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Brief

Canadian Federal and Provincial CCS Policies

Global CCS Institute

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1. Introduction

This policy brief focuses on Canadian federal policy that is relevant to carbon capture utilization and storage (CCUS/CCS), but also includes a description of CCUS policy in Alberta and Saskatchewan, with particular attention to programs and policies to support emissions reduction such as Alberta's Technology Innovation and Emission Reduction (TIER) program.

2. Federal policy relevant to CCUS

2.1 Paris agreement and Canada's NDC

In Canada's latest Nationally Determined Contribution (NDC) under the Paris Agreement, the government enhanced its NDC in line with the climate science that has demonstrated the need for ambitious action. Canada pledged to cut its emissions by 40 - 45% below 2005 levels by 2030 and to Net Zero by 2050, which is consistent with the Paris Agreement aims to hold the increase in the global average temperature to well below 2°C above pre-industrial levels while pursuing efforts to limit the temperature increase to 1.5°C (Government of Canada, 2021a).

Canada has codified its Paris commitment through the ***Canadian Net-Zero Emissions Accountability Act***, which commits the country to achieving net-zero greenhouse gas (GHG) emissions by 2050. The legislation also requires that the government set interim targets and set emission reduction development plans for 2030, 2035, 2040, and 2045 (Government of Canada, 2021a). While the details of interim targets and long-term plans have not yet been determined, this Act does help give some long-term certainty in the overall pathway that Canada's emissions will take, which will help reduce some policy risk for large capital-intensive carbon reduction projects like CCS.

Canada's NDC outlines the actions it has taken over the last five years to meet its commitments under the Paris Agreement. In 2016, Canada adopted its first national climate change plan, the *Pan-Canadian Framework on Clean Growth and Climate Change* (PCF). The PCF outlines four pillars of action: Pricing carbon pollution; Complementary actions to reduce emissions; Adaptation and climate resilience; and Clean technology, innovation and jobs (Government of Canada, 2018). The PCF notes that provinces and territories have been early leaders on implementing carbon capture projects. Canada expects that implementing the PCF will achieve a 36% reduction below 2005 emissions by 2030, short of its reduction commitment (Government of Canada, 2021a).

2.2 Canada's climate change plans

To enhance its climate actions, Canada adopted a new climate change plan in 2020, *A Healthy Environment and a Healthy Economy - Canada's Strengthened Climate Plan (SCP)*. The SCP "includes federal policies, programs and investments to accelerate emissions reductions and build a stronger, cleaner, more resilient and inclusive economy" (Government of Canada, 2021a). The pillars of the SCP that indirectly relate to CCS are "pollution isn't free" and "clean, affordable transportation," and the pillar that addresses CCS directly is "Building Canada's Clean Industrial Advantage" (Government of Canada, 2021b).

