HOUSE OF COMMONS
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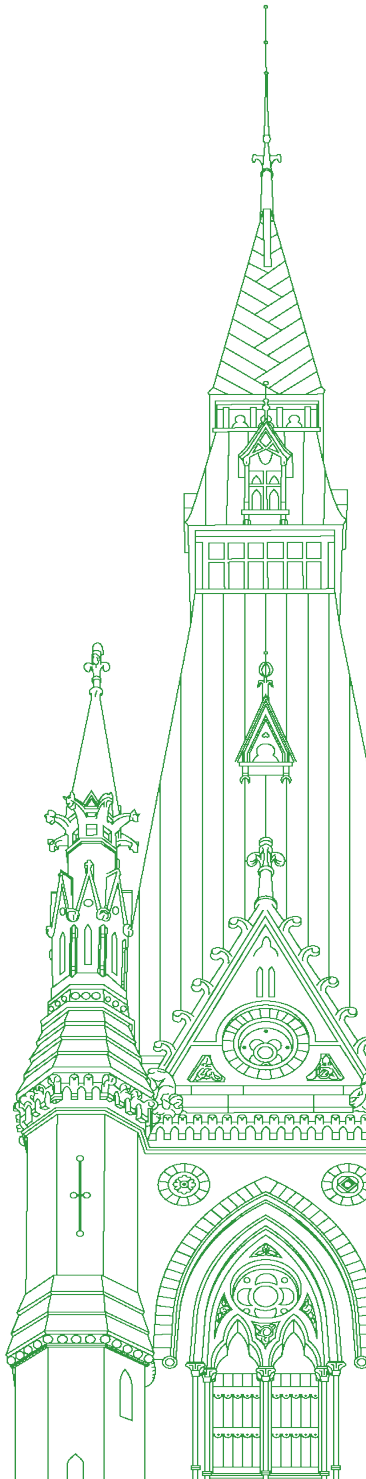
45th PARLIAMENT, 1st SESSION

Standing Committee on Environment and Sustainable Development

EVIDENCE

NUMBER 053

Thursday, October 29, 2026



Chair: Shannon Miedema

Standing Committee on Environment and Sustainable Development

Thursday, October 29, 2026

● (1535)

[*English*]

The Chair (Shannon Miedema (Halifax, Lib.)): I call the meeting to order. Good afternoon, everybody.

Welcome to the 53rd meeting of the Standing Committee on Environment and Sustainable Development.

To our witnesses who are appearing in person, please remember to follow the health and safety guidelines, as per the cards on the table, to prevent audio and feedback incidents for our translators.

Today we're focused on our study of carbon capture, utilization and storage technologies. We have a series of witnesses for both hours.

We're going to begin with David Keith, professor of geophysical sciences from the University of Chicago, who is with us online. Welcome.

We have Miriam Zitner here in person. She's the general manager, Canada, in the Carbon to Sea Initiative.

We also have Alastair Jarvis, vice-president, external affairs, with pHathom Technologies Inc.

You're each going to have five minutes to provide some opening remarks, and then we'll move to questions by committee members. If it's helpful, I do have time cards. I will show you the card that shows when you have one minute remaining and then show you when the time is up. When you see the card, you don't have to instantly stop, but try to wrap up and conclude. I'll use these throughout the questioning as well.

We will begin online with David Keith for five minutes.

The floor is yours. Thank you.

David Keith (Professor, Geophysical Sciences, University of Chicago, As an Individual): Thank you very much.

I'm David Keith. I'm a Canadian based in Canmore, Alberta, but I'm speaking to you today from the University of Chicago, where I lead the climate systems engineering initiative, which is perhaps the most ambitious effort at a big research university to build climate engineering as a field. That includes open-system carbon removal.

I've worked in climate more or less full time since 1990. In the early 2000s, I was one of the first people to realize that combining biomass energy with carbon capture and storage would produce something radically new—a power plant that could remove carbon dioxide from the atmosphere and move the carbon to long-term storage. I and others helped to push these ideas and other methods into the climate policy system through the IPCC, and they were adopted into models of energy decarbonization.

In 2009, still as a professor at University of Calgary, I founded Carbon Engineering, which became one of the major companies working on direct air capture. The plant using that technology would capture half a million tonnes a year from the air and is now commissioning in west Texas. That company was sold, and I'm no longer involved in it.

About a decade ago, climate modelers tasked with assessing how the world might meet the newly signed Paris commitment to a goal of 1.5°C relied on models that had the biomass energy with CCS. This is technology that I and others had worked on. Because those models showed a huge reliance on these, this catapulted carbon removal into the mainstream, and it became a hot topic among businessmen and politicians concerned with climate change.

An academic idea, if you like, had gone from obscurity to, I think, some overhype within about a decade. The overhype brought sensible criticism that carbon removal served industry and the status quo by holding out the promise that climate commitments could be met by substituting vague promises of future removals for emissions cuts today.

Now, as the carbon removal bubble is somewhat deflating, it's easy to dismiss the technology. My view is that this dismissal would be a mistake, because carbon removal is a unique tool in the climate solutions tool box. It's the only way that we can move the atmosphere back towards its pre-industrial state, making the atmosphere more like that in which humans and every species now alive evolved. I see it, then, as an essential part of the climate tool box if we wish to help to restore the natural world back from these impacts.

What should Canada do to advance carbon removal? I just got invited to do this on the last day. My understanding is that the topic here is carbon removal, but it sounds like maybe it's more about carbon capture and storage, which I have also worked on, but it is not what I'm addressing most now.

My view is that large-scale deployment of carbon removal makes little sense until the latter half of this century, when emissions have been substantially reduced. In the near term, our focus should overwhelmingly be on cutting emissions, and the goal for the next few decades for carbon removal should be not to deploy the technology at scale but to figure out which carbon removal technologies could be scaled up to this gigatonne-a-year scale with acceptably low cost and low environmental impacts while we maintain the focus on cutting emissions.

Much of the current policy framework supporting carbon removal aims to help various small companies grow gradually into larger markets, and this is complemented with funding for academic research. I'm somewhat skeptical of this framework. The niches, which make sense for small companies to develop under these current voluntary and other carbon markets—however well intentioned, however hard people work at them—may not do that much to advance the learning needed to enable large-scale, environmentally sound CDR later in the century. Academic research is often far too dominated by theory and is insufficiently grounded in practical engineering.

I suggest that Canadian policy-makers who want to advance these technologies rethink this strategy and think hard about how to develop publicly funded efforts towards technology development within environmental constraints. That might look quite different from the current policy environment.

I look forward to answering questions. Thank you.

The Chair: Thank you for that, Mr. Keith.

We will now turn to Ms. Zitner for five minutes.

The floor is yours.

● (1540)

Miriam Zitner (General Manager, Carbon to Sea Canada): Thank you, Madam Chair, for the opportunity provided to offer testimony today.

My name is Miriam Zitner. I'm the general manager of Carbon to Sea Canada. I've spent the last 30 years working with large technology companies, start-ups and governments to bring forward new technologies, most of which have centred around the same questions this committee has about safety, efficacy and the role of government in providing guardrails and support.

By way of background, Carbon to Sea is a non-profit funded by philanthropy. We've granted more than $50 million in the last four years to answer questions about whether the ocean can help address climate crisis through marine carbon dioxide removal.

Whereas carbon capture and storage stops carbon dioxide from reaching the atmosphere, carbon removal takes out what is already there, and ocean alkalinity enhancement—the form of marine carbon dioxide removal we focus on—usually involves adding alkaline minerals to seawater. This mimics the ocean's natural ongoing process of drawing down carbon dioxide from the air and storing it in the ocean for tens of thousands of years.

To be clear, neither carbon capture and storage nor carbon removal are more important than cutting emissions, but the IPCC has been clear that large-scale removal will be required to stabilize the climate.

Today I'd like to share the work that is happening in Halifax, Nova Scotia, to advance OAE—ocean alkalinity enhancement—R and D, which I believe is a model worth replicating across the country.

Carbon to Sea has invested more than a third of our grant funding—roughly $20 million—in R and D initiatives in Halifax. We partner with researchers at Dalhousie University and with ocean innovation institutions like COVE, the Ocean Frontier Institute and MEOPAR. We collaborate closely with our private sector partners, all of whom have strong working relationships, as well as with indigenous communities and our fishing industry.

The results over just a few years have been promising. The research happening in Halifax has shown that rigorous environmental monitoring is possible and that marine carbon dioxide removal can be measured. It's being funded by philanthropy and builds on decades of public investment in ocean research, and private sector buyers have committed $80 million to Nova Scotian start-ups in the field.

In my experience, this kind of collaboration is unprecedented. Together, we're maximizing the impact of existing resources while demonstrating how collaboration for innovation can work: responsibly paced, well governed, transparent and built in Canada.

The scientific community agrees that a portfolio approach to carbon removal will be required to meet our climate goals and protect people, and OAE is regarded as a high-potential approach worth evaluating. As this committee designs policy that will shape carbon management in Canada, we ask that you prioritize partnerships and include marine carbon removal.

I have three recommendations for your consideration.

The first is to include marine carbon removal in your thinking about Canada's carbon management strategy. Where incentives exist for carbon capture and storage, ocean-based storage should also qualify on the same terms, based on outcomes.

Second, seize the opportunity to integrate marine carbon removal with existing investments. This includes the defence industrial strategy's evolution of the ITB framework and the Prime Minister's $82-million OceanEye commitment. Ocean sensors and uncrewed vehicles are already helping to measure carbon removal. There are systems in place that can support the R and D.

Lastly, I would ask the committee to consider the role of provinces in governing local marine carbon removal initiatives. The work in Halifax demonstrates the power of leveraging existing resources. As Environment and Climate Change Canada develops its view on OAE and other approaches, we ask you to consider provincial leadership in advancing federal guidelines and to consider a consolidated access point to permitting and enforcement.

I appreciate the opportunity to provide testimony today. I'm happy to answer any questions you might have.

Thank you.

The Chair: Thank you very much, Ms. Zitner.

We will now turn to Mr. Jarvis for five minutes, please.

Alastair Jarvis (Vice-President, External Affairs, pHathom Technologies Inc.): Madam Chair and members of the committee, thank you for the invitation to appear.

My name is Alastair Jarvis. I'm vice-president of external affairs at pHathom Technologies in Nova Scotia. We capture CO2 from biomass flue gas, react it with limestone and seawater in a closed engineered system to form dissolved bicarbonate and store that bicarbonate in the ocean, where it stays for thousands of years. Think of it as carbon capture and storage where the storage is marine rather than geological.

We're at demonstration scale, and our pilot stores CO2 in tanks today. Our first marine storage is planned in Nova Scotia for late 2027.

Here's why this matters to your study.

Canada's CCUS policy was built around geology and pipelines. Much of our coastal industry has neither. What it has is tidewater. Marine storage gives those facilities a local carbon capture and storage option where today they have none.

