Carbon to Sea Initiative

October 21, 2025

Senator Fabian Manning
Chair
Standing Senate Committee on Fisheries and Oceans
The Senate of Canada, Ottawa, Ontario
Canada, K1A 0A4

Senator Bev Busson
Deputy Chair
Standing Senate Committee on Fisheries and Oceans
The Senate of Canada, Ottawa, Ontario
Canada, K1A 0A4

Re: Standing Senate Committee on Fisheries and Oceans Report on Ocean Carbon Sequestration

Dear Chairman Manning and Deputy Chairman Busson:

Thank you for the opportunity to submit written testimony. My name is Diane Hoskins and I am the Director of Global Policy at Carbon to Sea Initiative. We are the largest non-commercial initiative evaluating if and how ocean-based carbon dioxide removal (oCDR) could be part of the global response to climate change. I've spent my career at the intersection of climate change, ocean conservation, and policy – so getting this right for our ocean environment and our climate is at the center of what motivates my work.

At Carbon to Sea, we work closely with academic institutions, the private sector, civil society, and First Nations to fund scientific efforts aimed at assessing the potential of one particular oCDR approach: ocean alkalinity enhancement, or OAE.

We explored multiple potential carbon removal solutions before deciding to focus on accelerating the evaluation of OAE. Our focus on OAE is rooted in the fact that leading scientists have independently identified OAE as a high-potential solution – including the National Academies of Sciences in the United States.

Our research program and grantmaking centers on rigorously answering three questions: Is it safe for people and the environment? Is OAE effective at removing legacy carbon from the atmosphere? And can it scale to be a climate-relevant solution?

As a philanthropy-backed non-profit, Carbon to Sea is entirely outcome agnostic. If the research we fund shows that OAE is not effective, safe, or scalable, we would also consider this a success because it would free us up to explore other promising ocean-climate solutions.

We're grateful for this committee's focus on ocean carbon sequestration and its commitment to protecting Canada's waters. Few nations are better positioned to lead in this work. With world-class researchers, a strong innovation culture, and governments at every level committed to climate action, Canada's coasts can become a global hub for responsible ocean-based carbon removal. We appreciate the chance to share why this underexplored field — and OAE in particular — deserves greater attention and support.

There are three key points this Committee should know about ocean-climate solutions:

1. Carbon Removal is a Necessary Complement to Emissions Reductions: Major scientific bodies, including the IPCC, have concluded that deep emissions cuts alone will not be enough to prevent the worst effects of climate change and meet climate goals. The world must also remove carbon at a gigaton-scale this century. In all credible scenarios, carbon removal is essential alongside rapid decarbonization to address legacy emissions.

2. Governments have a unique role to play in shaping oCDR: Today, private and philanthropic investment is driving most ocean-based carbon removal research but evaluating oCDR is a public-interest endeavor at its core. Governments have a critical role to play in steering responsible research, setting clear rules, and ensuring the field develops with transparency, safety, and the public good in mind. That is especially true in the ocean, a shared global resource where public trust and stewardship are paramount.

3. Canada can lead by supporting research, development, and demonstration: Through its Greening Government strategy and the Treasury Board's plan to procure carbon removal services, Canada is already showing foresight and adopting a forward-looking posture on climate. But with the longest coastline in the world, world-class research institutions, and a robust ocean-based economy, it has a huge opportunity to deepen its leadership by focusing on and advancing responsible research and development of ocean-based climate solutions. That means: 1) dedicating public funding to support OAE research and development efforts; 2) ensuring the Treasury Board's upcoming RFP advances oCDR eligibility for approaches deemed appropriate; 3) establishing specific carbon removal targets; and 4) expanding investment tax credits to incentivize private sector investments.

CDR IS A NECESSARY COMPLEMENT TO EMISSIONS REDUCTION

Eliminating reliance on fossil fuel use is the top priority to slow global warming. At the same time, the world's leading scientific bodies say we must develop and responsibly scale CDR to draw down legacy carbon emissions from the atmosphere. According to the Intergovernmental Panel on Climate Change (IPCC), CDR "is required to achieve global and national targets of net zero CO_2 and greenhouse gas emissions. CDR cannot substitute for immediate and deep emissions reductions, but it is part of all modeled scenarios that limit global warming to 2° or lower by 2100." The International Energy Agency similarly reports that CDR must account for 8 percent of emission reductions in order to meet the goals outlined in the Paris Agreement. The High Level Panel for a Sustainable Ocean Economy - which Canada is a Member of - estimates that in the 21st century, the world will need between 100 to 1,000 gigatons of carbon dioxide removal, depending on how fast emissions are reduced.