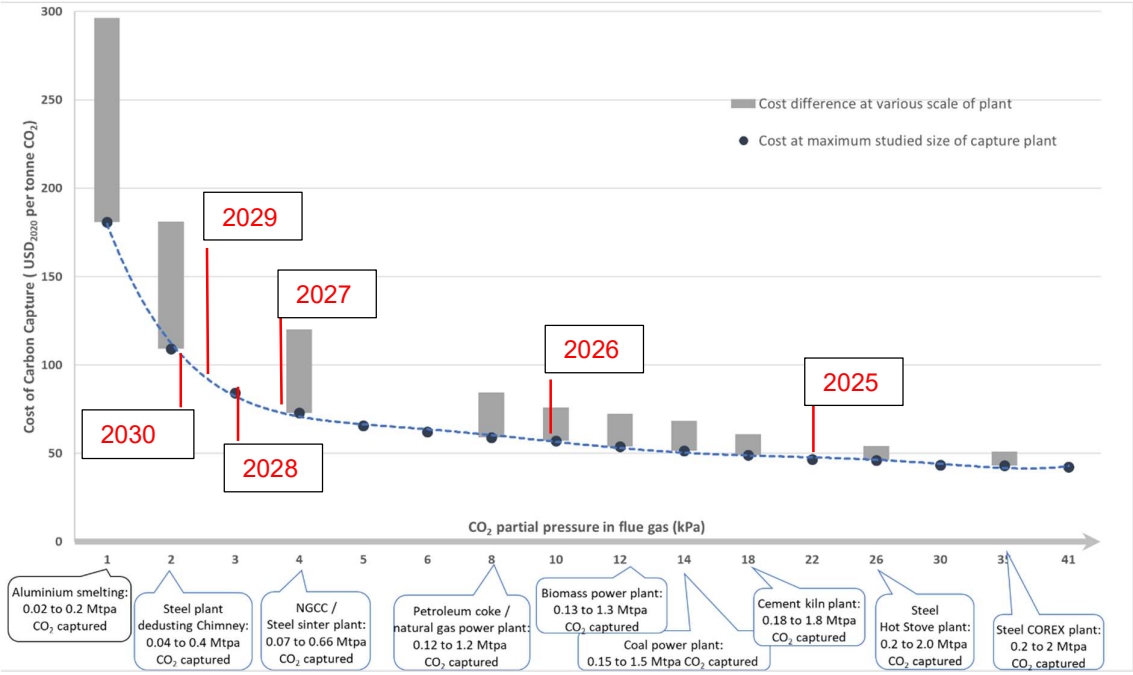
Under the "pollution isn't free" pillar, Canada has established a two-pronged approach to carbon pricing. It requires a Fuel Charge for individuals that applies to gasoline, diesel, natural gas, and other hydrocarbon fuels consumed directly by individuals. Canada also mandates an Output-Based Pricing System (OBPS) for industry. In both cases, provinces can opt to implement and operate equal or more stringent systems, including a cap-and-trade system as an alternative to the OBPS, instead of the default federal systems. Provinces can also mix and match by implementing their own system for industry or individuals and using the federal system for the other. For example, Alberta has implemented an alternative system to the OBPS called the Technology Innovation and Emission Reduction (TIER) policy for large emitters, discussed later in this policy brief, but defaults to the Federal Fuel Charge for individuals. Proceeds from the OBPS will be used to enable industrial

decarbonization projects.

Carbon pricing policy

The benchmark carbon price serves as a minimum price for all provinces. Canada will ramp up the benchmark carbon price that began in 2019 at $20/ton CO_2e to $50 per tonne CO_2e in 2022 and to $170/ton CO_2e by 2030 (Government of Canada, 2021b). If we convert the benchmark carbon price to USD and assume that compression, transport and storage cost is 20 USD per tonne, the years noted on Figure 1 correspond to when the benchmark carbon price reaches points on the carbon capture cost curve (Global CCS Institute, 2021). By 2030, many large industrial applications will likely face carbon capture, transport and storage costs lower than the benchmark carbon price.

Figure 1: Impact of CO2 partial pressure and scale on the cost of carbon capture. Studied flue gas streams are at atmospheric pressure. The circle marker indicates the cost at the maximum studied size of a single carbon capture plant. Each grey bar indicates the capture cost ranges from 10% to 100% of the scales shown in the callouts for that particular application.



While the benchmark carbon price has been defined only through 2030, Canada's NDC and the ***Canadian Net Zero Emissions Accountability Act*** provide a reasonable expectation that a carbon price will continue through 2050. A long-term carbon price – or at least the expectation of a long-term carbon price – is key to provide enough certainty to justify investment in CCS infrastructure with long lifetimes.

The Fuel Charge may also provide some incentive for hydrogen investment, including blue hydrogen and CCS, as an alternative to hydrocarbon fuels. The Clean Fuel Standard is a complementary policy to the Fuel Charge and may also be a driver for blue hydrogen. The Clean Fuel Standard requires liquid fuel (gasoline, diesel, home heating oil) suppliers to reduce the carbon intensity of the fuels they produce and sell for use in Canada by 13% (below 2016 levels) by 2030 (Government of Canada, 2021b).

