Carbon Sequestration & Geological Storage: Atlantic Canada's Route to Net-Zero by 2030

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The Problem

Canada's 2021 GHG emissions reached 691 Mt of CO_2 equivalent, with Atlantic Canada contributing 50 Mt primarily from oil & gas, cement, and metal manufacturing. With federal and provincial reduction targets set for 2030, industry is under pressure to transition toward renewable energy.

This shift is hindered by:
- Lack of incentives
- Infrastructure replacement costs
- Inherent challenges of renewable sources

As the energy transition continues, proven carbon removal technologies represent a critical and necessary parallel pathway to meeting emissions goals.

What is CCS

Carbon Capture and Storage (CCS) details the process of capturing carbon from point sources such as refineries and cement plants, transporting it to a point of use or storage, potential utilization in enhanced oil recovery or recycled into products, and eventually storing it, either in specialized containers or within suitable subsurface geological formations.

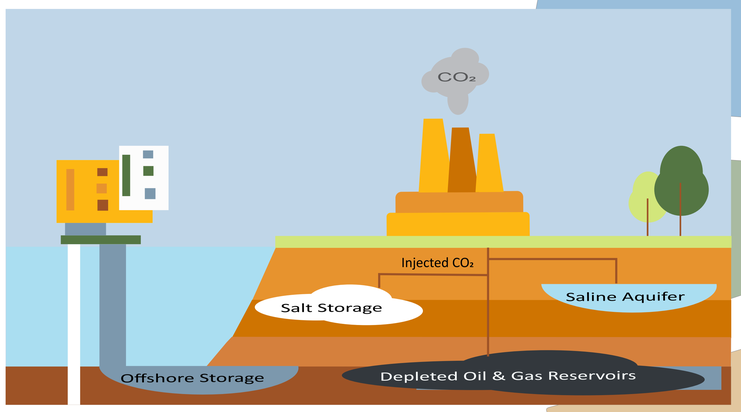

Figure 1. Carbon Capture and Storage in different geological systems (S. Salehi 2026).

The Research

With limited onshore storage options due to shallow reservoir depths (below 800 m), Atlantic Canada's offshore basins have become a zone of interest for potential carbon geostorage opportunities.

Offshore basins currently under consideration include the Fundy Basin, the Jeanne d'Arc Basin, the Magdalen Basin, the Orpheus Graben, the Sable Basin and the Sydney Basin

Our team at Dalhousie University, in partnership with Memorial University, University of New Brunswick, and University of Waterloo, is working to further evaluate Atlantic basins and classify their potential suitability for geological carbon storage.

Field work has been completed on the Fundy Basin in Nova Scotia and New Brunswick, including:
- Creating stratigraphic logs of chosen outcrops
- Describing lithofacies and collecting samples
- Measuring data relating to porosity, permeability, and geochemistry/mineral composition
- Creating a comprehensive view of CCS potential in the Fundy Basin

Each basin is studied based on criteria including:
1. Reservoirs with pore volumes suitable for injection and of appropriate thickness;
2. Presence of a continuous top seal, within target depth, temperature, and pressure;
3. Presence of faults and fractures;
4. Existing hydrocarbons;
5. Historical seismicity;
6. Presence of existing infrastructure.

With 2030 emission reduction targets fast approaching, CCS presents a critical innovation for Atlantic Canada offering a viable parallel pathway to renewable energy by capturing and sequestering industrial emissions while the broader energy transition unfolds. Beyond emissions reduction, successful CCS development in the region could unlock long-term economic, environmental, and social benefits, including job creation and positioning Atlantic Canada as a leader in clean energy technology.

Workflow

As a relatively new technology with no offshore projects yet established in Canada, there are inherent gaps in the regulatory framework, delaying development and leaving stakeholders in a holding pattern.

Key jurisdictional authorities involved in offshore CCS
- Transport Canada
- Fisheries and Oceans Canada (DFO)
- Natural Resources Canada (NRCan)
- Environment and Climate Change Canada (ECCC)
- Crown-Indigenous Relations and Northern Affairs Canada
- Canada-Nova Scotia Offshore Energy Regulator (CNSOER)
- Canada-Newfoundland and Labrador Offshore Energy Regulator (CNLOER)

Economic Considerations
High project costs, risk-averse operators, and limited government funding that tends to favour shorter-term solutions. These pressures risk pushing increased operating costs onto end users, raising concerns around energy affordability.

Technological and Project Complexities
Establishing MMV standards, resolving transportation logistics (truck, ship, pipeline, or rail) across provincial and offshore boundaries, and addressing risks such as induced seismicity, pore space ownership, licensing, and long-term liability.

