Patchy, but Promising

Compliance systems available to Canadian carbon dioxide removal initiatives

July 2025

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PEMBINA Institute

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These acknowledgements are part of the start of a journey of several generations. We share them in the spirit of truth, justice and reconciliation, and to contribute to a more equitable and inclusive future for all.

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Abbreviations

AEOS	Alberta Emission Offset System
BECCS	Bioenergy with carbon capture and storage
CCUS	Carbon capture, utilization and storage
CDR	Carbon dioxide removal
DACCS	Direct air carbon capture and storage
GHG	Greenhouse gas
ICVCM	Integrity Council for the Voluntary Carbon Market
IFM	Improved Forest Management
IPCC	Intergovernmental Panel on Climate Change
OBPS	Output-Based Pricing System
PACM	Paris Agreement Crediting Mechanism
TIER	Technology Innovation and Emissions Reduction
WCI	Western Climate Initiative

Executive summary

In Canada, emissions compliance systems for industry aim to reduce emissions while spurring innovation and maintaining industry competitiveness. Our report examined how carbon dioxide removal (CDR) methods are currently treated under compliance systems across the country and set out recommendations on how to integrate CDR more broadly in these systems.

Compliance systems are not homogenous across jurisdictions, and a number of mechanisms are used to mitigate emissions, which results in a complex patchwork of regulations.

Offsets or carbon credits are one of the mechanisms used in the federal compliance system, as well as in Alberta, British Columbia, Saskatchewan and Quebec. Offsets allow large emitters to meet a portion of their compliance obligations by funding emissions mitigation projects that are outside of their usual operations. Most of the existing offset projects in Canada are for either reducing or avoiding emissions. Where CDR has been included in compliance systems, it has been mostly for low-durability (shorter-term) methods like afforestation and improved forest management. However, recent progress has been made in integrating "durable" CDR into compliance systems.

CDR is the capture and subsequent storage of atmospheric carbon dioxide (CO_2) using a wide range of methods. Methods such as direct air capture and carbon storage (DACCS) and bioenergy with carbon capture and storage (BECCS) are considered durable since they can store carbon for thousands of years.

Emissions removal, unlike reduction and avoidance, can mitigate historical and hard-to-abate residual emissions. Durable CDR methods in particular can play an important role, but need additional support to ensure their scalability. Incorporating durable CDR into compliance systems in the near term can help establish increased and reliable demand for this process, spurring its development and deployment to meet long-term climate goals.

Recent updates to compliance systems provide promising signs. For instance, the federal Greenhouse Gas Offset Credit System is developing a protocol for DACCS and is considering developing a BECCS protocol, while B.C. is drafting a protocol that recognizes both these methods. Alberta and Saskatchewan already have protocols in effect that allow DACCS and BECCS projects to generate credits.

To strengthen the recognition of durable CDR, we recommend the following for provincial and federal carbon compliance systems:

- Differentiate between CO_2 removals and reductions in regulations.
- Set separate targets for CO_2 removals and reductions.
- Increase cooperation between compliance systems.
- Collaborate with leading CDR registries.

1. Introduction

The Government of Canada has set a federal target of reducing greenhouse gas emissions 40–45% from 2005 levels by 2030 and achieving net-zero by 2050 to contribute to keeping global temperature rise to 1.5°C relative to pre-industrial levels. The compliance systems to achieve these targets are a complex patchwork of provincial and federal regulations, although all are aimed at minimizing costs to consumers and corporations. This complexity across jurisdictions is due in part to the range of policies and mechanisms available to reduce emissions, each with different advantages and disadvantages.

A key objective of compliance systems targeted at industrial emitters is to reduce emissions while spurring innovation and maintaining competitiveness. Offsets or carbon credits are one approach used in the federal system, as well as in Alberta, B.C., Saskatchewan and Quebec.

Under this approach, credits are issued for projects that decrease emissions. These credits can then be purchased by a large emitter looking to meet its emissions obligations by funding innovative projects outside of their normal operations. For example, an operator of a fossil fuel power plant may purchase offset credits from a landfill methane destruction project to help meet its compliance obligations.

Many types of offset projects are eligible under current compliance systems. The rules for each type of offset project are publicly available and are known as protocols or methodologies. Most of the current protocols are for project types that reduce emissions, such as landfill gas destruction and renewable energy.

While reducing emissions is important, limiting the global average temperature increase to 1.5°C will require removing carbon dioxide (CO_2) from the atmosphere, according to the Intergovernmental Panel on Climate Change (IPCC).[1] Removals, unlike reductions, can mitigate the climate impact of historical emissions and also address residual emissions from hard-to-abate sectors.

Carbon dioxide removal (CDR)

CDR is the capture and storage of atmospheric CO_2 using a wide range of methods, each with its own distinct way to capture and store CO_2. The durability of storage also varies according to the method.

[1] IPCC, *Climate Change 2023 Synthesis Report: Summary for Policymakers*, 2023, 19. https://doi:10.59327/IPCC/AR6-9789291691647.001

CDR methods vary in technological maturity, but generally are not yet deployed at climate-relevant scales. Including CDR in compliance systems in Canada is crucial to establish reliable demand, spurring development and deployment.

This report examines how CDR methods are currently treated under compliance systems across Canada and makes recommendations for broader inclusion and effective integration of CDR in compliance systems. It provides a snapshot in time of what is a rapidly evolving landscape.

1.1 Removal vs. reduction vs. avoidance

Carbon dioxide *removal* is often conflated with carbon dioxide *avoidance* and *reduction*.

