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FEBRUARY 2026

CARBON REMOVAL, FROM AIR TO SEA

Canada, a leader in restoring ocean ecosystems and fighting climate change

Report of the Standing Senate Committee on Fisheries and Oceans

The Honourable Fabian Manning, Chair
The Honourable Bev Busson, Deputy Chair

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The Honourable Senators

Victor Boudreau

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Ex officio members of the committee:

The Honourable Pierre Moreau, P.C., or the Honourable Patti LaBoucane-Benson
The Honourable Leo Housakos or the Honourable Yonah Martin
The Honourable Raymonde Saint-Germain or the Honourable Bernadette Clement (until January 4, 2026)
The Honourable Lucie Moncion or the Honourable Joan Kingston (since January 5, 2026)
The Honourable Scott Tannas or the Honourable Rebecca Patterson (until January 4, 2026)
The Honourable Flordeliz (Gigi) Osler or the Honourable Robert Black (since January 5, 2026)
The Honourable Judy A. White

Other senators who have participated in the study:

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The Honourable Réjean Aucoin
The Honourable Jean-Guy Dagenais (retired)
The Honourable Pat Duncan
The Honourable Jane Cordy (retired)
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Order of Reference

Extract from the Journals of the Senate of Wednesday, October 8, 2025:

> The Honourable Senator Manning moved, seconded by the Honourable Senator Batters:
>
> That the Standing Senate Committee on Fisheries and Oceans be authorized to examine and report on ocean carbon sequestration and its use in Canada;
>
> That the papers and evidence received and taken and work accomplished by the committee on this subject during the First Session of the Forty-fourth Parliament be referred to the committee;
>
> That the committee submit its final report to the Senate no later than December 31, 2025, and that the committee retain all powers necessary to publicize its findings for 180 days after the tabling of the final report; and
>
> That the committee be permitted, notwithstanding usual practices, to deposit reports on this study with the Clerk of the Senate, if the Senate is not then sitting, and that the reports be deemed to have been tabled in the Senate.

Clerk of the Senate

Shaila Anwar

Extract from the Journals of the Senate of Tuesday, December 2, 2025:

> The Honourable Senator Martin moved, for the Honourable Senator Manning, seconded by the Honourable Senator Batters:
>
> That, notwithstanding the order of the Senate adopted on Wednesday, October 8, 2025, the date for the final report of the Standing Senate Committee on Fisheries and Oceans in relation to its study on ocean carbon sequestration and its use in Canada be extended from December 31, 2025, to March 31, 2026.
>
> The question being put on the motion, it was adopted.

Clerk of the Senate

Shaila Anwar

Executive Summary

The Standing Senate Committee on Fisheries and Oceans (the committee) undertook a study on ocean carbon sequestration and its use in Canada. The committee learned a great deal about land-based installations that sequester carbon by adding alkaline materials (such as limestone) to rivers and harbours – a process called alkalinity enhancement.

This technology has the potential to remove carbon dioxide (CO_2) out of the air and sequester it in the marine environment for long periods of time; a service that, if applied, could be essential to meeting Canada's climate action targets.

The report outlines a path forward for the Government of Canada to help this new, innovative sector flourish. A focus on implementing safe and reliable land-based ocean alkalinity enhancement methods, backed by independent science, is crucial. As is fostering and securing social licence through collaboration with proponents and stakeholders such as Indigenous and local communities, ocean users and other knowledge holders.

To help answer outstanding questions about the sector, the Government of Canada should publish a research strategy to guide the science undertaken in parallel with projects.

The Government of Canada should create a regulatory framework that enables innovation and balances risks with opportunities, and includes a robust monitoring, reporting and verification (MRV) protocol. This will help ensure that the carbon credits produced in Canada are of the highest quality and industry leading.

The committee ascertained that Canada is a global leader in the research and development of land-based ocean alkalinity enhancement technology. Canada must now strive to be a global leader in the implementation and scaling of this technology and in the establishment of enabling regulations.

List of Recommendations

Recommendation 1
(Setting national carbon dioxide removal targets)
The committee recommends that, in addition to setting emissions reduction targets, the Government of Canada also set national carbon dioxide removal targets and that it do so by the end of the 2026 calendar year.

Recommendation 2
(The importance of land-based ocean alkalinity enhancement methods)
The committee recommends that the Government of Canada formally recognize, by the end of the 2026 calendar year, land-based ocean alkalinity enhancement methods as valuable tools in the fight against climate change in order to give compliance market value to high quality carbon removal credits.

Recommendation 3
(Canada's approach to consultations)
The committee recommends that the Government of Canada champion a two-tiered approach to consultation alongside a trusted, independent third party. The first tier includes broad public consultations and information sharing about carbon dioxide removal methods (including marine-based methods). The second tier focusses on consultations for specific project proposals. This approach to consultation should be in place by the end of the 2027 calendar year.

Recommendation 4
(Claiming sovereign jurisdiction over the regulation of land-based ocean alkalinity enhancement projects)
The committee recommends that the Government of Canada immediately release a statement that asserts that land-based ocean alkalinity enhancement projects are regulated by existing domestic legislation and regulations.

Recommendation 5
(A streamlined application process)
The committee recommends that the Government of Canada streamline the application process for land-based ocean alkalinity enhancement projects (and for other marine and ocean-based projects at a later date), through the use of a new sector-specific regulatory sandbox that includes all federal regulators.

Recommendation 6
(A land-based ocean alkalinity enhancement research strategy)
The committee recommends that the Government of Canada, in collaboration with relevant stakeholders, establish a marine carbon dioxide removal and storage research strategy specific to land-based ocean alkalinity enhancement projects. This strategy would identify the research questions that must be answered in order to ensure that land-based ocean alkalinity enhancement technologies are: 1) safe for ecosystems; 2) effective at storing carbon; 3) scalable; and 4) producing high quality and marketable carbon credits.

Recommendation 7
(Developing a robust monitoring, reporting and verification protocol)
The committee recommends that the Government of Canada, in order to help build public confidence and an effective carbon market, develop a robust monitoring, reporting and verification protocol (MRV protocol). This MRV protocol should help ensure that marine carbon dioxide removal projects can effectively measure the amount and permanence of the carbon it captures and stores.

Recommendation 8
(Establishing a marine carbon dioxide removal task force)
The committee recommends that the Government of Canada champion a multi-departmental and multi-organizational task force, composed of representatives from federal, provincial, and territorial departments and agencies and other relevant stakeholders and knowledge holders, to work towards the development of a marine carbon dioxide removal regulatory framework for Canada. The regulatory framework should be in place by the end of the 2027 calendar year.

Recommendation 9
(Creating a national marine carbon dioxide removal strategy)
The committee recommends that the Government of Canada position the country as an industry world leader in marine carbon dioxide removal, by establishing a national strategy for the sector that includes an evidence-based, agile approach to permitting, monitoring, measurement, investment and reporting.

Glossary

Carbon dioxide (CO_2): A greenhouse gas that is emitted through various means, including the burning of fossil fuels.

Carbon dioxide emissions reduction: Methods or technologies employed to avoid the release of new CO_2 emissions into the atmosphere.

Carbon dioxide sequestration/removal: Methods or technologies employed to remove CO_2 that is already present in the atmosphere and to store it.

Carbon storage: The process of storing captured CO_2 in a manner that is long lasting, including in marine environments.

Land-based ocean alkalinity enhancement: The process of adding an alkaline material, such as limestone, to internal waters, such as rivers or harbours, with the aim of modifying (or rebalancing) the water's pH to counteract ocean acidification. These alkaline materials originate from a land-based facilities.