Canada has already taken the first step. This month, the Government of Canada selected pHathom for a standing offer for BECCS removals with marine storage under the Isometric standard. As far as we know, it's the first time any government has selected BECCS with marine storage for procurement.

Next comes the path to scale. Solar and batteries became cheap because buyers stuck with them while they were expensive. Carbon removal needs to follow that same curve, and it has 24 years to reach the scale that our climate goals need. We'd like to ask the committee to recommend three more steps to get there.

Ms. Zitner made the general case. Here's what it looks like for one pathway.

First is capital. The CCUS investment tax credit supports carbon stored underground or in concrete. This past spring, the Department of Finance proposed extending it, and budget 2026 lands on November 5. We're asking for a third eligible use: dedicated marine storage, defined by a qualified process, with independent verification, the way concrete is today. The act already designates jurisdictions for geological storage, and the same test could apply to marine storage. Marine storage fits the existing credit, with no new program.

Second is a permitting pathway. ECCC has advised that our process appears to fall outside the London protocol definition of marine geoengineering, and it treats our return water as an industrial effluent under section 36 of the Fisheries Act. Today, there's no permit we can apply for. The onus is on us to show that the discharge isn't harmful. What's missing is a way to review a discharge like ours before it starts.

We'd ask that ECCC and DFO work with interested provinces to build one, with the federal regulator deciding what's safe and a province permitting against those thresholds before a project operates, with monitoring and reporting that show that the carbon stays stored. That's the kind of framework that the minister looks for to designate a province for the credit.

Third is accounting. The IPCC's inventory guidelines, written back in 2006, have methods only for geological storage. The IPCC is writing new guidance on carbon removal now for adoption at the end of 2027. We're asking Canada to make sure the BECCS chapter doesn't foreclose on non-geological storage that is measured and verified under a robust protocol. We aren't asking the IPCC to endorse marine carbon removal. We're asking only to keep the BECCS chapter open to this kind of storage. Canada's own protocols should follow the same principle.

Members, the proposed national electricity strategy sets out to double Canada's electricity supply by 2050, and clean, firm power is the hardest part to build. On our coasts, the biomass plants that can provide it sit in communities that have watched the pulp and paper economy contract around them. Carbon removal is the mechanism that makes firm biomass power economically and environmentally viable. It's also a new export, bringing money from buyers around the world into rural Canada. Canada has said that it intends to be an energy superpower in both clean and conventional energy. This is the clean part. Canada does have what the world wants, and carbon removal can be part of it.

With these three changes, the first plant in Nova Scotia becomes the first of many.

Thank you. I look forward to your questions.

● (1545)

The Chair: Thank you very much, Mr. Jarvis, and thank you to all our witnesses for their testimony.

We'll now turn to questions.

We'll begin with six minutes from the Conservative Party and Mr. Leslie.

Branden Leslie (Portage—Lisgar, CPC): Thank you, Madam Chair, and thank you to our witnesses.

I'll start with you, Mr. Keith.

In July, the Liberal government agreed to give taxpayer support for the ongoing costs of the Oil Sands Alliance Pathways carbon capture project, on top of the existing tax credits to help build it. In your view, at what point do we draw the line on taxpayer subsidies?

David Keith: I don't see a convincing case for taxpayer subsidies or funding for that project, because it's very unlikely that this technology would be successfully exported outside of Canada and build added value to Canada. It's also not a very cost-effective way to cut CO2 emissions.

I understand that in the high politics of the oil sands, this has become an enormously important thing. I should say that I served on one of the original federal committees that led to some of these things a decade and a half ago. However, I see this as a profound political dead end. We will end up spending public money for little long-term gain in Canadian competitiveness.

● (1550)

Branden Leslie: Thank you.

Back in 2010, you warned a parliamentary committee that different government financial incentives made it difficult to determine which technologies reduced emissions at the lowest cost. Today, the government offers a 60% tax credit for direct air capture but only 50% for other carbon capture. As we've heard, it offers even less on the marine front.

What evidence is there that these different rates deliver the greatest emissions reductions for taxpayers, rather than simply allowing government to pick winners and losers?

David Keith: For carbon removal in Canada, I don't think there would be meaningful evidence to say that those were cost-effective.

Branden Leslie: I'll continue on that.

You share the view that taxpayers should be entitled to see exactly how many dollars of government support are being spent for each tonne of emissions reduced.

David Keith: For technologies that are being deployed at scale, meaning for solar, wind and nuclear power, for energy efficiency, we need effective ways to show what the marginal cost is. We're actually doing large-scale reductions, so we need to understand costs.

As for carbon removal, I don't think we're doing carbon removal in practice on a large scale. I think the goal is more to do future cost discovery and also discovery of future environmental impacts so that we can make decisions about how to direct public resources towards this long-term potential of doing large-scale carbon removal.

Branden Leslie: With regard to your earlier point on the deployment versus the research side, I guess you would agree that we need to figure out what the lowest cost is, particularly on the public funding side, for each tonne removed, regardless of the process.

David Keith: No. That's because it's a trade-off. There are several dimensions that matter.

I've been mostly focusing on cost and environmental impacts. Those trade-offs are real. There are ways that are of relatively low cost but that have high environmental impacts, and vice versa. I think both of those factors matter. It's not only dollars per tonne; it's dollars per tonne within the other environment and social constraints we face.

Branden Leslie: Under the carbon tax credit as it exists, a company could promise to capture, say, a million tonnes of CO2 per year. It could receive substantial taxpayer support to build the facility but ultimately may end up capturing only half of the amount that it claimed. However, it wouldn't automatically have to repay any of the credits that enabled the construction of the facility.

Shouldn't taxpayers have some sort of guarantee that they're paying for reduced emissions rather than simply for the cost of building the equipment?

David Keith: I don't know enough about the specifics of that policy now in Canada to comment. I'm sorry.

Branden Leslie: I have one more for you, and then I'm going to throw it over to our other colleagues here.

Let's say the government wants to forge ahead now rather than, as you said, wait and focus on emissions reductions in the meantime. If you had a limited amount of federal funding now, what would you invest in first to achieve the greatest verified emissions reductions?

David Keith: I would respectfully reject the question, or I wouldn't take the job. That is, I don't think it makes sense now to be spending money focused on getting verified reductions under these quite questionable verification protocols. I think it makes sense to be focused on building practical technology pathways within environmental constraints, and I have a bunch of ideas about how to do that.

Branden Leslie: I'll pivot to somebody who I think might take the job.

You mentioned measurable outcomes in your opening. How do we do a better job of measuring actual carbon removed rather than building a process for what we hope will be carbon removed?

Miriam Zitner: There are verification processes already under way. I'm happy to share, at a later time, the Isometric verification protocol.

There are rigorous ways to measure what has happened. Our colleagues from Planetary, who are testifying later, will be able to tell you more about that. I think we would all agree that we're asking for the Canadian government to pay more attention.

If you have questions about measurement and verification reporting, we, from Carbon to Sea, would certainly invite them. Our goal in philanthropy, as philanthropists, is to fund the research required to answer the questions you have.

This is not to send this back your way, but we agree that it is at an early stage. We're looking to try to understand if, and under what conditions, you can scale. To do that, we need to understand what the government thinks about, what it's concerned about and what it would like us to fund with respect to R and D to be able to ask and answer the very questions you have.

● (1555)

The Chair: Thank you very much, Ms. Zitner.

Thank you, Mr. Leslie.

[*Translation*]

Mr. Watchorn, you have the floor for six minutes.

Tim Watchorn (Les Pays-d'en-Haut, Lib.): Thank you, Madam Chair.

Thank you to the witnesses for joining us.

Mr. Keith, what you said is interesting. At the beginning of your presentation, you said carbon capture and removal were part of the tool box the government or industries should use to improve the state of our climate.

I would like you to explain how biomass systems, systems that produce energy using biomass, can use carbon capture to improve their environmental footprint.

[*English*]

David Keith: That is a profoundly hard question. One of the deep challenges is that....

Sustainably harvested biomass can produce energy. When you burn a fuel, you produce CO2, just as if you had burned a fossil fuel, but that CO2 is recaptured when the biomass regrows. Biomass combined with carbon capture and storage captures that CO2 and puts it underground. There's a net transfer from the active biosphere, from fresh CO2 in the atmosphere, to the deep underground.

The challenge is the environmental footprint of biomass extraction, because the climate is just one environmental problem that people face. Another problem is the human appropriation of photosynthesis on the land surface.

Forgive the professor in me, but historically, the environmental impacts from excessive use of biomass have been huge. In the United Kingdom, where the Industrial Revolution started, it transitioned from being dominantly biomass-powered to fossil fuel-powered around the end of the 1700s. That was because they'd essentially cut down a significant fraction of all the standing biomass they had access to.

A real challenge is that while biomass absolutely can work, it inevitably involves trade-offs with other environmental things we might care about. There are other environmental reasons we might like to leave natural systems as undisturbed as possible.

I think we should, most of all, be focusing on energy systems that have a small land footprint. Solar power and nuclear power, for example, have a relatively small land footprint compared to biomass per unit of energy. I'm not saying we should ignore biomass—Canada has a big biomass potential—but we have to think hard about the trade-off between the benefits of reducing net carbon emissions, which is what this committee cares about and what matters for the climate, and other environmental concerns, for which increased biomass use will have other negative environmental impacts.

● (1600)

[*Translation*]

Tim Watchorn: Thank you very much, Mr. Keith.

I'm going to continue on the same topic with Mr. Jarvis.

Mr. Jarvis, you said that your technology uses an inshore biomass system and reinjects the carbon captured into the ocean.

First, I would like you to explain how this technology works.

Second, I would like to understand an aspect related to the pH of water. I know the ocean and the dilution factors are quite significant.

Isn't there a risk of altering the marine or river environment to the point where it is harming the species living there?

How do you deal with those two aspects, one on the technology of transferring biomass to the ocean and the other on the protection of species?

[*English*]

Alastair Jarvis: We capture CO2 from biomass flue gas, react it with seawater and limestone in a closed engineered system and store the result as dissolved bicarbonate in the ocean. Bicarbonate is already the main form that carbon takes in seawater, and we know it stays there for thousands of years. The water that we return carries extra bicarbonate, which is what gives seawater its buffering capacity.

At scale, the effect is tiny, and it isn't something we claim or sell.

I'm tempted to go back to the biomass question in terms of sustainability. Let me start there.

The federal forest sector transformation task force put the problem pretty plainly in the spring, when they said, “No industry player can be profitable using only 30% of a tree.” In Nova Scotia, where I live, when the Bowater mill in Liverpool closed, the low-grade wood lost its market, and that hit sawmills in rural communities pretty hard. Getting more value from every stem cut is what pays for more careful, more expensive forest management.