Removal — Removing CO_2 from the atmosphere followed by long-term storage in carbon reservoirs.

Avoidance — Preventing emissions that would otherwise occur, such as halting deforestation. While many carbon avoidance projects are impactful, a subset was found to overstate emissions avoided, according to recent studies.[2]

Reduction — Reducing emissions from a process by methods such as improving fuel efficiency in a fossil fuel power plant.

A reduction method often confused with CDR is carbon capture, utilization and storage (CCUS). CCUS involves the point-source capture of CO_2 from an industrial facility, such as an oilsands upgrader, and then either permanent storage in a geological formation or use of the captured CO_2. At best, this may result in a carbon neutral process, whereas CDR can achieve a carbon negative process.[3]

Carbon neutrality: Emissions removed = Emissions emitted

Carbon negativity: Emissions removed > Emissions emitted

CO_2 avoidance, reduction and removal are all vital for climate change mitigation. In its Climate Change 2022 summary report, the IPCC stated that "the deployment of carbon dioxide removal

[2] Grayson Badgley et al., "Systematic over-crediting in California's forest carbon offsets program," *Global Change Biology* 28, no. 4 (2022), 1433. https://doi.org/10.1111/gcb.15943

[3] Carbon Gap, "The Difference between CCS CCU and CDR," November 16, 2022. https://carbongap.org/the-difference-between-ccs-ccu-and-cdr-and-why-it-matters/

(CDR) to counterbalance hard-to-abate residual emissions is unavoidable if net-zero CO_2 or GHG emissions are to be achieved."[4]

1.2 Storage durability across CDR methods

One key differentiator across CDR methods is the durability of the storage medium.

Methods like afforestation store carbon within organic plant material and soil, which are expected to keep the carbon from re-entering the atmosphere for decades to centuries. However, forest fires, disease, and other disasters can reduce that timespan.

In contrast, methods like direct air capture with carbon storage (DACCS) and bioenergy with carbon storage (BECCS) store CO_2 in deep underground reservoirs. Although leaks are a potential risk, the reservoirs are expected to hold the CO_2 for thousands of years. Mineralization of CO_2 by forming stable carbonate rock is another method that can trap carbon for millennia. These long-term-storage methods are categorized as "durable" CDR.

Durable CDR can have a higher climate impact per tonne of CO_2 removed than shorter-term methods. Recent research has highlighted the importance of durable CDR in the context of net-zero frameworks.[5] However, most durable CDR methods involve new technology or systems that need additional support to achieve large-scale development.

1.3 Laying the foundation for durable CDR

Durable CDR can play a crucial role in climate change mitigation. But greater and more predictable investment in the near term is needed to reduce costs and increase the scale. As it stands, many durable CDR methods are not yet deployed widely enough to have a significant impact, and they generate carbon credits that are currently expensive relative to other options.

The present demand for durable CDR has primarily come from the voluntary carbon market. While this market provides an important revenue stream for project developers, it is largely driven by corporate sustainability commitments rather than mandatory compliance targets. As a result, deployment of CDR technologies may be delayed until a more substantial, reliable and consistent source of demand is established. Incorporating durable CDR methods into emissions compliance systems as a way to generate carbon credits could help meet this need.

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[4] Intergovernmental Panel on Climate Change (IPCC), ed., "Summary for Policymakers," in *Climate Change 2022 - Mitigation of Climate Change*, 1st ed. (Cambridge University Press, 2023), 36. https://doi.org/10.1017/9781009157926.001

[5] Cyril Brunner, Zeke Hausfather, and Reto Knutti, "Durability of carbon dioxide removal is critical for Paris climate goals," *Communications Earth & Environment* 5 (2024), 645. https://doi.org/10.1038/s43247-024-01808-7

Recognition of durable CDR projects within compliance systems is unlikely to create immediate demand for credits from these projects. Durable CDR credits are not currently cost-competitive with other compliance options. For example, the market price for carbon credits in Alberta's Technology Innovation and Emissions Reduction (TIER) market hovered around $50 per tonne of CO_2 in 2024.[6] By contrast, analysis of voluntary durable CDR credit purchases found an average price of $225 to $1,132 per tonne of CO_2, depending on the method.[7]

Nevertheless, recognition under compliance systems would increase the credibility of durable CDR methods and create a path towards future, reliable revenue. Continued progress in durable CDR development is expected to lower project costs and eventually position certain methods as cost competitive options within compliance markets. Furthermore, voluntary purchases can leverage definitions and protocols from government compliance systems, thereby achieving more credibility for projects and reducing risk in the eyes of credit buyers. Combined with other policy supports, this recognition in compliance systems could be a core component of a thriving CDR market.

[6] Emma Dizon and Grant Bishop, *Strengthening TIER for Alberta's Low-Carbon Growth: Measuring credit oversupply risks in Alberta's carbon market* (Clean Prosperity, 2024), 18. https://cleanprosperity.ca/alberta-must-fix-carbon-credit-market-to-ensure-low-carbon-growth/

[7] CDR.fyi, "Keep Calm and Remove On - CDR.fyi 2024 Year in Review," February 14, 2025. https://www.cdr.fyi/blog/2024-year-in-review

2. Canadian emissions compliance systems for industry

Canada has numerous compliance systems and mechanisms for regulating emissions.[8] The provinces and territories use one of the following three options:

- follow the full federal system
- follow their own carbon pricing system
- apply a hybrid system comprising the federal fuel charge and a customized output-based pricing system for industry

There is surprisingly strong inclusion of CDR within Canadian systems, with several compliance systems recognizing it in some capacity. However, much of this recognition is for low-durability methods, such as improved forest management and afforestation. Few durable CDR methods are recognized, but we see promising signs that this is changing.