Marine carbon dioxide removal (mCDR): Marine-based methods of sequestering/removing and storing CO_2.

Monitoring, reporting and verification (MRV) protocol: A protocol that allows for the effective measurement of the CO_2 sequestered by a particular carbon dioxide removal method (marine or otherwise) and of the durability of its storage.

Ocean acidification: The long-term change in the chemistry and pH of ocean waters caused by the ocean's absorption of CO_2 from the atmosphere. When CO_2 is absorbed into water, it reacts and forms an acid (carbonic acid), which decreases the water's pH.

Ocean alkalinity enhancement (OAE): The process of adding an alkaline material, such as limestone, to ocean waters with the aim of modifying (or rebalancing) the water's pH to counteract ocean acidification.

Technological readiness levels (TRLs): A scale used by Natural Resources Canada to measure the readiness of different technologies. The scale ranges from one to nine, with nine meaning that the technology is at the late-stage demonstration phase.

Introduction

On 24 September 2024, the Standing Senate Committee on Fisheries and Oceans (the committee) was authorized to undertake a special study on ocean carbon sequestration and its use in Canada.[1] Over the course of six meetings, the committee heard from 23 witnesses of varied backgrounds and lived experiences before the prorogation and dissolution of the 44th Parliament. On 8 October 2025, the committee was authorized to undertake the special study anew.[2] Over the course of four meetings, the committee heard from 14 witnesses and received additional briefing materials. The committee learned a great deal from all the witnesses that appeared in person and via videoconference in 2024 and 2025 and from the materials shared. Senators would like to thank all those who contributed to this study.

This report summarizes the committee's key findings and presents recommendations to the Government of Canada to support the responsible development of promising land-based ocean alkalinity enhancement technologies, and eventually, of other marine and ocean-based carbon sequestration technologies.

The Oceans and Carbon Sequestration

The United Nations (UN) Climate Action website describes the ocean as "the world's greatest ally against climate change."[3] It refers to oceans as the "lungs of the planet" because they produce 50% of the world's oxygen, and as "the planet's greatest carbon sink" as oceans absorb 30% of all carbon dioxide (CO_2) emissions. Oceans are believed to have the capacity to sequester two to 10 times more CO_2 than forests.[4] Some underwater ecosystems are known for their carbon sequestration abilities. UN Climate Action notes that "[o]cean habitats such as seagrasses and mangroves, along with their associated food webs, can sequester carbon dioxide from the atmosphere at rates up to four times higher than terrestrial forests can."[5]

[1] Senate of Canada, *Journals of the Senate*, 1st Session, 44th Parliament, 24 September 2024.

[2] Senate of Canada, *Journals of the Senate*, 1st Session, 45th Parliament, 8 October 2025; and Senate of Canada, *Journals of the Senate*, 1st Session, 45th Parliament, 2 December 2025.

[3] United Nations (UN) Carbon Action, *The ocean – the world's greatest ally against climate change*.

[4] Blue Carbon Canada, *Research Projects*.

[5] UN Carbon Action, *The ocean – the world's greatest ally against climate change*.

Climate change is affecting the world's oceans. Impacts include the melting of multi-year sea ice, sea level rise, and ocean acidification and warming.[6] Each of these impacts is said to incur cascading negative consequences for oceans, such as marine biodiversity loss.

Stephanie Hewson (Staff Lawyer, West Coast Environmental Law Association) explained that "[c]limate change is a huge threat, and time is running short. We need to make sure we are investing in the most impactful solutions that don't risk further damage to the health of the planet."[7]

The committee has learned that, although the oceans are being negatively affected by climate change, these same oceans may also be an important tool in our fight against it.

CO_2 Emissions Reduction and CO_2 Removal Methods

CO_2 Emissions Reduction	CO_2 Removal
Methods or technologies employed to avoid the release of new CO_2 emissions into the atmosphere.	**Methods or technologies employed to remove CO_2 that is already present in the atmosphere.**

CO_2 emissions reduction initiatives (which are the subject of much climate policy, such as Canada's *2030 Emissions Reduction Plan: Clean Air, Strong Economy*[8] and the *Paris Agreement*[9]) and CO_2 removal (which is the subject of this report) are two terms that are often used in climate change policy discussions. What is the difference?

Na'im Merchant (Executive Director, Carbon Removal Canada) helped the committee visualize the difference by using the following metaphor about an overflowing sink or bathtub, with the water representing CO_2. Emissions reduction measures essentially turn off the CO_2 tap (i.e., reduce or eliminate new greenhouse gas emissions), while CO_2 removal measures pull the plug (i.e., absorb or remove historic or legacy greenhouse gas emissions from the atmosphere).[10]

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[6] UN Carbon Action, *How is climate change impacting the world's ocean*.

[7] Senate, Standing Committee on Fisheries and Oceans (POFO), *Evidence* (Stephanie Hewson, Staff Lawyer, West Coast Environmental Law Association), 12 December 2024.

[8] Government of Canada, *2030 Emissions Reduction Plan: Clean Air, Strong Economy*.

[9] United Nations, *Paris Agreement*, 2015.

[10] POFO, *Evidence* (Na'im Merchant, Executive Director, Carbon Removal Canada), 5 December 2024.

Na'im Merchant explained that "carbon removal seeks to remove excess carbon dioxide from the atmosphere that was emitted at any time since the start of the Industrial Age."[11] The committee learned that gigatonnes[12] of CO_2 will need to be removed from the atmosphere in the next several decades to address historic (also known as "legacy") greenhouse gas emissions. In fact, the committee learned that as much as 9 gigatonnes of CO_2 need to be removed from the atmosphere per year by 2050, and that up to 17 gigatonnes of CO_2 need to be removed per year by 2100.[13] To help put this into perspective, Canada reported emitting 0.694 gigatonnes of greenhouse gases (or CO_2 equivalents) in 2023 and the global CO_2 emissions reported for that same year were 37.4 gigatonnes.[14]

Many witnesses stressed that both CO_2 emissions reduction measures and CO_2 removal measures are required to meet Canada's climate action targets. Carbon removals should not be preferred over emissions reduction initiatives; they should be developed and implemented in lockstep as part of Canada's climate action plan. In addition to setting emission reduction targets, the Government of Canada should also set CO_2 removal targets. The value and need for CO_2 removal targets in Canada's climate strategy cannot be overstated.

Recommendation 1
(setting national carbon dioxide removal targets)

The committee recommends that, in addition to setting emissions reduction targets, the Government of Canada also set national carbon dioxide removal targets and that it do so by the end of the 2026 calendar year.

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[11] Ibid.

[12] The scale of these removals is significant because 1 gigatonne of carbon dioxide (CO_2) is equivalent to 1 billion metric tonnes of CO_2.

[13] POFO, *Evidence* (Helen Gurney-Smith, Research Scientist, Fisheries and Oceans Canada and Canadian and Ocean Acidification Community of Practice), 21 October 2025; and Carbon Removal Canada, *What is the market size potential for carbon removal?*

[14] Government of Canada, *Greenhouse gas emissions*; and International Energy Agency, *CO2 Emissions in 2023: Executive Summary*.