OCEAN-BASED CDR IS AN UNDEREXPLORED OPTION

oCDR stands out as a particularly promising pathway to unlock both the economic and climate benefits of carbon removal because **the ocean is already the world's largest carbon sink, holding about 50 times more carbon than the atmosphere** and because the ocean covers more than 70 percent of the planet. In short, the ocean already removes carbon dioxide from the atmosphere every day at a massive scale. Can it remove more, safely and at scale? There are strong reasons to think so, including one estimate from the High Level Panel for a Sustainable Ocean Economy, which said ocean alkalinity enhancement could remove as much as 3GT of carbon dioxide per year by 2050 if proven safe, effective, and scalable.

The oceans are slightly alkaline as a result of a natural geological process in which alkaline rocks wash into the sea and dissolve over time. This increase in alkalinity causes a chemical reaction that converts dissolved carbon dioxide into carbonates and bicarbonates. That chemical reaction in turn allows the ocean to absorb more carbon dioxide from the atmosphere. The converted carbon dioxide is stored in the ocean for tens of thousands of years, making this geological process effectively permanent.

If we accelerate this process without creating adverse effects on the larger ecosystem, we could remove billions of tons of atmospheric carbon dioxide. That's the theory behind OAE, which Carbon to Sea is focused on evaluating.

The concept of adding alkalinity to water has been used for decades to improve the productivity of shellfish hatcheries and to reduce acidification in rivers. Recent laboratory[1] [2] [3] [4] studies and controlled outdoor research efforts,[5] [6] which simulate real-world conditions[7] on a smaller scale, show that while there are upper limits as to how much OAE

should be done in any particular place,[8] [9] OAE can theoretically be done in effective,[10] [11] [12] safe,[13] [14] [15] and responsible[16] [17] [18] ways.

CDR'S ECONOMIC POTENTIAL

oCDR represents a climate opportunity, and over time it could also contribute to economic growth. Estimates vary, but all signs point to the fact that by mid-century, oCDR will be a major industry — between $259 billion (Rhodium Group), to $1 trillion (Bloomberg) or $1.2 trillion (McKinsey).

For Canada, a recent feasibility study funded by CTS and other partners estimates that the mCDR industry could provide nearly 100,000 jobs across Canada. It could contribute $7-20 billion to Canada's GDP, representing about 40% of the current scale of Canada's ocean economy. For context, Canada's electricity utility sector currently employs about 100,000 people and contributes $35 billion to Canada's GDP. If pursued, Canada's ocean-based CDR could approach the economic scale of today's electricity utilities in jobs and GDP by 2050.

U.S. ACTION ON MARINE CDR

The United States has taken a series of steps to advance ocean-based CDR over the last several years. Despite recent shifts in U.S. policy, a number of these actions offer insight into how Canada could pursue research, development, and policy incentives to identify safe and effective oCDR approaches, and advance their technological readiness to contribute to the nation's climate goals. We hope that they will also show the potential for future collaboration between our governments and our scientific communities.

Last year, the U.S. Department of Energy launched a $35 million Carbon Dioxide Removal Purchase Pilot Prize with the goal of awarding up to $35 million to teams working on innovative CDR technologies, providing them incentives to further develop their technologies and eventually provide CDR credits through offtake agreements to the DOE.

In May of 2024, four OAE companies (Crew Carbon, Ebb Carbon, Equatic, and Vycarb) were among the winners of the first round of competition to deliver verified CDR credits to the DOE. While this program is now currently stalled, it's notable that DOE was reviewing OAE-related companies' readiness for contracts. This effort ties in well with the Treasury Board of Canada Secretariat (TBS) effort to procure permanent carbon removals in support of the Greening Government strategy, which is addressed in more detail below.

In September 2024, the U.S. House of Representatives held a hearing to evaluate research and development needs for oCDR. There was also bipartisan legislation

introduced jointly in the U.S. House and Senate in late 2024 to strengthen U.S. leadership in oCDR research and development.

In November 2024, the White House published a National Marine Carbon Dioxide Removal Research Strategy, which set a government-wide framework for safe, responsible research after robust public consultation and all-of-government coordination. Its objectives were to:

- Promote responsible, interdisciplinary research to answer key questions about safety and efficacy
- Prioritize approaches that show the greatest potential for safety and efficacy
- Ensure efficient and effective permitting of research, and
- Promote coordination and foster dialogue across the diverse sectors and communities with an interest in oCDR.

In the past two years, the U.S. has begun permitting OAE field research at both the federal and state levels. In 2024, Vesta received a first-of-its-kind permit for a standalone oCDR pilot from the North Carolina Department of Environmental Quality and the U.S. Army Corps of Engineers. Vesta began their small-scale, highly monitored pilot to place olivine sand off the coast of Duck, North Carolina in 2024 – the project includes a three-year monitoring period.