Under the Isometric standard that we sell under, sustainable sourcing is a yes-or-no test in our supply chain. Feedstock either meets the sustainability criteria audited back to the forest that it came from or generates no credits at all.

I want to be clear. We don't make any carbon claims in the forest for improved forest management. What we pay for is sustainability assurance, which buyers require before they'll accept the removal that we claim at the stack.

I don't know if I have time, but I will answer some of the questions about the work we're doing.

The Chair: You have about 20 seconds.

Alastair Jarvis: I'll leave it there.

I can also talk about what we're doing at the Huntsman Marine Science Centre around ecotoxicology testing, but I'll leave it there for now.

The Chair: Thank you, Mr. Watchorn.

[*Translation*]

Mr. Bonin, you have the floor for six minutes.

Patrick Bonin (Repentigny, BQ): Thank you, Madam Chair.

Mr. Keith, I'd like to discuss a carbon capture and sequestration project, the Pathways Plus project.

Do you think this justifies the increase in gas, oil or oil sands production, as the Prime Minister wants to do?

[*English*]

David Keith: I'm sorry. I'm guessing you said, “justify the production of additional oil and gas”. Is that correct?

[*Translation*]

Patrick Bonin: Yes, that's correct.

● (1605)

[*English*]

David Keith: That's a reasonable fear, but in practice, I think not.

Canada is a small part of the global oil market. There are good reasons that we expect the oil market to peak relatively soon. Those reasons are, most importantly, electric vehicles, but there are other shifts in oil and gas. I think that will be what determines the long-term oil price and, therefore, what happens in Canada.

In the long run, if we want a stable climate, we are obviously going to have to move away from oil and gas and bring its production down toward zero. I think that will be driven by larger market forces and collective decisions that are made about decarbonization.

On this idea of capturing the upstream CO2 from that project, the reason I would not choose to put much effort into that is that our goal as Canadians is to do two things. It's to reduce our own emissions and also to build technologies and companies that can provide value added to the Canadian economy to manage another challenge Canada has, which is relatively low economic productivity growth.

If we develop some technology that is replicable around the world and we can hope to have a sustainable business selling it, that's a plus. I think the problem with the Oil Sands Alliance Pathways project is it's a type of CCS that's unique to that project. It has very high dollars a tonne, and it's not likely to be replicable in other projects.

I want to use the time, while I have it, to say that several people have mentioned Isometric verification. Be careful. Isometric was funded by Lowercarbon Capital. There's a little ecosystem of things funded together that are not truly independent, and there needs to be a cleaner independent review that I don't believe Isometric provides.

[*Translation*]

Patrick Bonin: In the last budget, the Liberal government changed its policy. It promised not to fund or subsidize carbon capture and sequestration in oil production, but it has changed its mind. It now allows subsidies to produce more oil. It subsidizes carbon sequestration and capture to produce more oil. We're talking about enhanced oil recovery.

Do you think it's a good idea to provide subsidies for this type of project?

[*English*]

David Keith: No, I don't think it's a good idea.

[*Translation*]

Patrick Bonin: That's very clear.

The government, meaning the Prime Minister, talks about green oil or carbon-free oil when he talks about expansion projects, such as an oil sands pipeline with a million barrels a day capacity. He says it could be green oil or carbon-free oil because of the Pathways Plus project on carbon capture and sequestration.

What are your thoughts on that? Is it greenwashing?

[*English*]

David Keith: It's complicated. I have both citizenships, but I feel much more Canadian. With the—I'm trying to find a polite way to say it—dangerous, threatening stance of the U.S. government toward Canada, I feel there are good reasons for Canada to look for alternative pathways to export a product. On that basis, I think there are reasons to support the pipeline, even though, in the long run, we will be transitioning away slowly from oil and gas.

What's not clear is whether there's actually a need for it. The existing pipeline can be expanded by at least a few hundred thousand barrels a day, as I understand it, pretty easily. To justify the new pipeline, there would have to be major new investments in increasing production capacity. While I'm not an expert, I am an Albertan and I listen to the oil and gas industry, and it's not clear to me that there's a real, burning interest in doing that. I think that's because it's not obvious that those investments will pay off, given the likely forecast for lower oil and gas prices as we go past peak production.

Overall, I would not vote for that pipeline if there were a referendum, but it's complicated, because there are legitimate reasons that Canada must think very hard about reaching export markets outside the U.S.

[*Translation*]

Patrick Bonin: I think you talked about the Intergovernmental Panel on Climate Change, or IPCC. In the latest IPCC report, there's a graph—I don't know if you've seen it—that compares some renewables in terms of their potential to reduce emissions and costs. If I remember correctly, carbon sequestration and capture, which were compared in this graph, had a much lower potential and a much higher cost than those associated with renewable energy, for example.

Can funding carbon capture and sequestration projects hinder other pathways, such as those supported by renewable energy, which could be more worthwhile?

● (1610)

[*English*]

The Chair: Give a short answer, please. We're out of time.

David Keith: Is the question still for me?

[*Translation*]

Patrick Bonin: Yes, the question is for you.

[*English*]

David Keith: I'd say that this is partially true, but there's a lot of uncertainty or spinning. There are different interests underneath those cost estimates.

If you're asking about CCS, let's start with the clearest case for CCS. I think that's cement. Cement produces CO2 as process emissions, as opposed to energy input. I forget the exact number now, but it's about 5% of global emissions. Forgive me if I have the wrong number.

The Chair: Thank you very much, Mr. Keith, for that answer.

[*Translation*]

Thank you, Mr. Bonin.

[*English*]

We'll now turn to Mr. Bexte for five minutes.

David Bexte (Bow River, CPC): Thank you, Chair.

Thank you, witnesses. It's been a fascinating discussion. At the risk of getting too technical, which I hope we don't, I'm keenly interested in this.

Professor Keith, you spoke a bit about biomass and how there are trade-offs in how we consider it. I'm very interested in how that's related to drawing the lines around arbitrary systems when we're deciding where to measure success. Historically, the government seems to predominantly measure success by how much money they spend on a file, as opposed to results.

How do we get the measurements right so that we can filter out different technologies at an early stage, instead of drifting over to picking winners and losers?

David Keith: I don't know. It's possible that some kind of new institution is needed to do that. I would say that academic institutions don't often do that very well, because they either don't have enough access to the underlying data or don't do that kind of production work. Government institutions often don't do that kind of analysis very well because they also have to justify all sorts of government policy. There aren't clear industrial third parties that do it.

To give us good-quality estimates of what the marginal cost is in dollars per tonne in various government policies.... There are lots of well-intentioned government policies, but they have very different costs in terms of dollars per tonne. We may need some kind of new institution.

I don't think it needs to be very expensive, but we need an institution that could get access to data, including industry data, in some cases, under NDAs, the way a big accounting firm works. It could produce high-quality, open estimates of what the costs are—a kind of dashboard, if you like. It wouldn't be something to set the policy but rather something to give information on what the current costs are. Canada doesn't have a mechanism to do that.

David Bexte: You mentioned earlier that you have ideas on how to design verification pathways. Is this what you're getting at?

David Keith: No, that's a separate topic.

To me, the question I thought I was answering was this: In the current economy, what's the cost of, say, heat pumps versus solar subsidies versus transportation subsidies versus nuclear power?

David Bexte: It's not necessarily about emissions management. The scope of this study is carbon capture, utilization and storage. It's related. It's in the whole basket of what you're talking about. It's about specifically choosing types of technologies and the size of footprint on the environment they should have as an effect that should be evaluated. If you arbitrarily draw a boundary around a technology, yet the adjacent supportive industry, technology or resource has a big impact on that—

David Keith: I think I understand you better.

David Bexte: We have to get the boundaries right. There's a lot of manipulation in order to jury-rig or engineer outcomes. This is something I'm concerned about. I know I'm going on about this a lot, but I'm trying to set the stage. It relates to how credits and verification issues emerge to support that picking-and-losing process. Objectivity is what we need.

David Keith: I don't have a magic answer. I'll give you one example from work I'm doing now.

As many of you may know, I founded a Canadian company called Carbon Engineering. While I had that hat on, I don't think we told any lies, but of course I would try to put the best case forward for CE's version of technology. Now, at UChicago, I have a lot of resources to work on, for example, open ocean alkalinity, on which we are in co-operation with Frontier, a big entity that has about $1 billion to spend on purchase commitments for this. We're actually funding a Canadian company, Sacré-Davey, to do an engineering analysis of the costs of large-scale lime production for open ocean alkalinity, just to give you that example. That's the kind of work that I think individual companies don't do, because the kind of work we're doing in this joint thing with UChicago and Sacré-Davey will be all public information, dealing with trying to assess the cost of very large-scale open ocean alkalinity in the long run. It's also something that regular academia doesn't do, because regular academia can't work with industrial contractors very well.

Maybe that's overselling our own work here, but I think there's a need in Canada for institutions like this.

● (1615)

David Bexte: I'm almost out of time, Professor Keith, and I have one more question.

The environment I'm looking at.... I'm a farmer in southern Alberta. I grow biomass like crazy every year, yet I don't get credit for incorporating biochar into the soil. There are so many different industries that have intersections, potentially, and our way of evaluating is just inadequate.

Thank you very much.

The Chair: Thank you, Mr. Bexte. We're out of time on that one.

We'll go to you, Mr. Fanjoy, for five minutes, please.

Bruce Fanjoy (Carleton, Lib.): Thank you, Madam Chair.

Dr. Keith, I'd like to begin with you. You began to discuss a particular use case of cement, and I want to give you some time to finish that thought.

David Keith: I was going to say that in terms of.... This is a response to ask, essentially, why we should do CCS if renewables are cheaper. The answer is that it's complicated. Renewables are not always cheaper by any means.

Cement is a particular case in which CCS does something that you essentially can't do any other way. The emissions from cement come from process emissions, and we need cement. The only plausible way, in my view, to reduce that is to do CCS on cement plants.

Bruce Fanjoy: Okay. Thank you.

A couple of witnesses mentioned the importance of cutting emissions and that this is where our first focus needs to be. To the extent that industry is focusing on carbon capture and storage, do you think that this will have a neutral impact on cutting emissions? Will it delay the cutting of emissions or advance them?

Maybe I'll turn to you, Ms. Zitner.

Miriam Zitner: Our understanding is that there needs to be about 1,000 gigatonnes of removals to meet climate standards. We've already exceeded 1.5°C, and I think nobody here is disagreeing that cuts are required. I think the reality is that cuts alone won't get us where we need to get to, so IPCC and others are saying that we must do removals. It's not now a question of either-or; it's a question of “and”.

As per David Keith's testimony at the beginning, now is the time to test and try small-scale deployment technologies to see which ones will advance, which ones work, which ones might not work, which ones can scale and under what conditions they can scale. We need to do that R and D now.

Bruce Fanjoy: Thank you.