These national CO_2 removal targets should be supported by financial and policy commitments and should encourage the responsible development of various promising CO_2 removal methods, including marine-based methods. In addition, Canada should recognize marine carbon dioxide removal methods when it next updates *Capturing the opportunity: A Carbon Management Strategy for Canada*.[15]

Marine Carbon Dioxide Removal Methods

There are several marine carbon dioxide removal methods (see the table below for examples), including ocean alkalinity enhancement, ecosystem protection and restoration, ocean nutrient fertilization, and deep sea storage, among others.[16] While they are not all examined in the context of this report, Canada's Ocean Supercluster provided the committee with a copy of its July 2025 report, in which it describes various methods and discusses their deployment potential.[17] Similarly, the Waterloo Climate Institute produced a report in which it presents a table of the key characteristics of six different marine carbon dioxide removal methods and categorized their efficacy.[18]

Examples of Marine Carbon Dioxide Removal Methods	Brief Descriptions
Ocean nutrient fertilization	The productivity of photosynthetic plankton is believed to be limited by certain nutrients (e.g., iron or phosphorous). The objective of ocean fertilization is to increase the content of these nutrients in the water to trigger an algal bloom that would increase the carbon absorption capacity of the photosynthetic plankton.
Protection and restoration of ocean and coastal ecosystems	The protection of existing high carbon-sequestering ecosystems, such as those dominated by seagrass, is meant to help ensure they can continue to sequester carbon. Restoration projects aim to help these types of ecosystems recover and sequester carbon once more.

[15] Natural Resources Canada, *Capturing the opportunity: A Carbon Management Strategy for Canada*, 2023.

[16] Waterloo Climate Institute, *Marine Carbon Dioxide Removal (mCDR) in Canada: Opportunities and Challenges*, 2024.

[17] RMI, "Executive Summary: The Potential for Marine Carbon Dioxide Removal in Canada," *Canada's Ocean Supercluster*, July 2025.

[18] Waterloo Climate Institute, *Marine Carbon Dioxide Removal (mCDR) in Canada: Opportunities and Challenges*, 2024.

Examples of Marine Carbon Dioxide Removal Methods	Brief Descriptions
Ocean alkalinity enhancement	The process of adding an alkaline material, such as limestone, to ocean waters with the aim of modifying (or rebalancing) the water's pH to counteract ocean acidification.
Deep-sea storage	Deep-sea storage utilizes technologies that remove CO_2 from the atmosphere, and that CO_2 is then meant to be injected into appropriate deep-sea geological formations. Sinking cultured biomass to the sea floor (e.g., farmed seaweed) is another example of a deep-sea carbon storage method.

Sources: Waterloo Climate Institute, *Marine Carbon Dioxide Removal (mCDR) in Canada: Opportunities and Challenges*, 2024; RMI, "Executive Summary: The Potential for Marine Carbon Dioxide Removal in Canada," *Canada's Ocean Supercluster*, July 2025; and Ocean Visions, *Marine Carbon Dioxide Illustrations*.

Ocean Alkalinity Enhancement

Greenhouse gas emissions are a known cause of ocean acidification, which negatively impacts marine ecosystems and the species that inhabit them.[19] As a natural buffering process, rock is eroded by wind and water and these eroded alkaline materials are deposited into rivers and internal bodies of water, modifying (or rebalancing) the water's pH, which counteracts ocean acidification.

A brief submitted by Exterra Carbon Solutions defined the ocean alkalinity enhancement process.

> *"Alkalinity is introduced into ocean waters, where it reacts with dissolved CO_2 to form bicarbonates (HCO_3^-). This process not only sequesters CO_2 but also mitigates ocean acidification, providing vital support for marine ecosystems."*[20]

Ocean alkalinity enhancement was described as a method that aims to replicate an accelerated version of the natural erosion process described by Exterra Carbon Solutions above. In simplified terms, the committee learned that ocean alkalinity enhancement actively adds alkaline materials, such as limestone, into the marine environment and that its objective is to rebalance the pH of ocean waters that were acidified by greenhouse gas emissions and restore balance to ecosystems. An added

[19] Government of Canada, *Canada's State of the Oceans Report, 2012*, 2012.

[20] POFO, *Brief* (Exterra Carbon Solution), 11 December 2024.

benefit of balancing the water's pH is increasing the ocean's capacity to absorb and store CO_2.

William Burt (Adjunct Professor, Department of Oceanography, Dalhousie University and Chief Ocean Scientist, Planetary Technologies) described alkalinity enhancement as "a remarkably simple, almost obvious win-win concept. If you deacidify seawater just a tiny amount, it will take carbon dioxide out of the air naturally, and that carbon storage in ocean chemistry will be long-lasting. By focusing on these small chemical changes, you'd minimize any biological impacts, and the sheer size of the oceans' carbon reservoir means immense potential scalability."[21]

The committee learned that ocean alkalinity enhancement is the subject of increasing scientific study and research. Mike Kelland (Chief Executive Officer, Planetary Technologies) explained that "[t]here were 10 times as many peer-reviewed studies on ocean alkalinity enhancement published last year versus five years ago, so there is an exponential growth in knowledge in this space as we explore it as a viable climate solution."[22]

Land-Based Ocean Alkalinity Enhancement

The committee learned that alkalinity enhancement has been used in rivers for many years in Atlantic Canada to help combat and reverse the negative impacts of acid rain on river ecosystems and species such as Atlantic salmon. Edmund Halfyard (Co-Founder and Chief Technology Officer, CarbonRun) explained that:

> *"In Nova Scotia, environmental charities such as the Nova Scotia Salmon Association, adopted river liming techniques that were widely used in Norway and Sweden. In its most basic form, powdered limestone rock is dissolved in rivers to de-acidify the water. Adding limestone replicates the natural process of rock weathering, which is the source of important elements such as calcium and magnesium, both of which are critical to aquatic life but also contribute to what is known as alkalinity or the ability to buffer against acidification.*

[21] POFO, *Evidence* (William Burt, Adjunct Professor, Department of Oceanography, Dalhousie University and Chief Ocean Scientist, Planetary Technologies), 21 November 2024.
[22] POFO, *Evidence* (Mike Kelland, Chief Executive Officer, Planetary Technologies), 21 November 2024.

Our work in Nova Scotia was highly successful and led to the ecological recovery of a highly degraded river and the rebuilding of a self-sustaining Atlantic salmon population."[23]

A hand holding alkaline materials. Picture provided by CarbonRun.

The committee learned that this alkalinity enhancement technique is now being tested in a different environment, the Halifax Harbour. David Koweek (Chief Scientist, Ocean Visions) explained that it is being "put through [its] paces," which "means tested in real-world settings…to understand real-world efficacy and impacts."[24]

[23] POFO, *Evidence* (Edmund Halfyard, Co-Founder and Chief Technology Officer, CarbonRun), 31 October 2024.

[24] POFO, *Evidence* (David Koweek, Chief Scientist, Ocean Visions), 31 October 2024.

Crushed limestone piped into a river. Picture provided by CarbonRun.

The term land-based ocean alkalinity enhancement can be confusing. It is meant to represent ocean alkalinity enhancement technologies that are implemented in rivers and harbours and for which the alkaline materials are placed into the water from a land-based facility or structure (such as the pipe in the picture above). Land-based projects can occur on a much smaller scale than ocean based projects, and monitoring land-based projects is relatively simpler because the ecosystems are often better understood, compared to vast, difficult to access ocean ecosystems. At present, only land-based ocean alkalinity enhancement activities are taking place in Canada.