The next sections detail the systems that recognize CDR, as well as the particular methods recognized. Figure 1 provides an overview.

[8] Environment and Climate Change Canada, "Carbon Pricing: Compliance Options under the Federal Output-Based Pricing System," last modified May 28, 2018. https://www.canada.ca/en/services/environment/weather/climatechange/climate-action/pricing-carbon-pollution/compliance-options-output-based-system.html

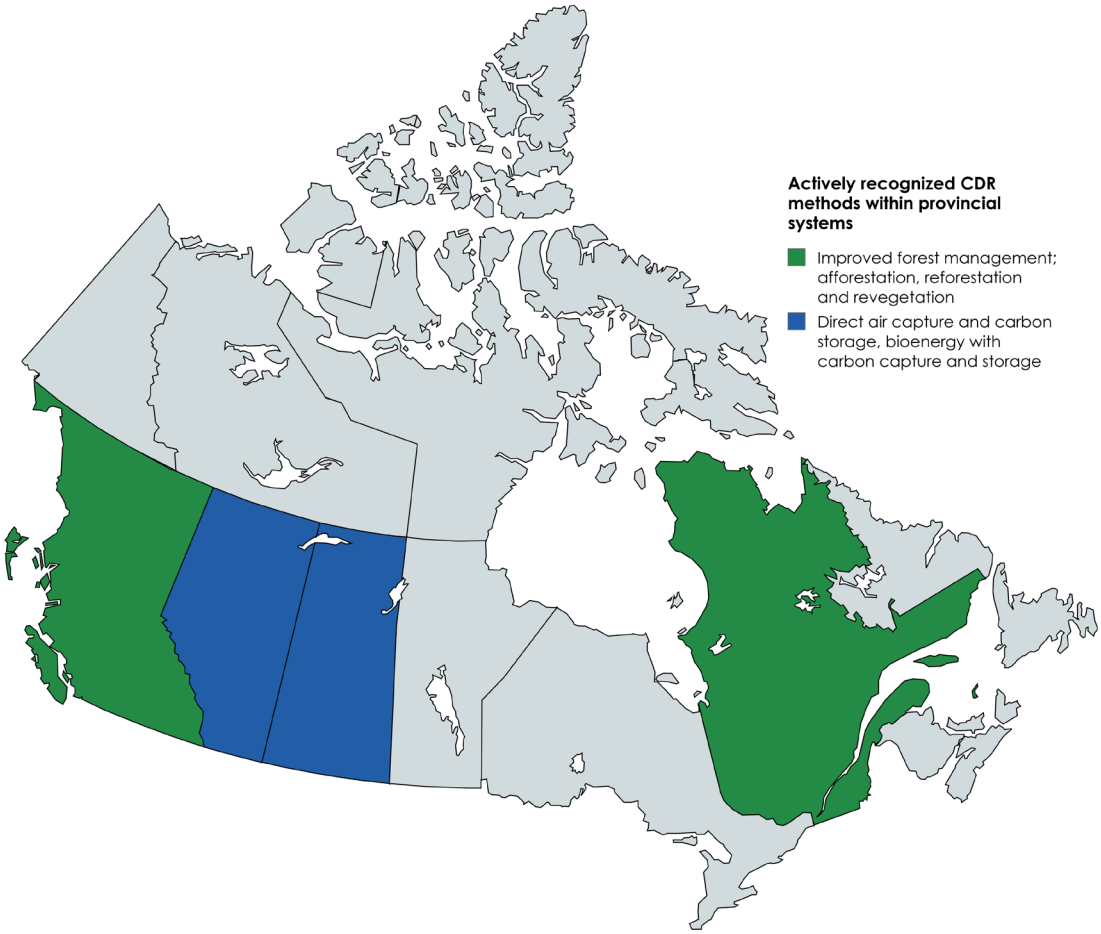

Figure 1. CDR methods that are recognized in provincial emissions compliance systems.

Note: Although not shown, the federal protocol on improved forest management on private land extends across the country except in B.C. In addition, projects that use CDR methods recognized under the Japanese Green Transformation Emissions Trading System and that meet the system's conditions can also be located anywhere in Canada.

2.1 Federal

Under the federal output-based pricing system, industrial emitters are incentivized to reduce their emissions. An emissions limit is set for each industrial emitter, and they must purchase surplus credits from other large emitters, pay an emissions charge, purchase eligible offset credits from Canada's Greenhouse Gas Offset Credit System, or a combination of the three.[9] Projects registering for the federal offset system can be located anywhere in Canada.

As shown in Table 1, the federal system includes five protocols for CDR with varying statuses, with only one in effect — the improved forest management (IFM) on private land. There is currently one active project under this protocol. No credits have yet been issued as of May 2025.

[9] "Carbon Pricing: Compliance Options under the Federal Output-Based Pricing System."

The protocol for direct air CO_2 capture and geological storage was released as a draft for comment in February 2025. It is the first federal protocol that recognizes a durable CDR method.