Ms. Zitner, what are the ecological risks of storing vast quantities of carbon in marine environments?

Miriam Zitner: I think you're asking two questions. One is about scale—you used the word “vast”—and the other is about risk.

In the Bedford Basin in Nova Scotia, there have been small-scale deployments, and Planetary will speak with you about this later this afternoon. The deployments have been verified by Isometric, which David also suggests there should be some conversation around. We have information based on that scale of deployment, and Carbon to Sea is looking at creating a global research network to try to determine what the impacts are in different regions and in different seasonalities, temperatures and salinities. The research is still early, and it needs to be scrutinized globally if it is going to scale and be a viable climate solution.

What I can tell you is that in the Bedford Basin, independent academic researchers' data suggests that there is no harm at the volume of the dosing that has occurred now.

I want to add that I do think that we invite the engagement, scrutiny and objectivity that you all wish for as well, and you would have heard me invite your attention on this. If you have questions, it would behoove you to develop the systems to objectively find those answers and to develop independent MRV protocols that meet your standards.

● (1620)

Bruce Fanjoy: I grew up next to the Bedford Basin, so I'm glad to hear that it's doing fine.

Mr. Jarvis, would you like to comment on ecological risks?

Alastair Jarvis: Yes, thank you.

Earlier, I was going to share that we work with the Huntsman Marine Science Centre in New Brunswick. At the moment, under the Fisheries Act, the onus is on us, as a company, to build the evidence that regulators require in the compliance regime. We've run toxicity testing across a range of species, including algae, zooplankton, urchins, lobster larvae and mussels. We do that testing against different concentrations of total alkalinity in order to set a safe design threshold and then identify the margin below it that we can design to. Again, the stressor we tested is the increase in total alkalinity above the ambient level. We'll publish those results soon.

To your question on emissions versus carbon removal, it isn't either-or. What's been made clear to us by the IPCC scenarios is that we have to eliminate the emissions where we can and remove carbon where we can't. It is going to take some time, as has been identified, to identify the portfolio of technologies that will be required to achieve our carbon removal goals, because—as we also heard—none of these individual technologies alone can achieve the scale we need within the planetary boundaries that constrain each of these pathways.

We're—

The Chair: Thank you, Mr. Jarvis. I'm sorry, but we're out of time.

We need to double our time for these technical conversations.

[*Translation*]

Mr. Bonin, you have the floor for two and a half minutes.

Patrick Bonin: Thank you, Madam Chair.

Mr. Keith, you talked about biomass and the potential ecological impact of extracting it.

Can you tell us more about that?

I'd like you talk about, among other things, carbon emissions related to soil disturbance and the resulting emissions, as well as emissions related to the part of the biomass that would not be recovered and sequestered, for example.

What kind of footprint does that leave? I'd like you to talk about biodiversity.

[*English*]

David Keith: The basic impact of extracting biomass is this: You cut down and use the standing biomass, which means you've interfered with the natural processes. That's the most general statement. Beyond that, it depends on the specifics. Extracting peat, as has been done in some cultures for a very long time, is very different from cutting fast-growing softwood, which is different from cutting wood in the boreal forest. There are very different impacts in different places.

The general thing to say is that there are competing demands for land. We need agriculture. We need recreation. We want to leave some land for nature. Using land for biomass energy is another land use. The economists teach us that there's no free lunch, and those competitions always have trade-offs. There are consequences to the large-scale use of biomass energy.

I wonder if I can say one thing that builds on prior discussion and give you a sense of the scale of effort on CCS versus cutting emissions or on carbon removal versus emissions.

Right now, globally, the world is spending about $2 trillion, or almost 2% of the global economy, on clean energy, which is a fantastic, amazing victory. It's the reason emissions will probably peak in the next couple of years. It's an enormous win. However, the total amount of money on all work, globally, on long-term carbon removal efforts is only a few billion dollars a year. As I said at the beginning, I absolutely agree that we shouldn't think we're going to distract ourselves from emissions cuts by carbon removal, but if we think carbon removal is important in the long term, it makes sense to spend 1% now. That would be over $10 billion a year globally—I'm not saying in Canada, since it's proportional—on capital for emissions cuts and testing out how different carbon removal methods work. That way, we can understand what happens and give our kids the chance to make decisions a few decades later.

The Chair: Thank you, Mr. Keith, for your answer.

We'll now go to Mr. Rowe for five minutes.

Jonathan Rowe (The Eastern Peninsulas, CPC): Thank you.

My first question is for Ms. Zitner.

It's great to see you taking advantage of, or using, our ocean. Newfoundland was founded on its ocean. Coming from a coastal riding, I think this is the answer to our future as well.

I see that there are other techniques. You guys are basically inserting stuff in the ocean to increase carbon capture in the ocean. We see some theories out there saying that plankton growth can also contribute to carbon storage. You insert certain minerals in the water, and then plankton can grow. Then they die and fall to the bottom of the ocean. It can be stored for centuries.

Are you guys looking into that kind of storage as well, or are you very much on alkaline chemical storage?

● (1625)

Miriam Zitner: We are very much focused on ocean alkalinity enhancement.

Jonathan Rowe: Do you think those can work together?

Miriam Zitner: There are some interesting questions about marine spatial planning—who is doing what, and where, and what is the state of R and D for each of the possible carbon removal technologies that require a system-wide assessment? When you hear me talking about engagement and inviting the Canadian government to get engaged, it is to come together to answer these kinds of questions, because, as it stands....

I used to work with technology companies. We'd talk about point systems. One technology is doing this, and other one is doing that. We're putting it together. It would be great to see consolidation and government-led initiates to assess, evaluate and develop.

Jonathan Rowe: For that type of carbon capture, one of the leading inputs for plankton growth is actually mammal manure. When whales release their manure, it increases plankton growth. Now, in Newfoundland and Labrador, we have the federal government trying to reduce mammal manure going into our oceans, which I think would actually decrease plankton growth and decrease the amount of carbon that would go through to our oceans. I was hoping you could speak to that, but I'll pivot to something more in your arena.

Do you use crushed rocks or crushed minerals, perhaps from old existing mines, to do what you are doing?

Miriam Zitner: Yes, we do, exactly.

There is research under way to take a look at exactly that to figure out which feedstocks are the best to use, like alkalizing minerals. We have been using magnesium hydroxide, and we're moving to calcium-based ones. A lot of the companies that are working in this space are looking at waste feedstock.

We tend to look at proximity to the dispersal site. You want to make sure you're quite clear about the LCA and, for lack of a more scientific word, the cleaning process. When you're using waste materials, you really need to take a look at trace metals. You might have differences in composition between batches from one waste source to another. It requires the kind of R and D that philanthropy is funding, the R and D that we are thinking about and that I urge all of us here to consider.

In the end, if it can be demonstrated that OAE is a viable climate solution, we are going to have to figure out a multiplicity of things, including the scale, the best feedstock to use, the best partnerships and whether to create independent MRV. These things need to be figured out.

Jonathan Rowe: I think there's an opportunity there for our mining industry to be much more profitable if we can put our waste into the ocean immediately and then help carbon storage. I understand what you're saying about needing a process. I'd be curious about the economics of that, if you want to submit that later.

However, I want to give my last minute to my colleague Branden Leslie.

Branden Leslie: Thank you.

Madam Chair, if you seek it, I believe you will find unanimous consent, based on previous discussions, for the following motion:

> That the Chair report to the House requesting that the committee be formally designated to undertake the statutory review required by section 27.1 of the Canadian Net-Zero Emissions Accountability Act.

I will give my remaining time back to my colleague.

The Chair: You have 30 seconds.

Jonathan Rowe: Mr. Keith, I'm curious about the tonnes of carbon storage versus the kilowatts produced. What is that looking like right now at today's best capacity, and what are you hoping for in the near future?

David Keith: For large-scale open ocean alkalinity, when we're turning limestone or dolomite into a hydroxide that goes into the ocean, there's very strong evidence from oceanographers that it could have very low environmental impacts and create permanent storage, which is why I see it as one of the more important kinds of storage. In this case, you're looking at a bit more than two kilowatt hours net per tonne reduced, assuming you've captured the CO2, if I did the math in my head correctly.

● (1630)

The Chair: Thank you, Mr. Keith. Thank you, Mr. Rowe.

[*Translation*]

Mr. St-Pierre, you have the floor for five minutes.

Eric St-Pierre (Honoré-Mercier, Lib.): Thank you, Madam Chair.

[*English*]

Dr. Keith, as someone I've known before and who lives in Canmore, I consider you to be Canadian. I wanted to get that on the record.

David Keith: I am.

Eric St-Pierre: I want to thank you for the great work. I was recently listening to the Canadian podcast that you're involved in, *Energy vs Climate*. Thank you for your contribution to Canadian climate policy.

Can you comment on the cost of carbon removal? Specifically, can you comment on the current cost of certain CDR technologies or processes? What cost do we need to get to in order to make it more marketable? Where is it right now, and where should we get it to?

David Keith: For many of the technologies now, we really don't have a meaningful answer to the question of where we are, because they're for very small projects.

There are two parts to this. I'd say for direct air capture, the answer is that the cost is many hundreds of dollars per tonne for projects that would be executed now. I think it's plausible that costs could come down quite a lot. Part of that depends on access to very cheap energy, which is likely solar power in sunny places. I think that's a realistic prospect, but it's moving a few steps further away in time.

For open ocean alkalinity, we've been thinking a lot about the cost assessment recently. There are good reasons to believe it's possible that without any fundamental technological advance in the process we have in place today, the cost could be on the order of $100 a tonne, but we simply haven't done much of the engineering. Really, very little has been done on the engineering of the large-scale dispersal of materials in the open ocean, and it's possible that there's actually no cost-effective way to do it. People just have not done the engineering for real.

In terms of the cost that we need to get to, I keep coming back to $100 a tonne as a nice benchmark. If we wanted to remediate some of the environmental damage we did by putting carbon dioxide in, in a world after 2050, when emissions are coming down, we would need to think as humanity about removing something like 1,000 gigatonnes—a teratonne—of CO2 over a long time, maybe a century, so that would be 10 gigatonnes a year. If you got to $100 a tonne, you'd be spending about 1% of the global economy on that.

It's not crazy to imagine that people would spend 1% of the global economy on this kind of long-term environmental cleanup. That's comparable to some other environmental costs, and it's comparable to what some developed societies have spent on different kinds of foreign aid or national parks protection that didn't have an immediate economic utility. You can hope that people would pay that.

Eric St-Pierre: Okay.

Very quickly, maybe in a minute, I'm curious about this: If we got it down to $100 a tonne, do you think government policy should play a role, or should we be leaving it to voluntary corporate initiatives?

I think of what a company like Stripe does, with multi-year advance purchase agreements for early-stage start-ups.

What role should governments play, and the federal government especially?