	Ocean Alkalinity Enhancement	Land-Based Ocean Alkalinity Enhancement
Brief Description	The addition of alkaline materials into ocean waters	The addition of alkaline materials into rivers and harbours
Location	Ocean environments (i.e., in Canada's territorial waters or international waters)	River or harbour environments (i.e., in Canada's internal waters and ports)
Regulatory Framework (see Figure 2)	Illegal at this time, pursuant to domestic and international law	Regulated domestically
Projects in Canada	None	Several small scale projects are underway

	Ocean Alkalinity Enhancement	Land-Based Ocean Alkalinity Enhancement
Monitoring	Difficult to monitor due to the complexity and size of the ocean environment	Relatively easier to monitor due to ease of access and local experts on river and harbour environments

As previously mentioned, it is important to note that there are various marine carbon dioxide removal methods. However, river and harbour-based (i.e., land-based) ocean alkalinity enhancement activities will be the focus of this report.

Recommendation 2
(THE IMPORTANCE OF LAND-BASED OCEAN ALKALINITY ENHANCEMENT METHODS)

The committee recommends that the Government of Canada formally recognize, by the end of the 2026 calendar year, land-based ocean alkalinity enhancement methods as valuable tools in the fight against climate change in order to give compliance market value to high quality carbon removal credits.

Picture provided by CarbonRun.

The Technological Readiness of Marine Carbon Dioxide Removal Methods

The committee heard contradicting testimony about the level of technological readiness of marine carbon dioxide removal methods in Canada. Officials from Natural Resources Canada explained that all technologies are measured against a technological readiness levels (TRL) scale.[25] This readiness scale ranges from one to nine, with nine meaning that the technology is at the late-stage demonstration phase.

Department officials explained that marine carbon dioxide removal technologies, for which the department representatives said it has 36 projects on its "radar," were rated at a four or five on its TRL scale.[26] However, Edmund Halfyard (Co-Founder and Chief Technology Officer, CarbonRun) explained that the company, which undertakes river alkalinity enhancement activities, is at a TRL nine.[27] He noted: "Our projects are delivering verified carbon-removal credits, backed by independent registries and rigorous measurement systems."[28] Mike Kelland (Chief Executive Officer, Planetary Technologies) confirmed that Planetary Technologies, which also undertakes land-based ocean alkalinity enhancement activities, would also be a nine on the TRL scale.[29]

[25] POFO, *Evidence* (Saviz Mortazavi, Director, Office of Energy Research and Development, Natural Resources Canada), 28 November 2024.
[26] Ibid.
[27] POFO, *Evidence* (Edmund Halfyard, Co-Founder and Chief Technology Officer, CarbonRun), 9 October 2025.
[28] Ibid.
[29] POFO, *Evidence* (Mike Kelland, Chief Executive Officer, Planetary Technologies), 9 October 2025.

Aerial view of a land-based ocean alkalinity enhancement facility located in the Halifax Harbour. Picture provided by Planetary Technologies.

This contradiction is concerning as it demonstrates a disconnect between the Government of Canada and the proponents of projects that have undergone approvals and are operating within the domestic regulatory framework. Departments such as Natural Resources Canada and Environment and Climate Change Canada should more closely monitor the technological readiness of marine carbon dioxide removal methods and projects to ensure that they remain aware of the rapid development of this sector and can work collaboratively with project proponents.

Risks and Research

The oceans are very large, very complex systems, and any intentional changes made to these systems should be made with extreme care. Witnesses explained that more research is required to answer questions such as: How does ocean alkalinity enhancement affect ocean ecosystems? How much carbon can be stored? Where will carbon be stored within the ecosystem? How long will the carbon be stored for?

Christopher Algar (Associate Professor, Department of Oceanography, Dalhousie University, appearing as an individual) noted that to determine the impact ocean alkalinity enhancement projects are having on the “natural alkalinity and carbon cycles in the sediments between the sea floor and the water column…it is important

to study them under real-world conditions through small- and medium-scale trials in the natural environment."[30]

Paul Snelgrove (Research Professor, Department of Ocean Sciences and Biology, Memorial University of Newfoundland, as an individual) explained: "I would be comfortable saying that some small-scale experimental work is appropriate to try to understand these impacts, but I do not believe we are ready to deploy any of these actions at a scale sufficient to actually move the needle on carbon uptake and carbon sequestration."[31] More research is needed to ensure that the ocean alkalinity enhancement technologies are safe for the environment and that the monitoring of projects is a sensible way of gaining that knowledge.

In addition, Stephanie Hewson (Staff Lawyer, West Coast Environmental Law Association) noted that "it is critical that Canada develops mechanisms to govern geoengineering research projects as a priority. This research is necessary to make evidence-based policy decisions about these technologies, but it requires oversight."[32]

The committee heard a lot of positive feedback about ocean alkalinity enhancement activities in rivers and in the Halifax Harbour and the potential of these projects to store carbon in the deep ocean. However, the committee also learned that the short, medium and long-term effects of the use of land-based ocean alkalinity enhancement in these ecosystems (and in the ocean) are not yet completely understood. The lessons learned from the small scale projects taking place in rivers and harbours may not be directly transferrable to ocean ecosystems and this uncertainty must be addressed before ocean-based projects are undertaken.

Helen Gurney-Smith (Research Scientist, Fisheries and Oceans Canada and Canadian Ocean Acidification Community of Practice) also explained that: "While society undoubtedly needs climate mitigation, proceeding with new ocean-climate initiatives without the necessary knowledge risks potential long-term harm to ecosystems and people."[33]

Marine carbon dioxide removal is a new and constantly evolving sector, and it has not been given much attention in Canada's carbon management strategy, *Capturing the opportunity: A Carbon Management Strategy for Canada*.[34] When officials from

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[30] POFO, *Evidence* (Christopher Algar, Associate Professor, Department of Oceanography, Dalhousie University, as an individual), 31 October 2024.

[31] POFO, *Evidence* (Paul Snelgrove, Research Professor, Department of Ocean Sciences and Biology, Memorial University of Newfoundland, as an individual), 12 December 2024.

[32] POFO, *Evidence* (Stephanie Hewson), 12 December 2024.

[33] POFO, *Evidence*, (Helen Gurney-Smith), 21 October 2025.

[34] Natural Resources Canada, *Capturing the opportunity: A Carbon Management Strategy for Canada*, 2023.

Natural Resources Canada and Environment and Climate Change Canada first appeared, the committee learned that Canada does not presently have a framework in place to enable the scaling up of marine carbon dioxide removal projects (land-based or otherwise).[35] When they appeared before committee a second time, Natural Resources Canada officials confirmed that the department does not have policy or program measures focused on ocean-based carbon dioxide removal at present.[36]

Projects and independent research should be taking place in parallel. This would ensure that research helps track the impacts of projects (positive and negative) to allow these projects to course correct when needed. Independent research can also help keep project proponents accountable. To ensure that the process is transparent, independent research should be published and made available to the public, in addition to the information produced by the project's proponents. Canada should be bold and ambitious in its goal-setting on marine carbon dioxide removal, but measured and thoughtful in its execution.

Consultations and Social Licence

The committee was often reminded that the benefits and risks associated with each marine carbon dioxide removal method must be identified, well understood, and based on scientific evidence. However, Canada must not lose momentum in this field; it must proceed expeditiously to increase knowledge about marine carbon dioxide removal methods and cement its position as a global leader in this emerging sector. To help accomplish this goal, witnesses called for small scale projects and additional science and research.

Witnesses also suggested partnering with local Indigenous communities as a possible way forward. Ken Paul (Member of the Wolastoqey Nation at Neqotkuk, as an individual) suggested that establishing various "small-scale demonstration projects" within willing Indigenous host communities could be beneficial to both the communities and those developing the projects.[37]

While appearing before the committee, Anya Waite (Chief Executive Officer and Scientific Director, Ocean Frontier Institute) explained that, in Canada, gaining social licence is "absolutely critical," but she does not believe Canada is quite "there

[35] POFO, *Evidence*, 28 November 2024.

