will be necessary to design sizing and phasing to optimally balance risk, economics and market opportunities. Funding and tolling methodologies are needed to encourage early users of the infrastructure. The pipeline is expected to operate below design capability in the early years while additional capture facilities and EOR markets are being built. Because this low utilization will lead to high unit costs, a defined tolling approach is important.

End use in Alberta

A CO₂-based EOR market in Alberta is in the early stages of development. This market is expected to expand as producer confidence increases, as technology advances and as additional conventional oil fields decline and become candidates for CO₂-based EOR. This market will require a stable and large volume of CO₂. This could result in approximately 1.2 billion barrels of incremental oil production, with higher or lower CO₂ prices inversely affecting production levels.

Storing CO₂ in depleted oil and gas reservoirs, or saline aquifers located two kilometres below the surface, can help manage any imbalances between supply and demand. Direct storage will also be necessary to handle the large volumes of CO₂ associated with capture over the long term.



There is potential for CCS across Canada. CCS can be part of Canada's national approach to handling CO₂ emissions.



ICO₂N participants

- Agrium Inc.
- Air Products Canada Ltd.
- Canadian Natural Resources Ltd.
- ConocoPhillips Company
- EPCOR
- Husky Energy Inc.
- Imperial Oil Ltd.
- Keyera
- Nexen Inc.
- Shell Canada Ltd.
- Sherritt International Corporation
- Suncor Energy Inc.
- Syncrude Canada Ltd.
- TransAlta Corporation

ICO₂N economic analysis

The EOR market in Alberta has the potential to take much of the captured CO₂. But EOR market development and CO₂ capture and storage are not perfectly aligned. EOR customers are price sensitive and a lower delivered price of CO₂ would maximize development.

As a result, EOR demand could be less than the available CO₂ supply. That means substantial volumes of CO₂ would have to be directed to non-EOR storage to maintain the desired reductions in greenhouse gas emissions. As offset credits are the only economic benefit generated by non-EOR storage, it provides less financial support than the EOR market and does not cover the costs of capture, transportation and storage associated with the ICO₂N system. To compound the issue, the potential oversupply of inexpensive CO₂ could put downward pressure on the price of CO₂ in the EOR market.

The resulting financial gaps associated with supplying CO₂ to the EOR market and/or non-EOR storage need to be addressed in order to implement a CO₂ capture, transportation and storage system in Canada.

Without government involvement, the equilibrium between supply and demand is expected to occur at a lower volume of CO₂ and in a timeframe much later than otherwise would be possible. This could delay and ultimately limit growth of the EOR market. This outcome is inconsistent with the goal of achieving large scale reductions in CO₂ emissions as well as the goal of realizing large scale EOR market development.

Moving ICO₂N forward

The ICO₂N system could be made viable through policy and risk sharing with government. Currently, a project of this scale is too risky and is not economical. Mechanisms to address this financial gap are currently being discussed by industry and both the Alberta and federal governments.

Before ICO₂N can proceed, significant regulatory risks need to be addressed. The interests of the project must be aligned with federal and provincial greenhouse gas reduction policies and regulations currently under development. In particular, federal intensity benchmarks and technology deployment criteria for capture facilities, as well as the offset quantification protocols must be consistent with, and supportive of, the ICO₂N concept.

ICO₂N faces many logistical and financial challenges. Among the outstanding issues:

- the need for further technical and commercial evaluation;
- greater clarity on CO₂ regulatory policy and offset credit pricing;
- improved understanding of market dynamics; and
- assessment and implementation of appropriate government support mechanisms.

For the ICO₂N project to proceed in a timely and effective manner – and for Canada to take its rightful position as a leader on the CO₂ reduction front – industry and government must work together in new and creative ways. The potential benefits, on both the environmental and economic fronts, suggest the effort is well worth making.

The time to act is now.

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