David Keith: The government's role is fundamental. This is a classic externality problem in economics. Stripe and Frontier do the same thing, and I work closely with those people. I don't think there's any prospect that the voluntary market will play a significant long-term role. It just can't. According to corporate law, companies are meant to be maximizing profit, and they can't be spending a huge amount on voluntary emissions reductions. That's just not the way we deal with environmental problems. This will be government policy, and we'll have a big fight to make it so.

Eric St-Pierre: Thank you.

Ms. Zitner, I'm really curious about seaweed or kelp. My colleagues may laugh at me for talking about seaweed, but kelp is one of those nature-based solutions that grows very quickly and absorbs a significant amount of ocean CO2.

Are there realistic ways of scaling kelp? I'm looking at my colleague from Halifax, who might get excited about this. What federal policy levers are at our disposal for ocean-based solutions?

Miriam Zitner: I've spent the last four years working with the private sector, academic institutions, philanthropy organizations and buyers on ocean alkalinity enhancement that uses alkalizing minerals and doses those into seawater. I have to admit that I don't have expertise on the question that you've asked. I can certainly ask others and get back to you via email.

● (1635)

Eric St-Pierre: Thank you.

I think I'm out of time. I have many other questions. Thank you for being here, witnesses.

The Chair: Thank you, Monsieur St-Pierre.

As chair, I'm going to use my prerogative to ask one quick question, as I have witnesses here from Halifax and Nova Scotia. I'm really excited to have you both here. We've worked together for some time.

I'm excited by the potential for supporting innovation leaders and trailblazers in this question of carbon capture, which the IPCC is saying that we need to do.

What is the most urgent and impactful thing, in your view, that the federal government needs to do to ensure that we can keep allowing folks like yourselves, these innovators and trailblazers, to continue the exploratory work that you're doing?

Ms. Zitner can go first, followed by Mr. Jarvis, please.

Miriam Zitner: You would have heard in one of my three recommendations that I'm urging the Canadian government to think about existing frameworks. I'm urging the Canadian government to think about the defence industrial strategy and the evolution of the ITB paradigm, especially with the increase in defence needs and, consequently, defence spending.

There are billions of dollars of private sector money that are now governed by the key industrial capabilities frameworks. Within those 17 KICs, at last check, there are notions around funding sensor vehicles and uncrewed ocean vehicles and providing guidance around funding for removing and reducing carbon pollution. There are pots of money that exist in the private sector. There are existing frameworks currently being evolved that could fund the R and D this committee is asking for to be able to explore the viability of some of the carbon removal technologies being assessed.

If there was one thing, I'd suggest that we all take a look at those paradigms that already exist and the funding that's already there, and that we think about how we can integrate with existing paradigms versus asking for new money and building new things. The money is there. The interest is 80% there. It just needs some fine tuning, some direction and, essentially, a sponsor to move that forward and focus it.

The Chair: Thank you, Ms. Zitner.

Go ahead, Mr. Jarvis.

Alastair Jarvis: There are three things for me.

First, add marine storage as a third eligible use in the CCUS tax credit; second, establish a permitting pathway with the provinces; and third, make sure federal protocols, the national inventory and Canada's IPCC engagement don't foreclose on non-geologic storage.

A fourth, if there were room, would be resources for ECCC and DFO to work with the provinces on this.

The Chair: I asked for one and you gave me four.

Thank you so much to our three witnesses for your time and expertise. We really appreciate it. We're going to suspend briefly to switch over to our next set of witnesses.

● (1635)

_____(Pause)_____

● (1645)

The Chair: We will resume our meeting with our second set of witnesses.

Thank you so much for being here.

In person, we have Donald Lawton, professor emeritus, from Carbon Management Canada, and Diana Philip, vice-president of community and government relations, from Planetary Technologies. Online, we have Yuliya Kravtsov, the CEO of CarbonCure Technologies Incorporated.

Welcome. You'll all have up to five minutes to provide some opening remarks. Then we'll move to questions from the committee.

We'll begin with you, Mr. Lawton, for up to five minutes, please.

Donald Lawton (Emeritus Professor, Carbon Management Canada): Good afternoon, Madam Chair and committee members. Thank you for the invitation to provide testimony at this important meeting.

My name is Don Lawton. I am an emeritus professor of geophysics at the University of Calgary and currently an adviser to a small not-for-profit, Carbon Management Canada, that has been working with industry, researchers and technology developers for the past 15 years on technologies for emissions reductions.

I myself have worked mostly on technical aspects of CCUS for the past 25 years and have been involved in public education about this technology. Just as a point of interest, I presented the basics of CCUS to parliamentarians here in Ottawa in 2021 through the so-called Bacon and Eggheads program that is put on by the Partnership Group for Science and Engineering.

Today, greenhouse gas emissions reductions face challenges from concerns about energy security, energy poverty, the economy and general affordability. In Canada, our annual GHGE equivalents are around 700 megatonnes per year. We're 13th on the world's scale, but we're among the highest in terms of individual emissions per capita.

On the question of longevity of oil and gas, in the previous discussion Dr. Keith mentioned the peak for oil production, but many agencies, including the IEA, talk about the continued use of oil and gas through to at least 2050. Thus, we cannot shy away from being proactive about emissions reductions, and we must focus on technologies that are most cost-effective and scalable in the short to medium term.

In my opinion, what I call “conventional CCS” can really lead the way. By this, I mean CO2 capture from large point source emitters and storage in deep underground saline aquifers or depleted oil and gas fields. These options are not available across all of Canada. Certainly in the west, the western Canadian sedimentary basin has gigatonnes of storage capacity, but deep aquifer storage does exist elsewhere, such as in southwestern Ontario, the St. Lawrence valley in Quebec and the Maritimes, but these capacities are still being investigated.

As you heard in the meetings last week, storage through mineralization of mine tailings and in basaltic and ultramafic rocks is also being investigated, but these technologies have yet to be proven at scale. There are valid questions about storage capacity, injectivity and the efficacy of monitoring and verification technologies for these, as well as their full life-cycle analysis.

For conventional CCS, about 80% of the project costs are in the capture side and the remaining 20% in transportation and storage. Canada is actually a world leader in new capture technologies being developed by companies, and this will be reducing costs. That's really the key: How do we reduce costs for all of these carbon renewable projects or carbon capture projects?

We also have carbon dioxide removal through, for example, direct air capture, which you heard about in the previous meeting. This is still expensive, because of the necessity to move very large volumes of air across the capture contactors. Ultimately, we need these carbon removal technologies to get scope 3 emissions, which are ubiquitous, but the technologies are generally not yet ready for upscaling and, for some of these technologies, performance in cold climates is still being evaluated.

The current state of the conventional CCS industry is that projects at the scale of about one megatonne per year are quite well established, such as by Quest and in Enhance in Alberta, but even at this scale, not enough projects are reaching FID to make a difference. I think this is primarily because of regulatory uncertainty and carbon pricing, which were discussed at the meetings last week. We must not only accelerate these projects but also upscale storage cumulatively to the 100-megatonne storage range. The Pathways project is an example of this next step to be able demonstrate the scalability of the technology.

However, upscaling geological carbon storage has challenges that need to be researched, including, for example, pressure interference—I'm getting to the technical stuff—between adjacent projects, induced seismicity, monitoring and verification strategies for regulatory compliance and addressing public assurance.

On this last point, Carbon Management Canada, in collaboration with the University of Calgary, has established a CCS field research station in southern Alberta that has been working with national and international partners to advance new cost-effective MMV strategies necessary for upscaling CCS to large-scale projects.

● (1650)

In conclusion, CCUS is not some singular silver bullet for emissions reduction. A broad range of technologies—including CO2 utilization, conversion and removal—must all be pursued. Arguably, CCUS has the highest potential to be upscaled rapidly to contribute significantly to Canada's emissions reduction climate plan. We must get on with it.

Thank you.

The Chair: Thank you very much, Mr. Lawton.

We will now turn to Ms. Kravtsov for five minutes.

Yuliya Kravtsov (Chief Executive Officer, CarbonCure Technologies Inc.): Madam Chair, vice-chairs and members of the committee, thank you for the opportunity to appear before you today.

My name is Yuliya Kravtsov. I'm the CEO of CarbonCure Technologies. [*Technical difficulty—Editor*] Canadian carbon utilization company had marked six months since I joined the company. I have spent the last 15 years in the building materials industry, working on decarbonization strategies and solutions for large multinational producers of cement, concrete and other construction materials.

CarbonCure was founded in 2012 on a simple promise but an ambitious idea: Carbon-captured CO2 can become both an ingredient and part of the solution in one of the world's most essential and difficult-to-decarbonize industries, concrete. Carbon utilization is often viewed as a niche solution. However, our solution at CarbonCure is far beyond the pilot stage.

Carbon-mineralized concrete, produced using CarbonCure technology, has built thousands of homes, hospitals, schools, skyscrapers, roadways, airports and much more. CarbonCure's technology has been adapted by hundreds of concrete plants across North America and many continents, producing over 12 million truckloads and delivering close to 100 million cubic yards of carbon-mineralized concrete to lower carbon on construction projects around the world. That is enough to build approximately 1,900 CN Towers in Toronto. To date, we've reduced and mineralized more than 840,000 tonnes of CO2 that would have gone into the atmosphere.

Our technology is very simple. It injects captured CO2 into concrete during production, where it can chemically react with nanoparticles to become nano-limestone and calcium carbonate. It embeds inside the concrete, permanently sequestering the CO2. Mineralization improves the concrete's microstructure, enabling producers to use less carbon-intensive cement while maintaining the concrete's strength. The result is low-carbon concrete that works with existing plans, supply chains and construction practices. This matters because cement accounts for approximately 7% to 8% of global CO2 emissions and because concrete demand is expected to remain very strong for decades. Decarbonizing this industry is essential.

Canada's opportunity is to scale practical solutions like CarbonCure's, which is already in operation and commercially proven, rather than waiting for the entirely new solution of CCUS to address this infrastructure. For CarbonCure, adoption depends on economies and sustainability. Reducing cement construction can lower costs, while lower-carbon products can help producers compete for construction projects. Climate technologies scale fastest when they create business value.

Government can accelerate this progress in two different ways.

First, buy clean procurement could consider embodied carbon alongside traditional purchasing criteria, creating demand for low-carbon materials and rewarding Canadian manufacturers that invest in innovation. Federal green procurement standards and embodied carbon requirements have already sent important market signals, but we need to continue to build on this product.

Second, we need an inclusive carbon market. As Canada explores a framework for internationally transferred mitigation outcomes, verified industrial emissions reductions should have a place alongside carbon-removing technologies in nature-based solutions. At CarbonCure, we share our carbon credit revenue with our concrete-producing partners. That revenue encourages technology adoption and greater use, generating further verified emissions reductions.