[36] POFO, *Evidence*, 18 November 2025.

[37] POFO, *Evidence* (Ken Paul, Member of the Wolastoqey Nation at Neqotkuk, as an individual), 5 December 2024.

yet."[38] Anya Waite provided the following as an example of a collaborative communication model:

> *"One of the things that we're doing here at Ocean Frontier Institute is something called the COMPASS program, in which we're bringing together researchers who think about social, scientific and regulatory aspects. We are bringing them all together in a small think tank to get this communication going and continuously reach out to communities and work with the different sectors to understand what their needs are and how they might benefit from this industry going forward."*[39]

Edmund Halfyard (Co-Founder and Chief Technology Officer, CarbonRun) noted that:

> *"Social licence is going to become the limiting factor on how [marine carbon dioxide removal projects] can scale up quite quickly. Technologically, we are making fast strides, but the communities around projects and the global community is, ultimately, going to be what makes this propel forward or slows it down.*
>
> *Social licence comes with trust, credibility and time. It's fundamentally a relationship where whatever we learn has to be effectively communicated in clear, concise and digestible ways. Without academic and government involvement, industry will never realize its full potential or see this through until we have the social licence to operate."*[40]

Edmund Halfyard also explained that CarbonRun is "collaborating closely with Indigenous communities to ensure that Indigenous voices are represented not only in these projects, but also in the development of this emerging economic opportunity."[41] He went on to say that "social licence absolutely must include Indigenous views and voices."[42]

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[38] POFO, *Evidence* (Anya Waite, Chief Executive Officer and Scientific Director, Ocean Frontier Institute), 7 November 2024.

[39] POFO, *Evidence* (Anya Waite, Chief Executive Officer and Scientific Director, Ocean Frontier Institute), 30 October 2025.

[40] POFO, *Evidence* (Edmund Halfyard), 31 October 2024.

[41] Ibid.

[42] Ibid.

At this time, the Government of Canada sees its role as a regulator, but it must play a more prominent role as a consultation facilitator. Consultations should not only take place when a proponent is ready to start a project, it should occur much earlier and involve many parties.

Figure 1 – A Collaborative Approach to Fostering Social Licence

Figure prepared by the Standing Senate Committee on Fisheries and Oceans.

The Government of Canada should recognize that partnerships with proponents, Indigenous, coastal, and remote communities, and with ocean users (such as fishers and aquaculture producers), independent scientists and other relevant knowledge holders will be key to the successful scaling-up and refinement of promising marine carbon dioxide removal projects. Early and frequent consultations and long-lasting partnerships will lead to greater understanding and will help foster and establish social licence.

The committee proposes a two-tiered approach. The public should be engaged early and discussions about marine carbon dioxide removal methods, at large, should be facilitated. Then, when proponents are looking to site a project, more targeted consultations should take place about that specific project.

Recommendation 3
(CANADA'S APPROACH TO CONSULTATIONS)

The committee recommends that the Government of Canada champion a two-tiered approach to consultation alongside a trusted, independent third party. The first tier includes broad public consultations and information sharing about carbon dioxide removal methods (including marine-based methods). The second tier focusses on consultations for specific project proposals. This approach to consultation should be in place by the end of the 2027 calendar year.

This partnership between the Government of Canada and a trusted, independent third party is recommended to help foster a balanced and collaborative two-tiered approach to consultation. This approach is meant to meet the needs of, and include the feedback of all those involved, including proponents, communities, independent scientists and other stakeholders and knowledge holders. It is meant to encourage innovation and discussion, not stifle it. The trusted, independent third party could be selected from a list of existing organizations, such as Canada's Ocean Supercluster or the Ocean Frontier Institute, which work at arm's length of the federal government and have mandates to advance marine-based sectors and innovation.

The first tier of consultations should be led by the Government of Canada and the trusted, independent third party, but must also include departmental and independent scientists and researchers. Information should be shared with the public using plain language to help engage them in the carbon dioxide removal discussion. Tier one consultations should be ongoing and must address the benefits and the risks of various carbon dioxide removal methods.

The second tier of consultations should be more targeted and include proponents and ocean users, in addition to the public and knowledge holders. They should focus on the project being proposed. Tier two consultations for marine-based projects should be funded by project proponents, but be undertaken in collaboration with Fisheries and Oceans Canada or Environment and Climate Change Canada.

International and Domestic Regulatory Frameworks

Figure 2 – Regulatory Framework Governing Marine Carbon Dioxide Removal in Canada

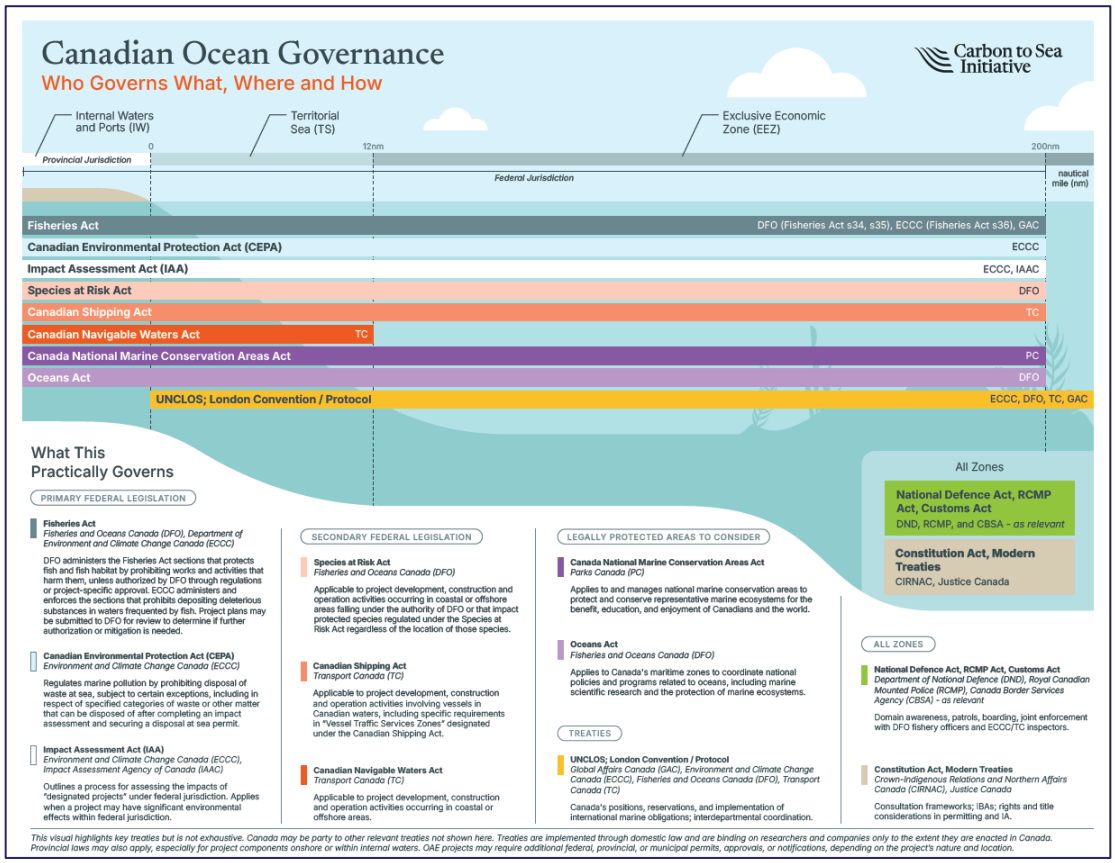

Image provided by the Carbon to Sea Initiative.