Phase 1: Project Scope and Resources

Phase 2: Regulatory Research

Phase 3: Report and Recommendations

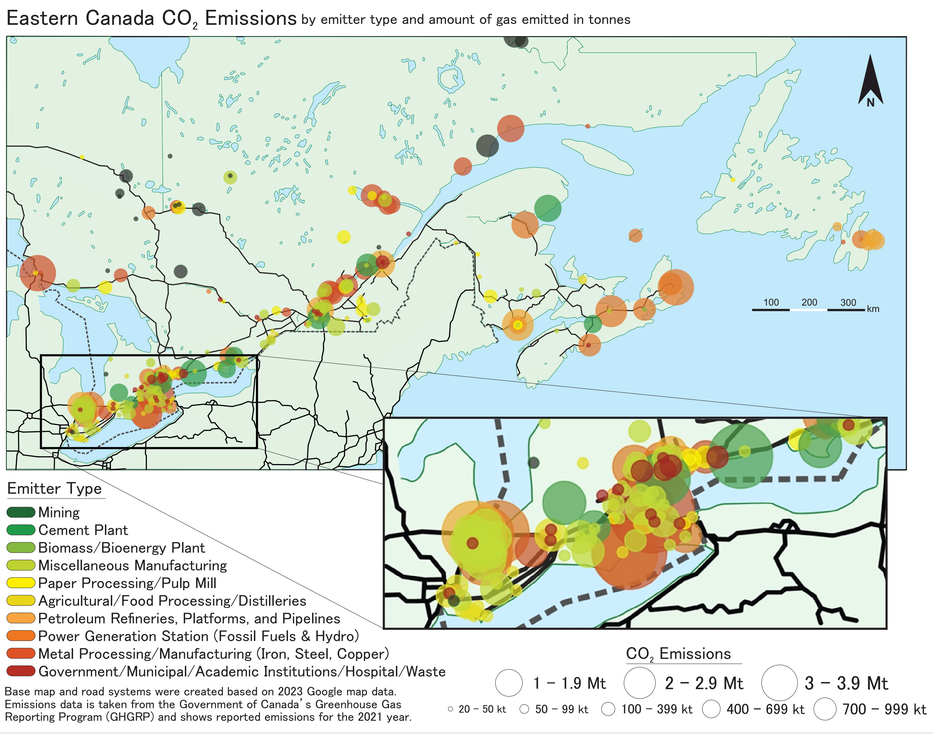

Figure 2. CO_2 emissions in Eastern Canada (L. Wheaton 2024).

SDG 7 – Affordable and Clean Energy

CCS supports the transition to cleaner energy by enabling industry to reduce its emissions without requiring immediate, full-scale replacement of existing energy infrastructure.
By allowing time for renewable energy capacity to scale up, CCS can serve as a bridge technology, keeping energy costs manageable for consumers while emissions are systematically reduced.
Geological formations explored for CO_2 storage may also facilitate short-term energy storage, complementing intermittent renewable sources like wind power and hydrogen.

SDG 9 – Industry, Innovation and Infrastructure

CCS directly advances industrial innovation by applying cutting-edge geological science, engineering, and monitoring technologies to solve a complex emissions challenge.
Repurposing existing petroleum infrastructure for CCS reduces costs and demonstrates how legacy industry assets can be adapted for a sustainable future.
The development of a robust regulatory framework for offshore CCS in Atlantic Canada would also establish new industry standards and infrastructure that could be replicated nationally and internationally.

SDG 13 – Climate Action

By capturing CO_2 from industrial point sources and sequestering it in subsurface geological formations, CCS directly reduces the volume of greenhouse gases entering the atmosphere.
Atlantic Canada's offshore basins represent a significant geological opportunity to contribute to Canada's 2030 emission reduction targets and its broader net-zero ambitions.
Advancing CCS research and regulatory readiness positions Atlantic Canada to take meaningful and measurable climate action.

Next Steps

We are working on a Regulatory Roadmap for Offshore Carbon Storage in Atlantic Canada to address the regulatory gaps and barriers unique to offshore CCS projects. The goal is to develop a comprehensive report of recommendations for legislators to consider in regards to offshore CCS development in Canada.

This involves:
1. Project scoping and identification of existing resources and regulatory gaps
2. Overview of global examples, best practices, and key lessons from comparable CCS programs
3. Outlining the CCS value chain and associated regulatory omissions
4. Developing a roadmap for a future regulatory framework aligned with development potential and existing legislation

A core project priority is public education by developing accessible materials and community engagement opportunities across the Maritimes to build foundational CCS knowledge before development begins. Informed communities are better equipped to meaningfully participate in future consultation and decision-making processes.

Acknowledgements

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