Table 1. CDR recognition in the federal offset system

Protocol	CDR method	Durability	Status
Improved forest management on private land	Improved forest management	Low	In effect
Direct air CO_2 capture and geological storage	Direct air capture and carbon storage	High	Under development
Improved forest management on public land	Improved forest management	Low	Under development
Enhanced soil organic carbon	Soil organic carbon	Low	Under development
Bioenergy with carbon capture and storage	Bioenergy with carbon capture and storage	High	Under consideration

Source: Adapted from Environment and Climate Change Canada[10]

The federal offset system is intended to complement, rather than compete with, provincial or territorial offset systems. A project can apply for the federal offset system only if it meets one of the following criteria:

- It is in a province or territory without an offset program.
- It is in a province or territory with an offset program and the program does not have a protocol applicable to the project, but the federal system does. For example:
  - An IFM on private land project in the Yukon can apply for the federal offset system because the Yukon does not have an offset program.
  - An IFM on private land project in Alberta can also apply for the federal system since Alberta's offset program does not have an IFM protocol.
  - An IFM on private land project in B.C. *cannot* apply for the federal system since B.C. has its own protocol.[11]

[10] Environment and Climate Change Canada, "Canada's Greenhouse Gas Offset Credit System: Protocols," last modified January 27, 2025. https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/output-based-pricing-system/federal-greenhouse-gas-offset-system/protocols.html

[11] Environment and Climate Change Canada, "Overview: Canadian Greenhouse Gas Offset Credit System Regulations under the Greenhouse Gas Pollution Pricing Act," last modified October 27, 2023. https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/output-based-pricing-system/federal-greenhouse-gas-offset-system/regulations/overview.html

2.2 Alberta

The Alberta Emission Offset System (AEOS) operates similarly to the federal offset system. Large emitters in Alberta are required to mitigate their emissions by reducing them directly, purchasing regulated offset credits, purchasing surplus credits from firms that have emitted less than their targets, or paying into the provincial Technology Innovation and Emissions Reduction (TIER) fund.[12]

The TIER fund, through Emissions Reductions Alberta, invests revenue from compliance systems into sustainable technology. Although CDR projects have received TIER funding, removal credits created by the projects, if any, are not attributable to the emitters paying into the fund to meet compliance obligations. Among the funded CDR projects are a feasibility study of implementing BECCS at the Hinton pulp mill, led by Vault 44.01, and a demonstration pilot plant for direct air capture by Carbon Engineering.[13]

Table 2 summarizes the CDR protocols in the AEOS. An updated version of the protocol for CO_2 capture and permanent geologic sequestration, released in January 2025, replaces the original protocol for CO_2 capture and permanent storage in deep saline aquifers. The key change in the new version is the issuance of removal credits rather than reduction credits if the captured CO_2 is biogenic or air sourced. While this new removal label provides no additional compliance benefit compared to other credits within the system, it may be useful for organizations or companies looking to purchase removal credits recognized by TIER.

Table 2. CDR recognition in the Alberta Emissions Offset System

Protocol	CDR method	Durability	Status
CO_2 capture and permanent geologic sequestration	Direct air capture and carbon storage Bioenergy with carbon capture and storage	High	In effect
Conservation cropping protocol	Soil organic carbon	Low	Retired

Source: Adapted from Government of Alberta[14]

A credit is retired once it has been used by the purchaser to offset emissions. In Alberta, nearly all retired credit as of May 2025 have been by either oil and gas or power generation companies.

[12] Government of Alberta, "Technology Innovation and Emissions Reduction Regulation," November 21, 2024, https://www.alberta.ca/technology-innovation-and-emissions-reduction-regulation

[13] Emissions Reductions Alberta, "Projects." https://www.eralberta.ca/projects/

[14] Government of Alberta, "Alberta Emission Offset System." https://www.alberta.ca/alberta-emission-offset-system

TransAlta, Alberta's largest power generator, has retired roughly one quarter of all offset credits issued in the province, about half of which came from tillage system management and wind power generation projects.[15] This is by far the most retirements by a single emitter in the AEOS, though the tillage reduction protocol — which aimed to increase soil organic carbon resulting in carbon removal — was retired in 2021 due to not satisfying the additionality criteria required for protocols in the AEOS. [16]

Additionality

Additionality is a key metric to assessing the quality of a CDR project. It determines whether a given project would have happened in a theoretical baseline scenario without revenue from carbon credits. In this baseline scenario, emission reductions or removals might occur due to natural processes, regulations and standard industry practices. A project is deemed non-additional if its activities would have happened without carbon credit revenue. Non-additional projects risk overstating their climate impact.[17]

2.3 British Columbia

B.C. has its own system for industrial emitters, known as the B.C. Output-Based Pricing System (B.C. OBPS). It also operates similarly to the federal OBPS in that large emitters are provided with a set of options to meet their emissions targets. The B.C. Carbon Registry manages offset projects that generate tradeable credits called B.C. Offset Units, with each credit representing one tonne of CO_2.[18] Table 3 summarizes the CDR protocols in the B.C. Carbon Registry.