International Framework

The committee heard that, at this time, international law does not adequately address ocean-based marine carbon dioxide removal methods.

Romany Webb (Deputy Director, Sabin Center for Climate Change Law, Columbia University, as an individual) explained that "there are currently no binding international agreements that specifically and comprehensively address ocean CDR [(carbon dioxide removal)]" and that although international climate change agreements, such as the *United Nations Framework Convention on Climate Change*[43]

[43] United Nations, *United Nations Framework Convention on Climate Change*, 1992.

and the *Paris Agreement*[44], "implicitly support the use of ocean CDR as a climate change mitigation strategy" they do not "establish detailed rules governing the conduct of ocean CDR projects."[45]

Similarly, Neil Craik (Professor of Law, Balsillie School of International Affairs, University of Waterloo, as an individual) noted that the "central international regulatory instrument that addresses the placement of material into the ocean is the *London Protocol* [*on Prevention of Marine Pollution* (the London Protocol)[46]], to which Canada is a party…The London Protocol includes a 2013 amendment that addresses marine geoengineering" which could include many marine carbon dioxide removal methods, such as ocean alkalinity enhancement.[47]

However, Neil Craik also noted that it was "important for this committee to understand that the London Protocol amendment, while adopted by the parties, is not in force" as it must first be ratified by 36 parties.[48] In addition, the "amendment only addresses ocean fertilization at present but has been proposed to be expanded to include other methods of mCDR [(marine carbon dioxide removal)], including ocean alkalinity and macroalgae."[49]

It can therefore be concluded that, although a patchwork of international law exists, it is not structured or sufficiently robust to enable science and research, data collection, public confidence, and the deployment of various proven carbon dioxide removal methods in the ocean environment.

Canada can be a leader in this field and promote the development of international regulations and best practices for the deployment of safe marine carbon dioxide removal methods in the world's oceans.

Domestic Framework

As previously explained, the committee has learned that the alkalinity enhancement projects taking place in Canada are land-based, conducted on the shores of Canadian rivers and harbours. As such, domestic legislation is being used to regulate these projects. For example, a Fisheries and Oceans Canada official explained that

[44] United Nations, *Paris Agreement*, 2015

[45] POFO, *Evidence* (Romany Webb, Deputy Director, Sabin Center for Climate Change Law, Columbia University, as an individual), 5 December 2024.

[46] Government of Canada, *London protocol on prevention of marine pollution*.

[47] POFO, *Evidence* (Neil Craik, Professor of Law, Balsillie School of International Affairs, University of Waterloo, as an individual), 5 December 2024.

[48] Ibid.

[49] Ibid.

small scale, land-based ocean alkalinity enhancement projects would be reviewed by the department pursuant to the *Fisheries Act*[50] using a risk-based approach to assess potential impacts to fish and fish habitat.[51] The department said that scientific, technical and Indigenous knowledge would be used to inform those assessments.

Mike Kelland (Chief Executive Officer, Planetary Technologies) explained that, in regards to the alkalinity enhancement work undertaken by Planetary Technologies: "we need the Canadian government to publicly affirm that processes like ours that work onshore can continue to be regulated domestically rather than under international law. This would mirror a similar declaration from the Environmental Protection Agency, or EPA, in the U.S. [(United States)]."[52]

Canada should assert its sovereignty in this domain and release a similar statement. Doing so will help ensure regulatory predictability and certainty for land-based ocean alkalinity enhancement projects.

Recommendation 4
(CLAIMING SOVEREIGN JURISDICTION OVER THE REGULATION OF LAND-BASED OCEAN ALKALINITY ENHANCEMENT PROJECTS)

The committee recommends that the Government of Canada immediately release a statement that asserts that land-based ocean alkalinity enhancement projects are regulated by existing domestic legislation and regulations.

Budget 2024 announced the Government of Canada's intent "to broaden the use of regulatory sandboxes across government" to "enable innovation by offering limited exemptions to existing legislation and regulations, streamlining the regulatory system, and reforming regulations to modern business realities."[53] This approach, guided by the Policy on Regulatory Sandboxes,[54] could enable innovative land-based marine carbon dioxide removal projects.

The committee heard that various federal and provincial entities are involved in the permitting process for land-based ocean alkalinity enhancement projects and that various acts and regulations are used to monitor and approve these projects. As such, the Government of Canada should undertake work to streamline the application process for land-based marine carbon dioxide removal projects to

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[50] *Fisheries Act*, R.S.C. 1985, c. F-14.

[51] POFO, *Evidence*, 18 November 2025.

[52] POFO, *Evidence* (Mike Kelland), 9 October 2025.

[53] Government of Canada, "*4.3 Growing Businesses to Create More Jobs*," Fairness for Every Generation, Budget 2024.

[54] Government of Canada, *Policy on Regulatory Sandboxes*.

ensure certainty for proponents and to help attract new investments and projects to Canada.

Recommendation 5
(A STREAMLINED APPLICATION PROCESS)

The committee recommends that the Government of Canada streamline the application process for land-based ocean alkalinity enhancement projects (and for other marine and ocean-based projects at a later date), through the use of a new sector-specific regulatory sandbox that includes all federal regulators.

This process would ensure that projects meet all the regulatory requirements prior to approval, but would incorporate the approvals required by all the relevant federal and provincial entities into one streamlined process.

A Canadian Strategy

In order to ensure the development of marine carbon dioxide removal technologies, including land-based ocean alkalinity enhancement technologies, is undertaken in a responsible manner, the Government of Canada must create a strategy that puts guardrails in place for the industry, while also providing a measure of flexibility as the industry grows and evolves (i.e., a regulatory sandbox). The following are some of the elements needed to ensure Canada's strategy is both robust and enabling.

A Research Strategy

The committee heard that many research gaps exist in the study of ocean-based marine carbon dioxide removal methods. In an effort to focus research and research proposals, Na'im Merchant (Executive Director, Carbon Removal Canada) suggested the following:

> *"[E]stablish a federally led research road map. We've heard repeated calls for 'more research' before proceeding, but there's rarely clarity about what 'more' actually means. Which specific topics need investigation? What studies would answer outstanding questions? What are the ultimate goalposts?*

> *This vagueness creates perpetual delay. The federal government should take an active role by deploying its own researchers and funding in partnership with academia and industry. We need specific milestones, defined timelines and clear success criteria — not open-ended investigation."*[55]

Additional science and research are needed now. Canada should help guide science and research by first developing a research strategy for the land-based ocean alkalinity enhancement sector (and later, for the ocean-based marine carbon dioxide removal sector more broadly).

Recommendation 6
(A LAND-BASED OCEAN ALKALINITY ENHANCEMENT RESEARCH STRATEGY)

The committee recommends that the Government of Canada, in collaboration with relevant stakeholders, establish a marine carbon dioxide removal and storage research strategy specific to land-based ocean alkalinity enhancement projects. This strategy would identify the research questions that must be answered in order to ensure that land-based ocean alkalinity enhancement technologies are: 1) safe for ecosystems; 2) effective at storing carbon; 3) scalable; and 4) producing high quality and marketable carbon credits.

The strategy should focus research and research funding, ensure scientific rigour, help industry move forward and adjust when required, and increase the social licence of the industry. The strategy should also be accompanied by appropriate Government of Canada support to ensure the continued existence and improvement of Canada's centres of excellence for ocean research.