In closing, Canada could not only lead in developing climate technologies like CarbonCure but could also create the policy and market conditions that allow for the faster adoption of those technologies locally.

● (1655)

Our message is simple: Recognize proven technologies for carbon utilization solutions used in public purchasing to drive the demand for technologies and ensure that credible carbon markets can support industrial decarbonization. Today, those measures can reduce emissions while strengthening Canada's innovation in manufacturing.

Thank you again for the opportunity to appear today. I look forward to your questions.

The Chair: Thank you very much, Ms. Kravtsov.

We'll now turn to you, Ms. Philip, for five minutes, please.

Diana Philip (Vice-President, Community and Government Relations, Planetary Technologies): Good evening, Madam Chair and members of the committee.

My name is Diana Philip. I'm the vice-president of community and government relations at Planetary Technologies.

Planetary is a Canadian climate tech start-up headquartered in Nova Scotia and developing an approach to carbon dioxide removal called coastal ocean alkalinity enhancement, or OAE. Using existing coastal infrastructure, such as power generating stations, we introduce carefully measured amounts of alkaline minerals into seawater. This supports the ocean's natural ability to absorb carbon dioxide from the atmosphere while potentially helping to counteract local ocean acidification. Scientific research and environmental monitoring are central to our work.

To reach net zero, Canada and the world need both emissions reductions and carbon dioxide removal. Our work focuses on removing CO2 already in the atmosphere. Canada is already demonstrating leadership in this emerging field. In Halifax, Planetary works with Dalhousie University and Nova Scotia Power, and we became the first company in the world to deliver independently verified coastal OAE carbon removal credits, with over 8,000 tonnes delivered to date.

Our work has attracted international buyers. Through Frontier, a coalition of major companies, including Shopify, Google, Stripe and McKinsey, has committed to buying over 100,000 tonnes of carbon removal from Planetary between 2026 and 2030. We have also conducted pilots in the United States and the United Kingdom, demonstrating how Canadian innovation can attract international interest and investment.

Developing a new ocean-based technology requires more than scientific progress. It also requires the involvement and trust of coastal and indigenous communities. Our “Community Engagement Report” documents our extensive work with indigenous nations, local communities, fishers and environmental organizations. This engagement has directly informed our projects, including adaptations to environmental monitoring. In Nova Scotia, we established the world's first two-eyed seeing committee in the carbon dioxide removal sector, bringing indigenous knowledge systems and western science together to inform our approach.

This emerging sector also presents a significant economic opportunity for Canada. A 2025 report commissioned by Canada’s Ocean Supercluster estimates that by 2050, the sector could contribute $16 billion to Canada's GDP and attract more than $30 billion in investments. It also projects potential annual carbon removal capacity exceeding 100 million tonnes. Realizing this potential will require continued research, investment and responsible development.

Planetary's experience illustrates how public and private investment can work together. We have attracted venture capital, received support through Canadian innovation and research programs and secured long-term carbon removal purchase commitments from private buyers. This has helped to advance research, technology development and scientific verification, and it has demonstrated market demand.

Canada now needs a clearer national framework to build on this progress. Nova Scotia has demonstrated how coordinated regulatory oversight, including through its large industrial file team, or LIFT, can support emerging technologies while maintaining environmental safeguards. However, greater clarity is needed federally. The Senate's report, entitled “Carbon Removal, From Air to Sea”, called for regulatory clarity and recognition of land-based coastal OAE, but these recommendations remain unimplemented. Canada's 2023 carbon management strategy acknowledges ocean-based carbon removal but does not integrate it into the national framework. Coastal OAE is also not accommodated under the CCUS ITCs, while eligibility for federal carbon removal procurement remains absolutely uncertain.

This matters for Canada's international competitiveness. Europe's horizon Europe and innovation fund programs support technologies from early research through first-of-a-kind commercial demonstration. Without comparable pathways, Canada risks losing investment, projects and skilled jobs.

I therefore leave the committee with three recommendations.

First, clarify the federal regulatory framework for land-based coastal OAE, building on the Senate's findings.

Second, update Canada's carbon management strategy to recognize coastal OAE.

Third, review federal investment incentives and carbon dioxide removal procurement policies so that independently verified technologies like ours can qualify, based on scientific evidence and rigorous environmental standards.

With the right framework, Canada can strengthen its competitiveness, protect our marine environment and create long-term opportunities for Canadian innovation, investments and jobs.

Thank you. I look forward to your questions.

● (1700)

The Chair: Thank you very much, Ms. Philip.

We will now go to questions from members, and we'll begin with Mr. Leslie for six minutes.

Branden Leslie: Thank you, Madam Chair.

I'll start with you, Mr. Lawton.

The Liberals have reversed their original position and now want enhanced oil recovery to qualify for carbon capture investment tax credits. It's a move that's drawn some strong criticism from many environmental groups.

From your perspective, should enhanced oil recovery qualify for those credits?

Donald Lawton: I think it should. Currently, it gets half the credit compared to CCS. Whether we should be subsidizing enhanced oil recovery is a good question. I think we should. At the level it's being done, I think it is appropriate.

When we look at the total captured emissions in 2024, we see that nearly half of them were actually from Petrobras' EOR. The question is that if we're doing carbon storage with enhanced oil recovery, we're adding more oil. The counter-argument is that if we don't do it, that oil will be produced elsewhere. If we do it with EOR, we're actually reducing the emissions on the production side.

I think it's reasonable to include those.

Branden Leslie: I'm curious. Back in 2022, our current Minister of the Environment, Julie Dabrusin, was strongly opposed to enhanced oil recovery for carbon capture tax credits.

Has there been some sort of major breakthrough in the last four years in our ability to sequester carbon via enhanced oil recovery, or is that a long-standing ability?

● (1705)

Donald Lawton: It's a long-standing ability. For every sweep of CO2 in terms of EOR, about a third of it remains captured. The rest is produced with the oil and is then separated and reinjected.

The technology is well established and improvements are being made, but the exact amount that will be stored is really a function of the reservoir. In round figures, about a third of the CO2 gets captured for every molecule that's used.

Branden Leslie: Dozens of environmental groups, including Greenpeace and Environmental Defence, have strongly opposed giving carbon capture tax credits to enhanced oil recovery. Now they're criticizing the Liberal government for reversing their position, arguing that it's effectively subsidizing big oil companies.

Is that a fair criticism on their part?

Donald Lawton: It's a fair criticism, yes.

Branden Leslie: You mentioned the tax credit piece, and I'd like to get your perspective on that.

The U.S. is now offering the same carbon capture tax credit per tonne of CO2 stored, whether it's used for enhanced oil recovery or stored underground without producing any oil. Canada, as you mentioned, is proposing to give enhanced oil recovery projects only half of the regular tax credit.

Could that difference encourage companies to invest in the U.S. instead of Canada?

Donald Lawton: Yes. We've seen that already. The so-called 45Q credit in the U.S. is a production credit for stored CO2. It's not an offset on the capital, whereas the ITCs are focused on the reduction of capital expenditures.

There have been discussions about whether or not it would benefit the Canadian system to have a production credit and perhaps even reduce the ITC values.

Branden Leslie: To take that a step further, the federal government currently offers a 50% investment tax credit for eligible carbon capture equipment, but it is proposing only 25% when that credit is used for enhanced oil recovery.

From a scientific standpoint, if both projects store the same amount of CO2, is there any justification for giving half a tax credit to one over the other?

Donald Lawton: I guess the counter is that the produced oil is a revenue generator for the companies and, therefore, the country, so it's offset by the revenue side.

Branden Leslie: If you could offer recommendations—one or two changes to the existing CCUS investment tax credit—that would encourage more investment while still ensuring permanent storage, what would they be?

Donald Lawton: One would be adding some level of production incentives on the storage side, per tonne stored.

Branden Leslie: It would be ongoing, similar to that of the U.S.—

Donald Lawton: Yes.

Branden Leslie: —rather than just the investment tax side. It would be ongoing.

Donald Lawton: Yes, but it certainly would not be the entire cost and maybe not at the level of the U.S. If you have the ITC on the capital side, you want to incentivize the production costs over the long-term life of the project.

Branden Leslie: Do we, as Canada, have any natural advantages? We're never going to be able to out-pay the United States in subsidies. Do we have any natural advantages we can lean on that are currently not being pondered or considered under the current scheme?

Donald Lawton: I think the storage potential in Canada is good. It's also good in the U.S. I don't see a difference or the U.S. having an advantage over Canada on that side.

Branden Leslie: With my remaining time, I will be tabling a motion for future debate. It reads:

> That, pursuant to Standing Order 108(1)(a), and as part of the committee's oversight of federal environmental assessments and approvals involving the Major Projects Office (MPO), given that the Privy Council Office confirmed the MPO had 99 personnel in April 2026, including 21 individuals on temporary assignments whose original employers continue paying their salaries, and that the MPO's CEO subsequently told the committee that its workforce had grown to approximately 200 people, the committee order the Privy Council Office to provide, within 21 days of the adoption of this motion:
>
> (a) a complete breakdown of MPO staffing since its establishment, which private companies and other organizations have supplied employees, how many people each has provided, what positions they hold, which projects they have worked on, and how much of their compensation is paid by their original employers versus the federal government;
>
> (b) all agreements, conflict-of-interest assessments, internal ethics approvals and safeguards relating to these arrangements, including any restrictions preventing employees from working on projects that could financially benefit their original employers;
>
> (c) a written explanation of who conducted and approved the internal ethics reviews, what criteria were used to identify potential conflicts of interest, what safeguards were put in place, and how the MPO ensures those safeguards are actually followed;
>
> (d) confirmation that all employees have sworn an oath of office, and passed a security screening;
>
> and that all documents be provided without redactions, with sensitive information kept confidential by the committee in consultation with the law clerk and parliamentary counsel, and that the government clearly identify any documents that do not exist.

● (1710)

The Chair: Thank you very much, Mr. Leslie. You should have started a minute sooner, because you took an extra minute, but it's well noted.

We'll now turn to Mr. Malette for six minutes, please.

Chris Malette (Bay of Quinte, Lib.): Thank you, Madam Chair.

I find this subject fascinating, the more we hear about it. My colleague Mr. Watchorn and I met this morning with representatives of Carbon Removal Canada for a little more discussion, because we'd heard from them last week. The more we learn, the more I'm finding this is a very captivating subject, and it's something I think we really need to get a good grasp on.

My first question is for Ms. Philip.

How do you independently measure and verify the amount of CO2 removed through ocean-based carbon removal, and how do you distinguish durable carbon removal from temporary changes in ocean chemistry? I'm still trying to get my head around the mechanics of all of this.

Diana Philip: For us, the mechanics have been made a bit easier by Isometric. They have a protocol in place that determines exactly that. How is carbon removed? What is the process for it? The additionality factor essentially means whether the company or the entity is responsible for removing the carbon or it is happening naturally. All of these processes are laid out in the protocol, and we follow that.