Most B.C. offset units issued can be attributed to a single project, the Great Bear Forest Carbon Project.[19] Similarly, a single organization, the Government of B.C., is responsible for most of the

[15] Government of Alberta, "AEOR Listing," 2025. https://alberta.csaregistries.ca/GHGR_Listing/AEOR_Listing.aspx

[16] John Storey-Bishoff, *Memorandum: Clarification on Withdrawal of the Quantification Protocol for Conservation Cropping*, July 8, 2022. https://www.alberta.ca/system/files/custom_downloaded_images/aep-clarification-on-withdrawal-of-the-quantification-protocol-for-conservation-cropping.pdf

[17] Axel Michaelowa, Lukas Hermwille, Wolfgang Obergassel, and Sonja Butzengeiger, "Additionality revisited: guarding the integrity of market mechanisms under the Paris Agreement," *Climate Policy* 19, no. 10 (2019), 1211–1224. https://doi.org/10.1080/14693062.2019.1628695

[18] Government of British Columbia, "Greenhouse gas emission offset projects," accessed November 27, 2024. https://www2.gov.bc.ca/gov/content/environment/climate-change/industry/offset-projects

[19] Government of British Columbia, "BC Carbon Registry." https://carbonregistry.gov.bc.ca/bccarbonregistry/public/bc

credit retirements in the B.C. Carbon Registry as part of its Carbon Neutral Government Program.[20]

Table 3. CDR recognition in the B.C. Carbon Registry

Protocol	CDR method	Durability	Status
Forest carbon offset protocol	Afforestation, reforestation and revegetation Improved forest management	Low	In effect
Carbon capture and sequestration protocol	Direct air capture and carbon storage (including *in situ* mineralization) Bioenergy with carbon capture and storage (including *in situ* mineralization)	High	Under development

Source: Adapted from the Ministry of Environment and Climate Change Strategy[21]

The forest carbon offset protocol allows for projects such as conservation and avoided conversion. Improved forest management activities permitted under the protocol include improving stocking, reducing regeneration delays, using faster growing plants, and increasing rotation age.[22]

The most recent draft of the carbon capture and sequestration protocol is flexible in the CO_2 sources allowed. The protocol differentiates between emissions captured from a point source and from the atmosphere, but both emission sources generate the same B.C. offset units.[23] Because the protocol is CO_2-source agnostic, the CDR methods of direct air capture and bioenergy with carbon capture and storage are eligible.

2.4 Saskatchewan

Saskatchewan has an OBPS with mandatory participation by large emitters. Compliance is met by purchasing carbon capture, utilization and storage (CCUS) credits from the provincial

[20] Government of British Columbia, "BC Carbon Registry."

[21] Government of British Columbia, "Offset Protocols," April 22, 2024. https://www2.gov.bc.ca/gov/content/environment/climate-change/industry/offset-projects/offset-protocols

[22] B.C. Ministry of Environment and Climate Change Strategy, *British Columbia Greenhouse Gas Offset Protocol: Forest Carbon*, April 28, 2024, https://www2.gov.bc.ca/assets/gov/environment/climate-change/ind/protocol/bc_forest_carbon_offset_protocol.pdf#page=20.42

[23] B.C. Ministry of Environment and Climate Change Strategy, "Draft Carbon Capture and Sequestration Protocol," 2023. https://www2.gov.bc.ca/assets/gov/environment/climate-change/offsets/offsets-portfolio/draft_ccs_protocol.pdf

registry, purchasing performance credits from other regulated emitters, or paying into the Saskatchewan Technology Fund.[24] A noteworthy feature of Saskatchewan's compliance system is the focus on CCUS.

The Saskatchewan CCUS Credit Standard provides credits for CCUS projects. For a project to be eligible, the CO_2 source and storage reservoir must be in the province. Biogenic CO_2 sources are recognized in the standard; however, removals are not mentioned. Ex-situ mineralization methods are not eligible for the program because CO_2 must be stored in an underground reservoir. Like in B.C., the rules are flexible on acceptable CO_2 sources, which enables the inclusion of DACCS and BECCS.[25] These two CDR methods are the only ones currently recognized in Saskatchewan.

The highest emitting sector in Saskatchewan comprises mining, quarrying, and oil and gas extraction, and was responsible for 58.2% of industrial emissions in the province in 2021.[26] The bulk of CCUS credit retirements can likely be attributed to this sector, but it cannot be easily confirmed since CCUS credit transaction data are not published by the province.

2.5 Quebec

Since 2013, Quebec has been using its cap-and-trade system for regulating emissions. Quebec's system requires industrial emitters to purchase emission allowance units, with one unit purchased for each tonne of emissions emitted, with some exceptions. The total units decline over time, aligned with climate targets. The emitters are also allowed to mitigate their emissions by purchasing excess emission units from other system participants or offset credits from the province's Register of Offset Credit Projects.[27] Currently, credit transaction data in the province are not publicly available. However, the largest emitting industries in the province include manufacturing; smelting and refining; and mining, quarrying, and oil and gas extraction.[28]

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[24] Government of Saskatchewan, "Guidance for Emitters." https://www.saskatchewan.ca/business/environmental-protection-and-sustainability/a-made-in-saskatchewan-climate-change-strategy/guidance-for-emitters

[25] Government of Saskatchewan, *The Carbon Capture, Utilization and Storage Credit Standard*, 2024. https://publications.saskatchewan.ca/#/products/121091

[26] Natural Resources Canada, "Industrial Sector – Aggregated Industries Saskatchewan, Table 2: Secondary Energy Use and GHG Emissions by Industry." https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=agg&juris=sk&year=2021&rn=2&page=0

[27] Government of Quebec, "Offset Credits," 2024. https://www.environnement.gouv.qc.ca/changements/carbone/credits-compensatoires/index-en.htm

[28] Natural Resources Canada, "Industrial Sector – Aggregated Industries Quebec, Table 2: Secondary Energy Use and GHG Emissions by Industry." https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=agg&juris=qc&year=2021&rn=2&page=0

Table 4 summarizes the CDR protocols in the Register of Offset Credit Projects.