A Monitoring, Reporting and Verification Protocol

While appearing before the committee, a Natural Resources Canada official highlighted two important factors in determining the effectiveness of a marine carbon dioxide removal method: 1) the ability to measure, report, and verify the amount of carbon captured and stored; and 2) the ability to determine the permanence of the storage.[56]

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[55] POFO, *Evidence* (Na'im Merchant, Executive Director, Carbon Removal Canada), 21 October 2025.

[56] POFO, *Evidence* (Amanda Wilson, Director General, Office of Energy Research and Development, Natural Resources Canada), 28 November 2024.

Recommendation 7
(DEVELOPING A ROBUST MONITORING, REPORTING AND VERIFICATION PROTOCOL)

The committee recommends that the Government of Canada, in order to help build public confidence and an effective carbon market, develop a robust monitoring, reporting and verification protocol (MRV protocol). This MRV protocol should help ensure that marine carbon dioxide removal projects can effectively measure the amount and permanence of the carbon it captures and stores.

Neil Craik (Professor of Law, Balsillie School of International Affairs, University of Waterloo, as an individual) explained that MRV protocols ensure that "carbon removal claims have integrity."[57] On the specific subject of ocean alkalinity enhancement and the effectiveness of its carbon storage, Helen Gurney-Smith (Research Scientist, Fisheries and Oceans Canada and Canadian Ocean Acidification Community of Practice) explained that:

> *"Ocean alkalinity enhancement is one of the different mCDR [(marine carbon dioxide removal)] options that are being considered. In general, it is considered a form of mCDR that could lead to durable storage, so it's storage which is over hundreds of thousands of years, which is what we really need to be doing for long-term carbon storage and for climate mitigation."*[58]

A robust MRV protocol will enable land-based ocean alkalinity enhancement projects (and other marine carbon dioxide removal projects) to monitize carbon removal by enabling proponents to guarantee carbon removal efficacy and longevity.

In a brief provided to the committee, Ocean Networks Canada noted that its "large-scale ocean infrastructure is being utilized to conduct research and develop monitoring, reporting, and verification for the six mCDR [(marine carbon dioxide removal)] approaches," including ocean alkalinity enhancement.[59] Ocean observatories, such as those operated by Ocean Networks Canada, could serve as data sources that feed into Canada's MRV protocol.

[57] POFO, *Evidence* (Neil Craik), 5 December 2024.

[58] POFO, *Evidence*, (Helen Gurney-Smith), 21 October 2025.

[59] POFO, *Brief* (Ocean Networks Canada), 28 October 2025

A Collaborative Task Force

The marine carbon dioxide removal sector could get lost in the machinery of government in Canada or, it could be stalled by either a lack of attention or an overly burdensome regulatory framework. It would be regrettable if this were to happen to such a promising sector. It will be important to overcome these risks, given the climate crisis and the need to reduce our climate footprint in an economically responsible manner.

As mentioned earlier, Canada should regulate its land-based carbon dioxide removal projects using existing domestic acts and regulations. However, Canada must establish a regulatory and communication framework for the ocean-based sector to build and maintain social licence, but it must not stifle innovation. The framework must be nimble and enable and support the development of promising, safe ocean-based carbon dioxide removal technologies.

In addition, the Government of Canada does not seem to have the capacity to lead the development of such a regulatory framework at the present time, nor does it seem interested in doing so. In fact, when Environment and Climate Change Canada officials appeared before the committee, they explained that the department is taking an "actively neutral" position regarding marine carbon dioxide removal.[60] In addition to being an ambiguous term, this is not a productive stance for the Government of Canada to take if Canada is to strive to be a global leader in the sector.

Too often, federal, provincial, and territorial departments and agencies do not communicate well with each other. They also are not known for communicating well with stakeholders, such as Indigenous governments, local communities, ocean users, and other knowledge holders. This will make working towards a common goal, such as the development of a regulatory framework, very difficult to achieve.

The United States' National Marine Carbon Dioxide Removal Research Strategy

In September 2023, the Fast Track Action Committee on Marine Carbon Dioxide Removal (also known as mCDR FTAC) was established "to provide overall guidance and direction regarding marine carbon dioxide removal science and policy" to the National Science and Technology Council.[61] The mCDR FTAC was a cross-departmental committee, with members representing a dozen United States departments, including

[60] POFO, *Evidence*, 28 November 2024.

[61] Office of the President of the United States, *National Marine Carbon Dioxide Removal Research Strategy*, November 2024.

the Department of the Interior, the National Oceanic and Atmospheric Administration, the Department of Energy, and the Environmental Protection Agency, all sharing information and working towards a common goal.

In November 2024, the Office of the President of the United States published the country's National Marine Carbon Dioxide Removal Research Strategy. The Strategy sets overall objectives and highlights "goals, principles, and recommendations that will responsibly produce sound science to guide future decision-making" as it relates to marine carbon dioxide removal research and methods in that country.[62]

Given this example, Canada should learn from the United States' mCDR FTAC and establish a similar multi-departmental task force. It could provide advice and direction to the Government of Canada regarding the development of a marine carbon dioxide removal regulatory framework, with a specific emphasis on land-based ocean alkalinity enhancement. This task force could also help develop a streamlined application process for land-based marine carbon dioxide removal projects (and for ocean-based projects at a later date).

Recommendation 8
(ESTABLISHING A MARINE CARBON DIOXIDE REMOVAL TASK FORCE)

The committee recommends that the Government of Canada champion a multi-departmental and multi-organizational task force, composed of representatives from federal, provincial, and territorial departments and agencies and other relevant stakeholders and knowledge holders, to work towards the development of a marine carbon dioxide removal regulatory framework for Canada. The regulatory framework should be in place by the end of the 2027 calendar year.

Canada as a Leader

The committee heard from multiple witnesses that Canada is seen as a global leader in the development of marine carbon dioxide removal technology. Canada must now strive to be a global leader in the implementation and regulation of this technology.

[62] Ibid.

For example, Shannon Sterling (Associate Professor, Dalhousie University and Founder, CarbonRun) explained that Canadians are "well positioned to be leaders in this field due to our natural resources, the talent and the expert leadership, scientifically and with the companies; we really are a hot spot with carbon dioxide removal innovation here."[63] Amanda Wilson (Director General, Office of Energy Research and Development, Natural Resources Canada) confirmed this by saying that Canada "punch[es] above [its] weight in terms of innovation in the carbon management space."[64]

Tom Heintzman (Managing Director and Vice-Chair, Energy Transition and Sustainability, CIBC Capital Markets) spoke to the potential economic benefits by noting that "[w]ith our abundance of rivers and thousands of miles of shoreline and our academics who are researching the topic in depth, Canada is well positioned to be a leader and even export our skills and technology internationally."[65]

A July 2025 document from Canada's Ocean Supercluster estimated that a marine carbon dioxide removal "industry operating on scales of tens of millions of tons of CO_2 removed each year would represent a significant new marine industry."[66] If ideal conditions were to be established (understanding that this could only occur many years into the future), the document "estimates that the new industry would provide up to almost 100,000 jobs across Canada [and] contribute $7-20 billion to its total GDP [gross domestic product]."[67]

In October 2024, the Government of Canada announced that it would purchase carbon dioxide removal services in an effort to "green government operations and achieve net-zero emissions."[68] In the announcement, the President of the Treasury Board and Minister of Transportation explained that $10 million in carbon removal services would be purchased as part of the Greening Government Strategy by 2030.

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[63] POFO, *Evidence* (Shannon Sterling, Associate Professor, Dalhousie University and Founder, CarbonRun), 21 November 2024.

[64] POFO, *Evidence* (Amanda Wilson), 28 November 2024.