Carbon pricing may not be sufficient for CCUS

A carbon price or equivalent (e.g., output-based tax incentive) is necessary to induce private sector investment, absent an investment mandate, but it may not be sufficient even if the price exceeds the

combined capture, transport, and storage costs. Unless a company can vertically integrate the value chain of capture, transport and storage, multiple companies will be involved along this chain.

The OBPS requires that the emitting facility pay for CO_2 emissions, so emitters have the incentive to capture those emissions in a hub type system, which would need to pass on some portion of the carbon price to pay for transport and storage. Hubs and shared pipeline networks result in lower carbon transport costs to deliver carbon to low-cost storage sites and thus offer greater potential than an integrated model. However, the complexity of a hub approach can pose challenges. Pipelines are a long-term investment that typically exceed the lifetime of any capture facility. Good storage locations will be able to store CO_2 from many different long-term sources. Yet, the direct economic incentive of the benchmark carbon price rests with the capture facilities, and any one facility cannot support a hub system. The coordination required can be a barrier.

Clean fuels

The "clean, affordable transportation" pillar of the SCP calls for 100% of new light duty vehicles (LDVs) and passenger trucks sold in Canada to be zero emission by 2035 (Government of Canada, 2021b). Electric Vehicles currently dominate the zero emission LDV market. Vehicle manufacturers are developing hydrogen LDVs, but "some automakers have shifted their short-term focus from LDV applications to medium- and heavy-duty vehicle (MHDV) applications" (National Academies of Sciences, Engineering, and Medicine, 2021). The key advantage hydrogen vehicles have in range becomes less important for LDVs as EVs improve in range every year and charging infrastructure outpaces hydrogen refueling infrastructure. EVs are expected to maintain their position in the LDV market. Hydrogen will most likely play a key role in other transportation segments like heavy-duty vehicles, marine transport, and aviation (at least via hydrogen-to-synthetic fuel pathways), yet Canada does not make any specific commitments to reduce emissions in these other transportation sectors, opting only to "work with partners, domestically and internationally, to reduce emissions from other modes of transportation, which can be challenging to abate …" (Government of Canada, 2021a). Additional policy may be necessary to provide sufficient incentives for blue hydrogen to play a role in hard-to-abate transport segments.

Industrial emission reduction incentives

The "Building Canada's Clean Industrial Advantage" pillar of the SCP calls for programs that provide direct assistance to industry to invest in carbon emission reductions, including investments in CCS.

- Energy Innovation Program: provides funding for innovative clean energy research, development and small-scale demonstration through grants, contributions, federal/provincial/territorial collaborations, and public-private partnerships. Among the projects supported are CCS; other areas of support are renewable energy, smart grids, energy-efficient buildings, and cleaner production of oil and gas (Wynne et al., 2020).
- Clean Fuels Fund: To complement the Clean Fuel Standard, the Canadian government has invested $1.5 billion over five years in a Clean Fuels Fund to "de-risk the capital investment required to build new or expand existing clean fuel production facilities," including clean hydrogen production (Government of Canada, 2021b).
- Net-Zero Accelerator Fund. An $8 billion CAD fund intended to help large emitters reduce their emissions (Government of Canada, 2021b).

Direct CCS policy

Although not highlighted as a pillar within the SCP, Canada nevertheless has developed policy targeting CCS directly. Historically, CCS policy and support in Canada has focused primarily on fossil fuels. The federal government, for example, gave a one-off $240 million allocation as part of its 2008 budget to support the SaskPower Boundary Dam unit 3 CCS project that began in 2014. Natural Resources Canada previously granted $120 million to the Quest project at Shell's Scotford refinery, and $63 million to the Alberta Carbon Trunk Line project which captures and stores CO_2 from a refinery and a fertilizer plant as part of the 2009 Budget (Wynne et al., 2020).