Table 4. CDR recognition in Quebec's Register of Offset Credit Projects

Protocol	CDR method	Durability	Status
Carbon sequestration through afforestation or reforestation on private lands	Afforestation, reforestation and revegetation	Low	In effect
Carbon sequestration through afforestation and reforestation on public lands	Afforestation, reforestation and revegetation	Low	Under development

Source: Adapted from the Government of Quebec[29]

Quebec's system is linked to California's cap-and-trade system, allowing for the trading of compliance instruments, including offset credits, between the jurisdictions. Trading is done through the Western Climate Initiative (WCI) carbon market.[30] From 2013 to 2020, almost 20 million credits were retired by emitters in Quebec. Ninety-five per cent of the retired credits were issued in California.[31] (For a discussion of California's protocols and recognition of CDR, see the International Compliance Systems section of this report.)

As of November 2024, California, Quebec and Washington are discussing a potential linkage agreement that would allow Washington to trade compliance units with the other two regions. The linkage agreement is expected to be finalized as soon as late 2025.[32]

[29] Government of Quebec, "Regulatory Framework for Offset Credits," December 13, 2023. https://www.environnement.gouv.qc.ca/changements/carbone/credits-compensatoires/cadre-reglementaire-credits-compensatoires-en.htm

[30] Government of Quebec, "The Carbon Market, a Green Economy Growth Tool!." https://www.environnement.gouv.qc.ca/changementsclimatiques/marche-carbone_en.asp

[31] International Carbon Action Partnership, "Canada - Québec Cap-and-Trade System," Offset credits. https://icapcarbonaction.com/en/ets/canada-quebec-cap-and-trade-system

[32] Washington State Department of Ecology, "California, Québec and Washington to begin linkage agreement discussions," news release, September 23, 2024. https://ecology.wa.gov/about-us/who-we-are/news/2024-news-stories/california-quebec-and-washington-to-begin-linkage-agreement-discussions

3. Relevant Canadian fuel standards

Fuel standards and regulations in Canada aim to reduce emissions from transportation fuels. These regulations could create demand for durable CDR, but there is limited progress in enabling this avenue.

3.1 B.C. Low Carbon Fuel Standard

The B.C. Low Carbon Fuel Standard (LCFS), introduced in 2008, involves setting increasingly stringent carbon intensity requirements for transportation fuels. Changes were proposed in 2022 to allow the generation of compliance credits from CDR activities.[33] The average credit cost under the fuel standard in the first half of 2025 was $308.03.[34] This is in stark contrast to credit prices in the B.C. Carbon Registry, which administers credits that can be used in the B.C. OBPS and by the Government of B.C. The highest price the government paid for an offset in 2023 was $15 per tonne.[35] Durable CDR credits could be a cost competitive compliance tool within this market.

3.2 Federal Clean Fuel Regulations

The Canadian Clean Fuel Regulations aims to reduce emissions from transportation fuels. One way to generate compliance credits under the regulations is by supplying low-carbon-intensity fuels, including synthetic fuels made from atmospheric CO_2 obtained via direct air capture.[36] While this involves CDR-related processes, since the atmospheric CO_2 is being used in a product rather than being durable stored, there is no mechanism here to generate credits for a full CDR process — that is, the permanent storage of captured atmospheric CO_2.

[33] Government of British Columbia, "Low-carbon fuel expansion cuts emissions, creates jobs," news release, May 9, 2022. https://news.gov.bc.ca/releases/2022EMLI0032-000730

[34] Government of British Columbia, "BC-LCFS Credit Market Data (2015 to present)," spreadsheet, June 2025. https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels/credits-market

[35] Government of British Columbia, *Public Sector Climate Leadership 2023 Year in Review*, 10. https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/yir/2023_cng_year_in_review_summary.pdf

[36] Government of Canada, *Clean Fuel Regulations*, SOR/2022-140, Regulatory Impact Analysis Statement. https://www.gazette.gc.ca/rp-pr/p2/2022/2022-07-06/html/sor-dors140-eng.html

4. Relevant international compliance systems

Several international compliance systems allow for credit generation from CDR projects in Canada. This section outlines these compliance systems since they represent potential demand for Canadian CDR projects.

4.1 California Low Carbon Fuel Standard

The Low Carbon Fuel Standard in California aims to lower the carbon intensity of transportation fuels in California and provide an increasing range of low-carbon alternatives. In 2019, a Carbon Capture and Sequestration Protocol was added to the regulations. This protocol recognizes the generation of offset credits from DACCS projects anywhere in the world, thus making it accessible for projects in Canada.[37] As of July 2025, no DACCS project has applied to generate credits within this program.[38]

4.2 California Cap-and-Trade Program

California's Cap-and-Trade Program, covering large emitters, sets a declining cap on statewide emissions and operates by creating tradeable credits (allowances) equal to the total allowable emissions under the cap. Established under this program, the Compliance Offset Program issues offset credits through the California Air Resources Board. Annually, fewer emissions are allowed while simultaneously the price emitters must pay to purchase allowances increases, resulting in reduced emissions and creating a carbon price signal. [39] Offset credits in California's program are tradeable with Quebec due to the linkage agreement between the jurisdictions.[40]

Cap-and-Trade Program participants may offset a small portion of their emissions by purchasing offset credits. Participants may use these credits to meet up to 4% of their

[37] California Air Resources Board, "Carbon Capture and Sequestration Project Eligibility FAQ." https://ww2.arb.ca.gov/resources/fact-sheets/carbon-capture-and-sequestration-project-eligibility-faq

[38] California Air Resources Board, "LCFS Credit Generation Opportunities." https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-credit-generation-opportunities

[39] California Air Resources Board, "Cap-and-Trade Program." https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program/about

[40] California Air Resources Board, "Program Linkage." https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program/program-linkage

compliance obligation in 2025 and 6% from 2026 to 2030.[41] For context, Quebec allows participants to offset up to 8% of their compliance obligation with no changes to this percentage over time. [42]

Table 5 summarizes the CDR protocols in this program.