Subsequently, this year, the U.S. Environmental Protection Agency (U.S. EPA) issued the first ever oCDR permit to the Woods Hole Oceanographic Institution for ship-based scientific research on ocean alkalinity enhancement, with the successful trial taking place in August in the Gulf of Maine. And for coastal outfalls, Ebb Carbon received a first-of-its-kind, two-year permit from the State of Washington's Department of Ecology for Ebb's electrochemical oCDR pilot project.

These early steps in the U.S. demonstrate how projects can meet rigorous federal and state environmental regulations. And they offer insights for how Canada could approach responsible advancement of oCDR technologies, consistent with its strong national climate laws and environmental protection policies.

CANADA'S EXISTING oCDR LANDSCAPE

Canada is already a fast-growing hub for ocean-climate research and development. In Halifax, researchers from Dalhousie University and start-up Planetary Technologies recently conducted the first OAE field trials in Canadian waters. They've also built a powerful regional ocean modeling tool to forecast oceanographic conditions in support of future field research.

Building on that research, Frontier, a consortium of companies that have committed to purchase over US$1billion in permanent carbon removal by 2030, announced offtake agreements to purchase more than $30 million in OAE carbon removal credits from Planetary. This is in addition to offtakes with two additional Canadian companies: CarbonRun, which secured more than $25m in offtake agreements from Frontier and pHathom, which also has an initial purchase agreement. These initial offtake agreements provide these companies the financing to conduct critical in-water field trials - research - that is vital to understanding whether OAE can eventually be deployed safely and effectively at large scales.

On the West coast, Vancouver-based Open Ocean Robotics is pioneering new remote monitoring technology that is already being used for OAE research in Iceland and offers potential to significantly advance ocean-climate research and to deepen scientific understanding of our oceans.

Building on this strong foundation, Canada has high potential for future research and development. In early global modeling studies, East and West Coast Canadian waters show promising results on efficiency of CO2 uptake. This finding, in addition to world-class research institutions with capacity for long-term carbonate chemistry monitoring, a robust ocean-based economy, and workforce expertise from shipping, offshore energy, and fishing, uniquely position Canada to lead in OAE research and development.

CANADA'S OPPORTUNITY TO BECOME A GLOBAL LEADER on OCDR

Right now, Canada has a window to boost research and development for OAE and become a global leader in ocean-related climate solutions. And it has an imperative to lead, given the fact that leading scientists say carbon removal has a role to play in avoiding the worst impacts of climate change in the decades ahead.

The philanthropic and private sectors are currently driving research and development, but the public sector has a crucial role to play by ensuring research proceeds transparently and in the public interest. In the U.S., the National Academies of Sciences estimated that funding for R&D needs to rise to about $301.5 million annually, for a ten-year investment of $2.41 billion. Governments have an essential role to play in helping fill this funding gap, ensuring research meets public interest, and creating an enabling regulatory environment for responsible research to understand whether OAE can fulfil its' potential.

It's important to note that Canada has already taken action to develop a responsible domestic market for carbon removals by expanding its Greening Government strategy to include the purchase of CDR services. The Treasury Board of Canada Secretariat is

developing a request for proposals (RFP) for the purchase of at least $10 million in CDR services through 2030.

Carbon to Sea submitted comments to the Board strongly urging it to advance a broad suite of high-integrity CDR pathways. The experience gained with diverse project types, including OAE, through voluntary government procurement will equip regulators to establish the rigor and integrity required for future compliance markets. This program will provide vital financial support for promising technologies in the development phase, and it will allow the government to gain valuable knowledge and experience with the wide range of CDR technologies that will be needed to meet Canada's climate goals. The RFP has been delayed and we urge the Board to move quickly to keep this project on track while ensuring that oCDR approaches are eligible when deemed appropriate.

What would even stronger action look like? The most important task to accelerate responsible evaluation of OAE is to provide adequate public sector funding. In Canada, that means:

- Expanding investment tax credits to cover a wider range of CDR technologies, including oCDR;
- Establishing specific carbon removal targets in addition to emission reductions; and
- For those approaches that prove safe and effective, consider development of protocols for participation in the Greenhouse Offset Credit System.

Canada has the resources, talent, and the coastline to lead the world in responsibly advancing oCDR. But every year the world waits to evaluate these technologies, we lose valuable time to understand which ocean-based solutions are safe, effective, and scalable.

If Canada steps forward now, it can help set the global standard for responsible oCDR while protecting its coasts, creating potentially thousands of jobs, and contributing to the global effort against climate change. By investing in research, clarifying regulations, and aligning climate and ocean policy, Canada can safeguard its marine ecosystems while unlocking a new pillar of its blue economy.

I appreciate the opportunity to submit this testimony. Please do not hesitate to contact me should you have any questions or need any further information.

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

Key Sources

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