In the 2021 Budget, the federal government offered an investment tax credits for CCUS with the intent

to reduce 15 Mt CO_2 per year. This tax credit would be available to various industries and applications, including concrete, plastics, fuels, as well as blue hydrogen projects and direct air capture projects, though not for enhanced oil recovery projects. The government sought consultation in the development of the investment tax credit until September 7, 2021. Details of the tax credit have yet to be released, however, are slated to begin in 2022.

As part of the Energy Innovation Program, Canada also committed $319 million over seven years to support research, development, and demonstrations for CCUS technologies.

Canada's CCUS policy may become better integrated over the various government programs and incentives in the coming years as a result of the development of a CCUS Strategy, which comes on the heels of Canada's Hydrogen Strategy. The government has solicited input from stakeholders and concerned citizens to develop its CCUS strategy. The feedback period is now closed, and the strategy is expected to be released early in 2022.

Canada's hydrogen strategy

The Hydrogen Strategy for Canada provides a vision for 2050 and path forward. By 2050, the strategy calls for:

- "Up to 30% of Canada's energy delivered in the form of hydrogen
- Canada is one of top 3 global clean hydrogen producers, with domestic supply >20 Mt/year
- Established supply base of low carbon intensity (CI) hydrogen with delivered prices of $1.50 - $3.50/kg
- >Five million FCEVs on the road
- Nationwide hydrogen fueling network
- >50% of energy supplied today by natural gas is supplied by hydrogen through blending in existing pipelines and new dedicated hydrogen pipelines
- New industries enabled by low-cost hydrogen supply network
- ~350,000 hydrogen sector jobs
- >$50 billion in direct hydrogen sector revenue for the domestic market
- Established and competitive hydrogen export market
- Up to 190 Mt-CO_2e annual GHG reduction"

The hydrogen strategy identifies hydrogen produced from fossil fuels with CCUS as the lowest cost pathway to low CI hydrogen. Citing an analysis done by the Transition Accelerator, the strategy calls for up to eight times the current production of hydrogen from natural gas, which would entail 203 Mt CO_2 captured and stored. The strategy also mentions the potential for industrial and in situ gasification of crude oil, bitumen, and coal.

3. Alberta policy relevant to CCUS

3.1 Technology Innovation and Emission Reduction (TIER)

Alberta has developed an alternative to the federal OBPS called TIER. The overall goal of the TIER program is to limit oil sands emissions to 100 million CO_2e, phase out coal-fired electricity generation by 2030, and to reduce methane emissions by 45% by 2020 (TIER is an evolution of previous systems in Alberta that have been in place since 2007) (IETA, 2021).

The Government of Alberta will use up to $750 million in proceeds from its TIER program to fund emissions reductions, including $80 million for a new Industrial Energy Efficiency and Carbon Capture Utilisation and Storage Grant Program. TIER would also invest $9.5 million through Emissions Reductions Alberta to support CCUS projects.

Large emitters that emit over 100,000 tonnes CO_2 per year are automatically enrolled in TIER, but

smaller emitters have the option to enroll as an alternative to complying with the OBPS (Government of Alberta, 2021b). What sets TIER apart structurally from the OBPS is that it is an output-based carbon trading (and pricing) system.

TIER is a CO_2e emissions trading program in which the allocation of emission credits is based on a benchmark of emissions intensity. The benchmark can be facility-specific or a high-performance benchmark for a given type of facility. If a facility opts for a facility-specific benchmark, the benchmark becomes 1% more stringent each year until it equals the high-performance benchmark (Government of Alberta, 2021b).

If a facility has an emissions intensity that exactly matches the benchmark, then it is allocated just enough credits to cover its emissions. If a facility has emissions below the benchmark, then it generates credits or offsets that can be sold to facilities that have emissions above the benchmark. Those facilities with emissions above the benchmark can opt to make investments to reduce emissions intensity down to or below the benchmark, can opt to purchase credits to lower its intensity or can pay the benchmark carbon price for the emissions that exceed the benchmark.