Table 5. CDR recognition in California's Compliance Offset Program

Protocol	CDR method	Durability	Status
U.S. forest projects	Improved forest management Afforestation, reforestation and revegetation	Low	In effect
Urban forest projects	Afforestation, reforestation and revegetation	Low	In effect

Data source: California Air Resources Board[43]

4.3 Japan Green Transformation Emissions Trading System

In 2023, Japan's Ministry of Economy, Trade and Industry launched the Green Transformation Emissions Trading System (GX-ETS). Currently, large Japanese companies can voluntarily participate in the GX-ETS; however, participation will be mandatory after 2026.[44]

The GX-ETS allows the sale and purchase of offset credits from several CDR methods, which are summarized in Table 6. At present, the GX-ETS does not have its own protocols. Instead, it relies on protocols approved by international standards bodies such as the Integrity Council for the Voluntary Carbon Market (ICVCM).

GX-ETS projects can be located outside of Japan under a few conditions. The international project must have significant investment or involvement from Japanese companies and be

[41] California Air Resources Board, "Compliance Offset Program: About." https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/about

[42] International Carbon Action Partnership, "Canada - Québec Cap-and-Trade System," Offset credits. https://icapcarbonaction.com/en/ets/canada-quebec-cap-and-trade-system

[43] California Air Resources Board, "Compliance Offset Program."

[44] Agamoni Ghosh and Aliana zulaika Yeong, "Japan's GX-ETS to Accept International Removal Voluntary Credits for Compliance Obligations," *S&P Global*, April 22, 2024. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/042224-japans-gx-ets-to-accept-international-removal-voluntary-credits-for-compliance-obligations

difficult to implement in Japan.[45] The significant involvement criteria can be met if, for example, a Japanese company provides the technology needed for the CDR project.

Table 6. CDR methods under Japan's GX-ETS applicable to projects in Canada

CDR method	Durability	Status
Bioenergy with carbon capture and storage	High	In effect
Direct air capture and carbon storage	High	In effect

Data source: Japanese Ministry of Economy, Trade, and Tourism[46]

4.4 Paris Agreement Crediting Mechanism

The Paris Agreement Crediting Mechanism (PACM) recently arose out of negotiations at COP29 in Baku, Azerbaijan. It is a global carbon market backed by the United Nations and is seen as the successor to the clean development mechanism, a carbon offset system under the Kyoto Protocol.

The PACM officially recognizes CDR, treating it distinctly from carbon reduction and avoidance.[47] The effects of the PACM on Canadian compliance systems and carbon markets more broadly have yet to be seen. As it stands now, there is the potential of CDR projects in Canada selling removal credits to other countries via the PACM.

[45] Tank Chen, "Japan's GX-League and Carbon Removal in GX-ETS," August 28, 2024. https://www.cdr.fyi/blog/japans-gx-league-and-carbon-removal-in-gx-ets

[46] "Japan's GX-League and Carbon Removal in GX-ETS."

[47] CarbonBrief, "COP29: Key Outcomes Agreed at the UN Climate Talks in Baku," November 24, 2024, https://www.carbonbrief.org/cop29-key-outcomes-agreed-at-the-un-climate-talks-in-baku/

5. Recommendations

Across Canadian compliance systems for industry, significant progress has been made in recognizing durable CDR. However, how much the systems will drive the adoption of durable CDR remains to be seen. The current federal carbon price schedule indicates a maximum price of $170 per tonne of CO_2, which is lower than what some projects would be able to secure within the voluntary carbon market.

The federal government's recent announcement to purchase at least $10 million in CDR by 2030 builds on the progress to date.[48] Integrating durable CDR into compliance systems is critical for establishing its credibility and generating reliable demand, helping to cement Canada as a global CDR leader. Additionally, rules for fuel like the B.C. Low Carbon Fuel Standard and the federal Clean Fuels Regulation offer potential alternative avenues given their higher carbon prices. Below, we present several recommendations on how to further integrate durable CDR into Canadian compliance systems.

5.1 Differentiate between removal and reduction

As a starting point, regulations should correctly differentiate between CO_2 removal and reduction. This is an important first step in recognizing the difference in roles between the two. Only B.C.'s draft carbon capture and storage protocol and Alberta's protocol for CO_2 capture and permanent geologic sequestration differentiate between the two. Across other credit systems, removals and reductions are referred to interchangeably and incorrectly. For example, the federal IFM protocol explicitly conflates "GHG removals" with "GHG reductions."

5.2 Set separate targets for removals and reductions

Setting separate targets for removals and reductions can ensure that progress continues to be made on reducing emissions, while enabling near-term investment in CDR to spur the sector, which will be needed to achieve long-term climate goals.