[65] POFO, *Evidence* (Tom Heintzman, Managing Director and Vice-Chair, Energy Transition and Sustainability, CIBC Capital Markets), 12 December 2024.

[66] RMI, "Executive Summary: The Potential for Marine Carbon Dioxide Removal in Canada," *Canada's Ocean Supercluster*, July 2025.

[67] Ibid.

[68] Government of Canada, "Government of Canada commits to purchase carbon dioxide removal services to green government operations and achieve net-zero emissions," *News release*, 9 October 2024.

The committee applauds this commitment and suggests that, in order to show leadership and confidence in Canada's promising land-based ocean alkalinity enhancement sector, the Government of Canada purchase carbon services (i.e., credits) produced by this emerging sector as part of its Greening Government Strategy.

Caution came from several witnesses, including William Burt (Adjunct Professor, Department of Oceanography, Dalhousie University and Chief Ocean Scientist, Planetary Technologies) when he said that "we now hold the position as leaders, but the rest of the world is waking up quickly to the opportunities."[69] Similarly, David Koweek (Chief Scientist, Ocean Visions) warned that marine carbon dioxide removal activities also take place in the United States, China and Europe.[70] Mike Kelland (Chief Executive Officer, Planetary Technologies) warned that Japan and the European Union are working to implement ocean-based pathways into their carbon removal regulatory frameworks and policies.[71]

For Canada to move towards being a leader, the federal government must help the sector develop efficiently and safely through the development of a national strategy.

Recommendation 9
(CREATING A NATIONAL MARINE CARBON DIOXIDE REMOVAL STRATEGY)

The committee recommends that the Government of Canada position the country as an industry world leader in marine carbon dioxide removal, by establishing a national strategy for the sector that includes an evidence-based, agile approach to permitting, monitoring, measurement, investment and reporting.

Canada must take the lead and spearhead this sector by implementing a "made in Canada strategy" that:

- Focusses on implementing only the safest and most reliable marine carbon dioxide removal methods, as confirmed by independent science and research.
- Includes local communities, ocean users, Indigenous peoples and other knowledge holders through genuine consultations that occur early and frequently.

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[69] POFO, *Evidence* (William Burt), 21 November 2024.

[70] POFO, *Evidence* (David Koweek), 31 October 2024.

[71] POFO, *Evidence* (Mike Kelland), 21 November 2024.

- Encourages scientists to conduct research in Canada by developing a sector-specific research strategy.
- Ensures the highest quality carbon removal credits through the use of a robust monitoring, reporting and verification (MRV) protocol.
- Attracts investment in Canadian technologies through the development of a regulatory framework and a streamlined application process for land-based ocean alkalinity enhancement projects (and for other marine and ocean-based projects at a later date).

Conclusion

The committee hopes that this report can help inform Canadians about marine (and ocean) carbon sequestration. The Government of Canada must support the responsible growth of the sector and must help Canadians learn about it as a means of mitigating the effects of climate change.

The committee expects that successful land-based ocean alkalinity enhancement projects and the lessons-learned from small scale projects can be used as catalysts for future research and marine carbon dioxide removal pilot projects in the ocean environment. The next step would be the study of ocean alkalinity enhancement in ocean ecosystems. The onus for this next step will also rest on the Government of Canada to spearhead, regulate and guide.

As noted in a brief provided to the committee:

> *"Canada stands at a pivotal moment in its climate journey...With the right policies, funding, and collaboration, Canada can lead the world in deploying scalable, effective carbon solutions."*[72]

The committee could not agree more.

[72] POFO, *Brief* (Exterra Carbon Solution), 11 December 2024.

Appendix A – Witnesses

Thursday, October 31, 2024

Christopher Algar, Associate Professor, Department of Oceanography, Dalhousie University, as an individual

Carly Buchwald, Associate Professor and Canada Research Chair in Ocean Chemistry, Dalhousie University, as an individual

Edmund Halfyard, Co-Founder, Chief Technology Officer, CarbonRun

David Koweek, Chief Scientist, Ocean Visions

Thursday, November 7, 2024

Galen McKinley, Professor, Earth and Environmental Sciences, Columbia University, as an individual

Anya Waite, Chief Executive Officer and Scientific Director, Ocean Frontier Institute

Thursday, November 21, 2024

William Burt, Adjunct Professor, Department of Oceanography, Dalhousie University and Chief Ocean Scientist, Planetary Technologies

Kimberly Gilbert, Co-Founder and Chief Executive Officer, pHathom Technologies

Mike Kelland, Chief Executive Officer, Planetary Technologies

Shannon Sterling, Associate Professor, Dalhousie University and Founder, CarbonRun

Thursday, November 28, 2024

Nicole Coté, Director General, Environmental Protection Operations, Environment and Climate Change Canada

Greg Flato, Director, Climate Research, Environment and Climate Change Canada

Jason Gadoury, Senior Director, Office of Energy Research and Development, Natural Resources Canada

Saviz Mortazavi, Director, Office of Energy Research and Development, Natural Resources Canada

David Taillefer, Acting National Manager, Marine Programs, Environment and Climate Change Canada

Amanda Wilson, Director General, Office of Energy Research and Development, Natural Resources Canada

Thursday, December 5, 2024

Neil Craik, Professor of Law, Balsillie School of International Affairs, University of Waterloo, as an individual

Na'im Merchant, Executive Director, Carbon Removal Canada

Ken Paul, Member of the Wolastoqey Nation at Neqotkuk, as an individual

Romany Webb, Deputy Director, Sabin Center for Climate Change Law, Columbia University, as an individual

Thursday, December 12, 2024

Tom Heintzman, Managing Director and Vice-Chair, Energy Transition and Sustainability, CIBC Capital Markets

Stephanie Hewson, Staff Lawyer, West Coast Environmental Law Association

Paul Snelgrove, Research Professor, Department of Ocean Sciences and Biology Department, Memorial University of Newfoundland, as an individual

Thursday, October 9, 2025

Kimberly Gilbert, Co-Founder and Chief Executive Officer, pHathom Technologies

Edmund Halfyard, Co-Founder, Chief Technology Officer, CarbonRun

Mike Kelland, Chief Executive Officer, Planetary Technologies

Tuesday, October 21, 2025

Helen Gurney-Smith, Research Scientist, Fisheries and Oceans Canada and Canadian and Ocean Acidification Community of Practice

Diane Hoskins, Director, Global Policy, Carbon to Sea Initiative

Na'im Merchant, Executive Director, Carbon Removal Canada

Thursday, October 30, 2025

Abed El Rahman Hassoun, Scientist, GEOMAR Helmholtz Centre for Ocean Research Kiel

Anya Waite, Chief Executive Officer and Scientific Director, Ocean Frontier Institute

Tuesday, November 18, 2025

Jason Gadoury, Senior Director, Office of Energy Research and Development, Natural Resources Canada

Cynthia Handler, Director General, Office of Energy Research and Development, Natural Resources Canada

James Manicom, Acting Senior Director, Major Projects and Clean Growth, Aquatic Ecosystems, Fisheries and Oceans Canada

David Taillefer, National Manager, Marine Programs, Environment and Climate Change Canada

Daniel Wolfish, Director General, Environmental Protection Operations, Environment and Climate Change Canada

Nick Xenos, Executive Director, Centre for Greening Government, Treasury Board of Canada Secretariat

Appendix B – Briefs and Supplementary Evidence

Amanda Wilson, Office of Energy Research and Development, Natural Resources Canada

Diane Hoskins, Global Policy, Carbon to Sea Initiative

Exterra Carbon Solutions

Ocean Networks Canada