The intent of an emissions intensity-based scheme is to encourage and reward facilities that perform better than the benchmark by providing an incentive via credit generation and trading. The logic of output-based schemes is that facilities that have emissions intensities better than the benchmark can also generate additional credits by increasing output without necessarily improving emissions intensity as long as emissions intensity stays below the benchmark. The net result is that marginal output in an output-based allocation scheme will increase relative to a fixed allocation scheme. Facilities can use a maximum of 60% credits to satisfy obligations under the scheme, which serves as a limit on the incentive for other facilities to increase output to generate more credits. Additionally, the increased supply of credits will serve to drive down the price of those credits and thus limit the generation of those credits up to an equilibrium clearing price. On the other hand, if few credits are generated and the price of credits is high, the Federal benchmark carbon price serves as a backstop option for compliance; facilities above the emissions intensity benchmark would always opt to pay the federal benchmark carbon price if it is lower than the market price of credits.

3.2 Alberta Carbon Sequestration Tenure Management

Alberta recognizes the importance of carbon hubs and that the pore space in areas with good storage potential should be maximized to efficiently serve multiple capture facilities. As such, Alberta has developed the Carbon Sequestration Tenure Management, which involves a request for full project proposal (RFPP) process for companies to submit proposals to develop and manage carbon hubs. The initial phase of this process is targeted to projects in the Northeast of Edmonton area (known as the Industrial Heartland), and is currently underway but coming to a close; proposals are accepted until February 1, 2022, and successful proposals will be selected by the end of March 2022. RFPPs for other areas in Alberta will be announced in Spring 2022.

Companies successful in the RFPP will be granted “the right to drill wells, conduct evaluation and testing, establish monitoring baselines, and inject captured CO_2 into deep subsurface formations within previously defined zones for sequestration” (Government of Alberta, 2021a). Along with those rights, successful companies will face the following obligations:

- managing the development of the hub and the efficient use of the pore space;
- ensuring open access to affordable use of the hub where appropriate; and
- provide just and reasonable cost recovery to the Agreement holder” (Government of Alberta, 2021a)

3.3 Alberta hydrogen roadmap

Alberta considers hydrogen as its path forward to maintain competitiveness in a “clean energy economy.” Alberta is uniquely positioned within Canada to lead blue hydrogen production. Alberta produces over half of Canadian natural gas, has exceptional carbon storage capacity, and leads

Canada's oil refining and petrochemical sectors. Alberta is already the largest producer of hydrogen in Canada and one of the largest producers of hydrogen in the world. The roadmap relies primarily on blue, or low CI hydrogen production but identifies wind-based hydrogen production as potentially being viable in the medium- to long-term in Alberta, but also points out that Alberta does not currently have a cost advantage in wind-based hydrogen production compared to the global average.

The Hydrogen Roadmap identifies seven pillars for policy to support the further development of hydrogen in Alberta: 1) build new market demand, 2) enable CCUS, 3) de-risk investment, 4) activate technology and innovation, 5) ensure regulatory efficiency, codes, and standards to drive safety, 6) lead the way and build alliances, 7) pursue hydrogen exports.

The roadmap considered two possible scenarios for how low CI hydrogen can be integrated into Alberta's energy demand and supply by 2030. One is termed incremental and is business as usual. The other scenario is termed transformative and is intended to be the result of implementing the roadmap. The transformative scenario:

Industrial: CCUS is added to hydrogen production facilities at 1) bitumen upgrading and/or oil refining sites and 2) ammonia and methanol facilities to reduce emissions by 12 Mt per year.

Residential and commercial heating: Hydrogen is blended at 15% by volume in natural gas distribution infrastructure across the province. Pure hydrogen networks and communities are demonstrated for 200,000 residences.