Compliance systems could establish different requirements for the use of removal credits and the use reduction credits. One approach would be to place a limit on the number of offset credits

[48] Treasury Board of Canada Secretariat, "Government of Canada Commits to Purchase Carbon Dioxide Removal Services to Green Government Operations and Achieve Net-Zero Emissions," news releases, October 9, 2024. https://www.canada.ca/en/treasury-board-secretariat/news/2024/10/government-of-canada-commits-to-purchase-carbon-dioxide-removal-services-to-green-government-operations-and-achieve-net-zero-emissions.html

an emitter can use to meet compliance obligations, as well as set out a minimum number of removal credits that must be used as part the offset.

5.3 Increase cooperation between compliance systems

There is promising momentum towards greater cooperation between compliance systems, as evidenced by Washington's impending integration with the California–Quebec linkage and Canada's design of federal offset protocols to complement provincial and territorial protocols. Cross-jurisdictional cooperation should continue to be enhanced. This could involve:

- allowing trading between provincial and territorial offset programs
- encouraging more jurisdictions to join the California–Quebec linkage
- forming new international linkage agreements
- aligning CDR protocols

Strengthening ties between compliance systems could increase market efficiency, reduce the resources needed to develop protocols, and broaden the demand for CDR projects.

5.4 Collaborate with leading CDR registries

Leading CDR registries, such as Puro and Isometric, have invested heavily in developing CDR standards and protocols, and registry infrastructure. Using existing rigorously researched, high-quality standards and protocols could efficiently accelerate CDR in Canada.

California's Compliance Offset Program provides an example of collaboration with existing registries. American Carbon Registry, Climate Action Reserve, and Verra are the approved registries. Project developers applying for the program must be listed in one of the approved registries, and the registry is expected to assist with tracking carbon credits, reporting, verification and validation. Being able to work with different registries allows developers to access different markets and helps compliance programs stay up to date with the latest best practices.

6. Closing

Industrial emitters across Canada have limited but growing options to integrate CDR into their sustainability strategies and approaches to meeting their emissions obligations. The federal compliance system — as well as compliance systems in four provinces — have taken steps to recognize durable CDR. See Table 7 for a full overview.

In Alberta, oil and gas companies, as well as power companies, can purchase removal credits from direct air carbon capture and storage (DACCS) and bioenergy with carbon capture and storage (BECCS) projects. This provides new opportunities for meeting climate targets and offers several additional benefits, including:

- enhanced collaboration and innovation between the emissions removal sector and the oil and gas industry, as some of the technologies used in DACCS are the same as that used in the oil and gas industry
- access to an alternative source of power for the energy sector through BECCS since it not only removes carbon dioxide, but also generates power

In Saskatchewan, mining and oil and gas companies can also meet compliance obligations by purchasing removal credits from DACCS and BECCS projects.

In B.C., removal credits from improved forest management and afforestation are available. Protocols for DACCS and BECCS are currently being drafted. Given that the Government of B.C. is the largest purchaser of credits within the OBPS, public procurement of removal credits from DACCS and BECCS projects could be an important validator of those protocols once finalized.

Finally, industrial emitters in Quebec, comprising largely of industries in oil and gas extraction, manufacturing, smelting and refining, and mining are not yet able to purchase durable CDR credits for compliance obligations. Their removal credit options are limited to afforestation and reforestation projects.

As can be seen, recognition of CDR in compliance programs is location and method specific, but it continues to expand rapidly. This recognition is important to ensure that the infrastructure is in place to nurture the long-term development of durable CDR.

To stay on top of information on CDR, including regulatory updates, visit the Pembina Institute's Carbon Dioxide Removal Centre at https://www.pembina.org/programs/carbon-removal or subscribe to our CDR mailing list by emailing carsonf@pembina.org.

Table 7. CDR methods by compliance system and project location

CDR method	Storage durability	B.C.[a]	Alberta[b]	Saskatchewan[c]	Quebec[d]	Projects across Canada	
						Federal system[e]	International programs
Improved forest management	Low	In effect			In effect[f]	Private land: In effect[g] Public land: Under development	
Afforestation, reforestation and revegetation	Low	In effect			Private land: In effect Public land: Under development		
Soil organic carbon	Low		Retired			Under development	
Biochar	Medium						
Biomass burial	Medium						
Direct air capture and carbon storage	High	Under development	In effect	In effect		Under development	Japan GX-ETS[h]: In effect California LCFS[i]: In effect

CDR method	Storage durability	B.C.[a]	Alberta[b]	Saskatchewan[c]	Quebec[d]	Projects across Canada	
						Federal system[e]	International programs
Bioenergy with carbon capture and storage	High	Under development	In effect	In effect		Considering	Japan GX-ETS: In effect
Enhanced rock weathering	High						
Ex-situ mineralization	High						
Direct ocean capture	High						
Ocean alkalinity enhancement	High						

[a] B.C. Output-Based Pricing System.

[b] Alberta Emission Offset System.

[c] Saskatchewan Output-Based Performance Standards Program.

[d] Quebec Cap-and-Trade System and California Cap-and-Trade Program.

[e] Canada's GHG Offset Credit System. The federal protocols are intended to complement provincial protocols. As a result, a project is eligible for the federal protocol only if there isn't an active equivalent protocol in the project's province.

[f] Participants in Quebec's cap-and-trade system have access to improved forest management credits due to links with California's cap-and-trade program. There is no provincial protocol for this type of project in Quebec.

[g] Excludes B.C.

[h] Japan's GX-ETS, which allows credits to be sourced internationally, including in Canada, provided certain requirements of Japanese involvement are met.

[i] California's Low Carbon Fuel Standard allows direct air capture projects to be located internationally.

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