More importantly, once we do that, we submit our data for verification by a third party, an independent verifier called 350Solutions, which verifies it and submits it to Isometric. That's essentially the process.

Chris Malette: In your estimation, Ms. Philip, what changes to Canada's federal regulatory framework would help responsible ocean-based carbon removal projects move forward while ensuring adequate environmental assessments and oversight?

Diana Philip: Thank you for asking a really important question.

We work under existing regulatory processes, which are attached to coastal discharges, whether they're waste water treatment facilities or power infrastructure. The clarity that the federal government, especially ECCC, needs to provide is that this is the recognized regulatory pathway for a land-based coastal OAE, and it's not been done so far.

Chris Malette: Thanks very much.

I believe I still have time.

The Chair: You have three and half minutes.

Chris Malette: Perfect. I'm on a roll.

My question is for Ms. Kravtsov. I understand your background is in the building industry as well.

Are Canada's current building codes, procurement rules and concrete specifications keeping pace with innovations that can reduce embodied carbon without compromising structural performance?

Yuliya Kravtsov: I think Canada's current regulations could use some innovation and updating in order to promote low-carbon materials in building construction, especially in the public sector, which plays a big part in purchasing concrete and cementitious materials from cement plants, which are one of the largest emitters of carbon dioxide in Canada.

We would encourage federal requirements to adopt carbon-mineralized concrete standards that we see being very successful in promoting carbon reduction in other countries that have used, prolifically, CarbonCure technology in order to reduce their embodied carbon.

Chris Malette: That's important, because I have a large cement plant in my Bay of Quinte riding in Ontario.

I have one more question for you, Ms. Kravtsov: Would predictable long-term federal purchasing commitments for lower-carbon concrete help your company and other Canadian innovators attract private investment and scale up?

● (1715)

Yuliya Kravtsov: Absolutely. We would be very much behind that support.

It would not only support companies like CarbonCure but also support innovation for other companies that are promoting capturing carbon dioxide out of the industrial emitting facilities as well as from air—atmospheric CO2—by using CarbonCure technology, embedding it back into concrete, which is the bedrock of building infrastructure for Canada.

Chris Malette: That's great. Thank you.

Do I have much time, Madam Chair?

The Chair: You still have a minute and 10 seconds.

Chris Malette: Mr. Lawton, what evidence do you have that captured carbon dioxide can be stored safely underground over the long term? In your view, what are the most significant remaining technological uncertainties?

Donald Lawton: We have a very well-established monitoring, measurement and verification protocol to ensure that captured CO2 remains in the subsurface. There's a lot of work that Carbon Management Canada and others are doing on advancing their technology and reducing their costs. With properly engineered projects, we can guarantee permanent storage.

Chris Malette: To your knowledge, are there any remaining uncertainties in the process?

Donald Lawton: There are uncertainties when we scale up. We're already at a scale of a megatonne per year. However, for example, Pathways is looking at at least six megatonnes per year and potentially as high as 12 megatonnes. There are uncertainties that need to be researched, particularly issues like induced seismicity, which we've seen a little of in Alberta currently, and this potential interference between different projects.

At the current scale, we have a good handle on it. If we want to increase it, which we must do, there are some unanswered questions that we're actively working on.

Chris Malette: They're mostly related to when we scale up. Yes.

Thank you.

Thank you, Madam Chair.

The Chair: Thank you, Mr. Malette. Thank you, Mr. Lawton.

[*Translation*]

Mr. Bonin, you have the floor for six minutes.

Patrick Bonin: Thank you, Madam Chair.

Mr. Lawton, what is the geological CO2 storage capacity in Canada?

[*English*]

Donald Lawton: The current capacity for storage in Canada is in the hundreds of gigatonnes range. There are probably at least 100 gigatonnes of storage capacity just in the western Canada basin, and up to probably 10 gigatonnes to 20 gigatonnes in eastern Canada. There was a study just done by Canadian Discovery for the Maritimes' capacity, and there's lots there.

[*Translation*]

Patrick Bonin: What is the global capacity?

[*English*]

Donald Lawton: The global capacity is in the trillion range. It's a thousand gigatonnes at least.

Patrick Bonin: Did you say a trillion gigatonnes?

Donald Lawton: It's a thousand gigatonnes.

Patrick Bonin: Is that a thousand or a trillion?

Donald Lawton: Well, a thousand gigatonnes would be a trillion tonnes.

Patrick Bonin: Okay, it's a trillion tonnes. Thank you.

[*Translation*]

On average, what percentage of their profits do Canadian oil companies invest in reducing emissions?

[*English*]

Donald Lawton: It's a good question. Thank you. I don't actually know those numbers offhand.

● (1720)

[*Translation*]

Patrick Bonin: Do you think a lot more of that money goes to shareholders in the form of profits and purchasing options?

[*English*]

Donald Lawton: There's something wrong with this machine, I think.

[*Translation*]

Patrick Bonin: I'll start again.

[*English*]

Donald Lawton: I have no volume here.

[*Translation*]

Patrick Bonin: You said you didn't know the percentage. According to the International Energy Agency, about 2.5% of oil and gas sector investment is in clean technology. It's probably similar in Canada. Companies making billions of dollars in profits—almost unprecedented in recent months—do not want to invest in carbon sequestration or capture. They want government funding.

Why would we give billions of dollars to oil companies that make billions of dollars in profits and invest next to nothing in reducing emissions?

Why would we invest public money in that instead of investing elsewhere, for example in emissions reduction technologies?

[*English*]

Donald Lawton: Thank you. Yes, I got the question that time.

The oil and gas companies are currently very profitable. I think they should be spending more on emissions reductions, and paying for it. Their argument is that it makes them uncompetitive. I'm not totally buying into that, but I think it should be a shared cost, because we all use petroleum products, whether it's oil and gas or petrochemicals. I think there's a responsibility to society to pay for some of that, but I think it should be shared. It should not be entirely placed on the public purse to do that.

[*Translation*]

Patrick Bonin: Okay.

Why would we give a billion dollars to oil companies that aren't investing much in reducing emissions rather than investing that money in solutions to reduce oil consumption or in the electrification of transportation, the automotive sector, public transit and renewable energy?

Why would we give that to an oil company that makes billions rather than other sectors that would allow us to reduce our oil and gas consumption?

[*English*]

Donald Lawton: That's a good question. My opinion is that we need to be addressing all of these issues on reductions in emissions from oil and gas production. It is a revenue generator for the country, so how do we balance the use of fossil fuels against the emissions that arise?

In answer to your question, I think we need to ensure that we capture emissions from oil and gas. The peak of oil and gas that was discussed earlier this afternoon is anywhere from 2030 to 2050. There's really no consensus on when that will be, because of issues of energy security.

[*Translation*]

Patrick Bonin: You're saying that according to the International Energy Agency's forecasts, peak oil is somewhere between 2030 and 2050.

Can you tell me which International Energy Agency scenario you're referring to?

I have never heard of peak oil in 2050. I've been working on the issue of energy and climate change for 22 years, and this is the first time I've heard that.

Which International Energy Agency scenario are you referring to when you talk about an oil consumption ceiling in 2050?

[*English*]

Donald Lawton: It's not necessarily the peak, but there will be continued use through 2050. The International Energy Agency thought the peak for oil would be somewhere in 2030 to 2040. Now, in their estimation, they're saying that it will be continuing through 2050.

The current worldwide consumption is about 100 million barrels per day. They're looking at it possibly being as high as 115 in 2050. They're not alone in that. That's one example. Other scenarios have it at less than that.

● (1725)

[*Translation*]

Patrick Bonin: You're saying that one of the International Energy Agency's scenarios forecasts an oil consumption of 115 million barrels per day in 2050. Is that correct?

Donald Lawton: Mr. Bonin—

Patrick Bonin: Can you talk about this oil consumption scenario of 115 million barrels a day in 2050? I have never heard that. I'm impressed, and I'd like to know what you're talking about.

[*English*]

Donald Lawton: I've just heard about that as well. I don't have the reference in front of me here, but that's the number I heard. I think it points to the issue that peak oil is a really difficult thing to predict.

[*Translation*]

The Chair: I'm sorry, Mr. Bonin, but your time is up. I've already added a lot of time to your turn.

[*English*]

Mr. Lawton, if you do have a reference that you would like to submit to the committee on that, it would be appreciated.

We are at 5:26. Round two would take us 22 and a half minutes if we're on time. We did have some technical difficulties. Does the committee wish to do the full 22 and a half minutes, or would you like to do a shorter second round? Is there any preference?

Some hon. members: Let's do shorter.

The Chair: Is there any opposition to a slightly shorter second round? We'll do three minutes instead of five.

David Bexte: If they want it shorter, they can give their time to me.

The Chair: If you oppose, we'll continue and do the full thing, Mr. Bexte. You have the power. What do you choose?

David Bexte: I'm fine with shorter.

The Chair: Okay, we'll do three minutes instead of five, and two minutes for our round two.

Mr. Bexte, it's your turn for three minutes, please.

David Bexte: I'm going to share a bit of my time with my colleague MP Arnold for some fisheries questions in a bit, so if you grant me a little bit of latitude, I'd appreciate it.

Dr. Lawton, thank you for being here. I appreciate your wisdom and what you've shared with us today.

My riding is Bow River. It's home to the CO2 centre near Brooks that you're talking about, I believe. I worked on the engineering on that site for the well construction efforts and some of the monitoring stuff in a previous lifetime. It's quite impressive.

My questions are going to be the same as in the last round—I'm not sure if you heard the witnesses in the previous hour—and relate to filtering of emerging technologies and how incentives for carbon capture work.

I'm concerned that governments working on these areas don't maintain their objectivity and end up picking favourites. Could you talk about how that impacts the carbon capture environment as you see it right now?

Donald Lawton: That's a good question.

I think what we're dealing with is the scope of scalability. For what I call “conventional CCS”, we know that the upscaling has large capacity and is largely available, while emerging technologies are rather expensive currently, and what's unknown is how scalable they are.

We've heard a lot about these carbon removal technologies that are being developed. It's uncertain yet what their scalability is, because they haven't been tested yet in a demonstration plant. It's a matter of whether the investment should go towards a known scalability or a somewhat unknown one.

David Bexte: In those sorts of scenarios, how important is it that we maintain the carbon capture utilization, in terms of CO2 flooding, as part of the mix or the basket of technologies or methodologies that we use in order to ensure that it continues without government subsidy?

Donald Lawton: Yes, we must do that. Utilization, for example, of synthetic fuels is a good example. It has very large-scale opportunities for the airline industry.

David Bexte: Thank you very much.

I'm going to cede my time to MP Arnold.

Mel Arnold (Kamloops—Shuswap—Central Rockies, CPC): I'll be as quick as I can.