Electricity generation: Natural gas supplying 1200 MW of Alberta's electricity generation is blended with hydrogen at 15% by volume. A demonstration project with hydrogen powered turbines is in operation. Hydrogen is also used as a seasonal storage system from surplus renewable electricity through power-to-gas.

Transportation: 5% of gasoline vehicles and 10% of diesel vehicles have transitioned to FCEVs.

Exports: Alberta exports 1 Mt of gaseous hydrogen, noting this would require a fully permitted and constructed pipeline to the west coast, liquefaction, and export infrastructure. In addition, Alberta also exports 1 Mt of hydrogen carriers (such as ammonia) to global markets by 2030.

4. Saskatchewan policy relevant to CCUS

4.1 Carbon Pricing

In Saskatchewan, there is a mix of federal and provincial legislation that applies to large emitters. The federal charge on fuel and combustible waste under Part One of the federal *Greenhouse Gas Pollution Pricing Act* (GGPPA) applies. However, the province has implemented an output-base pricing system (OBPS) under *The Management and Reduction of Greenhouse Gases Act*.

The federal OBPS applies to (1) electricity generation facilities that use fossil fuels, or (2) natural gas transmission pipelines that emit more than 50,000 tonnes carbon dioxide per annum (tCO_2pa). The provincial OBPS applies to all other provincial facilities that emit more than 25,000 tCO_2pa, with a voluntary opt-in for facilities over 10,000 tCO_2pa.

Performance standards are based on the emissions per unit of production. Provincially regulated emitters are required to meet the performance standards by reducing emissions, or by using approved compliance options, including payment into the provincial technology fund (the Technology Fund), submission of a best performance credit, and/or submission of a provincial offset credit, which can be bought and sold. While the performance standards and reporting requirements are currently in effect, the offset credit program itself is not. On August 28, 2020, the Government of Saskatchewan indicated that the implementation of the offset program would be delayed until 2022.

In addition to being a compliance mechanism, the Technology Fund also provides funding for initiatives that aim to reduce, sequester, or capture GHGs. The fund is set up so that those who exceed their permitted emissions can pay into the fund to fulfill the requirements, with the funds to be allocated to projects that reduce GHG emissions. The Technology Fund is also funded by penalty payments under *The Oil and Gas Emissions Management Regulations.* The Technology Fund is available to regulated emitters only and is administered by Innovation Saskatchewan.

According to its 2019-20 annual report, published by the Ministry of Environment, the Technology Fund was not yet operational for that year, however, is expected to become operational sometime in the future as it was pushed back due to COVID – no specific date has yet been provided.

4.2 Incentives for Transportation to Support CCS

There are two incentive programs that specifically support CCUS deployment in Saskatchewan. Specifically, the Oil and Gas Processing Investment (OGPII) Program and the Oil Infrastructure Investment Program (OIIP). Both are transferable oil and gas royalty/freehold production tax credit programs available to qualifying companies that demonstrate new or expanded value-added (above and beyond required) projects in Saskatchewan's oil and gas sector. The OGPII Program contains a project-specific credit cap at 75M CAD for oil, gas, and helium projects, and $70M for chemical fertilizer projects. Both provide tax credits for qualified projects and are calculated at a rate of 20% of eligible project costs and can be claimed at a rate of: 20% of total credits in the first calendar year of operations; 30% in the second year; and 50% in the third year.

4.3 Energy as an Export for the Province

Saskatchewan is one of the few places in the world that produces energy from nearly every source – crude oil, natural gas, coal, uranium, biofuels, geothermal power, wind power, and hydro power (Government of Saskatchewan, 2022a).

Fuels derived from CO_2 are argued to be an attractive option in the decarbonization process because they can be deployed within existing transportation infrastructure. As such, hydrogen has been identified as a driver of change to meet net zero goals. While Saskatchewan does not currently have a formal hydrogen strategy, a pilot project is currently operating to produce it from oil fields near Kerrobert (Government of Saskatchewan, 2022b).

5. Acknowledgements

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