My question is for Ms. Philip.

You mentioned increasing the alkalinity in the ocean. I'm curious as to what this does to the homing senses of fish, because we know they home in on certain chemistry in their natal streams, and so on. In fact, I was just in a meeting earlier this week where someone was describing what they're able to do at the University of British Columbia by dissecting the otolith bones that are in the heads of the fish—

● (1730)

The Chair: Mr. Arnold, you're out of time, but we'll let Ms. Philip answer your question.

Mel Arnold: They were able to tell where those fish were, even in their young stages—

The Chair: Mr. Arnold, we agreed to a shorter round and you did ask a question. Would you like her to answer before you're out of time? You can try again in the next slot if you'd like.

An hon. member: I'll give you my time.

The Chair: Go ahead, Ms. Philip, and answer.

Diana Philip: We do extensive monitoring in order to ensure environmental safety. We do ecotoxicology testing on over eight different species. One of those is mandated by the DFO, primarily to ensure that there is safety.

I'll just reiterate that we work with Dalhousie University to ensure that there are ecosystem studies looking at long-term impacts. To the scale that we are operating, we haven't come across any kind of risk so far, but of course long-term studies need to be done.

The Chair: Thank you very much.

We'll now turn to Mr. Greaves for three minutes, please.

Will Greaves (Victoria, Lib.): Thank you very much, Madam Chair.

Good afternoon, colleagues. Good afternoon to our witnesses. Thank you all for being here.

I'd like to start with Dr. Lawton.

Good afternoon, Professor. As a U of Calgary alumnus myself, it's great to have you before the committee today.

I wonder if you could speak briefly to some of the concerns that we hear about the potential environmental impacts of sequestering carbon underground. Can you speak to whether or not long-term underground carbon storage has potential environmental impacts, including the risk of carbon leaking back into the atmosphere? How reliable a technology is that? How safe it is for the surrounding ecosystem?

Donald Lawton: This came up in one of the earlier questions. Thank you.

A properly engineered CCS project would not leak to the surface. The paramount concerns about the near surface, in the public's eyes, are about groundwater and near-surface impacts. We monitor for all those contingencies, even though the likelihood that they will occur is very remote. There were claims against the project in 2011 that there was a leak at the Weyburn site in Saskatchewan. There was a concern that CO2 was leaking to the surface and contaminating a slough. The monitoring work was able to demonstrate that this was a natural process in the near surface, not a leak from below.

Even though the likelihood of leakage from deep saline aquifer storage, which is typically greater than 1,500 metres below surface, is small, we continue to monitor all the near surface for public assurance.

Will Greaves: The chance of a leak might be very low, and obviously it is something that proponents of a project would seek to avoid. If there were a leak of stored carbon to the surface, can you speak to what kinds of impacts it would have on the surrounding environment?

Donald Lawton: The leak rate would be very low. The impact would probably be on vegetation. It would be almost impossible to have anything that would be catastrophic in terms of wildlife or humans. We ensure that it won't happen by monitoring not just the near surface but everything from the storage zone through to the surface. If there were going to be escape from the deep site, we would know it early enough to be able to mitigate it by changing the pressure regime of the injection strategies.

Will Greaves: Thank you for that.

Ms. Kravtsov, thank you for being with us today. I'm wondering if you could please speak to the proportion of global CO2 or GHG emissions that, in your view, could be currently captured under existing technologies using the concrete emission storage that you've referred to today. What share of emissions could potentially be captured by using that technology?

Yuliya Kravtsov: Thank you for your question. I think that's an important one.

CarbonCure technology does two things. It permanently mineralizes this captured CO2 in the concrete while also allowing concrete producers to reduce the use of cement and cementitious materials in the concrete that have high carbon intensity.

There are two different benefits. One is the permanent removal and storage, and one is the reduction. Through our technology, we can impact 5% to 7% of the GHG emissions if our technology is used in the concrete manufacturing process.

● (1735)

The Chair: Thank you, Ms. Kravtsov, for that answer.

Thank you, Mr. Greaves.

[*Translation*]

Mr. Bonin, you have the floor for two minutes.

Patrick Bonin: Thank you, Madam Chair.

Mr. Lawton, I'm going to clarify, because there were interpretation issues earlier.

I'll go back to the oil consumption scenarios. If countries, like Canada, meet the Paris Agreement commitments to achieve net-zero emissions by 2050, which is the goal, there is no scenario where we would consume 115 million barrels a day in 2050. That's what I wanted to clarify.

These are scenarios in which no effort would be made and, under current policies, we would continue to literally burn the planet.

[*English*]

Donald Lawton: Yes, I agree with you.

[*Translation*]

Patrick Bonin: Thank you for clarifying that.

Madam Chair, I'm going to use my precious speaking time to give notice of a motion. In fact, it's related to the study of the Pathways Plus project, among other things. My motion has been sent to the clerk, and it reads as follows:

> That the committee request the Parliamentary Budget Officer to conduct a study on the public funding of the Pathway project and the Pacific Link pipeline, including federal participation, such as through the indigenous loan guarantee program, in order to address, among other things, questions regarding the total costs incurred and projected throughout the infrastructure's life cycle, based on the latest available data, specifying (i) the total annual cost, (ii) the annual maintenance cost, (iii) the annual cost of debt service, (iv) any other operating costs, specifying the type, on an annual basis, (v) projected revenues, and (vi) environmental costs.

I am therefore giving notice of this motion.

Mr. Lawton, I would now like to come back to the risks.

[*English*]

The Chair: Wait.

I'm sorry. Go ahead.

[*Translation*]

You have 30 seconds left, Mr. Bonin.

Patrick Bonin: Mr. Lawton, I wanted to come back to the risks associated with the Pathways project. A number of witnesses have talked about risks associated with a CO2 pipeline should there be a breach.

Do you know anything about that? Do you know the risks to ecosystems and humans if the CO2 pipeline should break?

[*English*]

Donald Lawton: My understanding is that the question is, in part, about the security of CO2 being carried in a pipeline.

Modern pipelines have advanced monitoring, usually with what are called fibre optics. If there's any change in temperature or acoustics in a pipe, they know immediately, so the chances of catastrophic failure in a pipeline are much less now than they were in the past.

The Chair: Thank you, Mr. Lawton.

[*Translation*]

Thank you, Mr. Bonin.

[*English*]

Go ahead, Mr. Arnold, for three minutes.

Mel Arnold: Thank you.

I will continue on with my questioning of Ms. Philip, if I may.

I believe you mentioned that your releases are monitored, so you have to meet DFO standards for toxicity and so on. My line of questioning is more around the effect on the migratory patterns of fish.

I just had a meeting with someone who can dissect the otolith bone that grows in the brains of fish. They can tell where those fish have lived—which particular stream they may have lived in for even a short period of time, and where they migrated to.

In your program, what is being done to determine whether there are positive effects and benefits or possible negative effects in terms of changing the salinity or alkalinity of the ocean?

A voice: That's a good question.

Diana Philip: We work on the coast, with existing coastal discharge. We don't work on the open ocean. That's why, when we began our monitoring work, we started with species in the ecosystem that is on the coast, rather than the migratory species you're talking about.

However, that's an extremely important aspect of it. We hope to expand our monitoring system to incorporate this, but we haven't reached that point as of yet.

Mel Arnold: Are you studying any of the fish passing through these areas for any potential impacts?

I was amazed by what they can tell. They raised fish in a hatchery that was fed by a well. The lab didn't even know it, but they picked up, roughly, the stream area where those fish were first living. They think they migrated back up another stream and out into the ocean. They can fine-tune that science so closely.

I'm curious to know what can be done in similar ways to improve your program or to avoid negative impacts.

● (1740)

Diana Philip: There are significant opportunities to do that. There are many research institutions doing that study. We've also partnered with Carbon to Sea on a joint learning opportunity project that brings independent researchers to do that kind of monitoring and study. Of course, there's a lot more that we can do.

Mel Arnold: I'll cede my time to Mr. Bexte.

David Bexte: Dr. Lawton, I've heard that number of 115 before, in the IEA study on when peak oil will occur. We've been talking about peak oil since the 1970s. It is a moving target, and it evolves versus recovery technologies. Is there anything you'd like to add on that point? Oil is going to be here for a long time.

The Chair: Give a short answer, please, Mr. Lawton.

Donald Lawton: I think we should reduce oil and gas consumption as soon as possible. We should always be investing in all the alternatives, like renewables, to do that, but the reality is that it will go up.

The Chair: Thank you very much.

Finally, we have Mr. Grant for three minutes, please.

Wade Grant (Vancouver Quadra, Lib.): Thank you so much.

Thank you to the witnesses.

Ms. Philip, I'm from the west coast of this country. I'm actually near the mouth of the Fraser River on the Salish Sea. Fish have been a very big part of my life and of the lives of many of the people I represent. My son actually lives on the east coast, where you are now.

You said something in your introduction that intrigued me because I am indigenous. Moving towards two-eyed seeing and putting it into practice is quite new. You're putting it into practice and allowing indigenous knowledge to be a part of finding solutions.

What have you seen, and what sorts of outcomes have you seen so far in that work?

Diana Philip: The constitution of the two-eyed seeing committee itself, in fact, was from years and years of engagement and collaboration with indigenous communities. We work very closely with The Confederacy of Mainland Mi'kmaq, which represents eight first nation communities in Nova Scotia.

That collaboration, along with conversations with fisheries, for example, is what helped us understand the kinds of species we should be monitoring. Lobster larvae, for example, which are extremely important in Nova Scotia, as you can imagine, were brought to our attention by the communities. That's essentially why we added that and changed our monitoring practice itself.

On top of that, a lot of times, communities' feedback is towards ensuring that it's not just early information that flows to the community but that it's also skill building to ensure that this particular process essentially reaches the communities. They can build their own indigenous process towards carbon dioxide removal. That's also part of what we're working towards.

Wade Grant: Ms. Kravtsov, what are the main barriers preventing smaller concrete producers from adopting carbon utilization technologies at this moment?

Yuliya Kravtsov: We would like everybody—large, small and vertically integrated players—to adopt our technology, because every single tonne of CO2 captured and mineralized can make a difference for us in Canada.

Small producers are really looking for support from the government to make sure that the technology or carbon-mineralized concrete is specified in the job and helps them secure projects, especially the ones that are driven by federal and provincial governments. They're looking for the CarbonCure technology to be the differentiator for them to drive business and to make sure that it's not a big expense item for them to do the right thing for the environment and for Canada, but is instead something that's business-enhancing.

Wade Grant: Thank you.

I think I'm at three minutes now.

The Chair: Thank you, Mr. Grant.

Thank you so much to all of our witnesses. That concludes our session for this afternoon. We really appreciate you.

Our next meeting of the committee will be on Tuesday, November 3, at 3:30 p.m.

This meeting is adjourned.

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